Explaining Corporate Effective Tax Rates Before and During the Financial Crisis: Evidence from Greece

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EXPLAINING CORPORATE EFFECTIVE TAX RATES BEFORE AND DURING THE FINANCIAL CRISIS: EVIDENCE FROM GREECE

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This paper examines the determinants of the variability in corporate effective tax rates before and after the beginning of the financial crisis in Greece. Analyzing firm-level data for the period between 2000 - 2014, we find strong evidence that specific firm characteristics including firm size, financial leverage, capital and inventory intensity influence the level of corporate effective tax rates. Our results also indicate that corporate effective tax rates and their association with the firm-specific characteristics were significantly influenced in the sub-period after the beginning of the financial crisis. Our findings may have important implications both for policy makers and firms.

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I. INTRODUCTION

Assessing the impact of the tax system on business activity is of primary importance to economists, tax advisors, firms and policy makers. One of the most important elements of the tax system is undoubtedly the statutory income tax rate. Statutory income tax rates may act as an incentive or an obstacle to business investment, and this is the most obvious reason they have been so widely studied.

Statutory income tax rates (*STR*), though, do not take into account the tax base of income tax. Effective Tax Rates (*ETR*s), on the other hand, demonstrate more accurately the direct monetary costs of taxation, as they incorporate in one single measure the *STR* as well as the tax base on which it is applied. Their study and the way they are determined for different firms across the same jurisdiction may provide important implications for policy makers and firms.

This paper uses panel data to examine the determinants of corporate *ETRs* before and after the beginning of the financial crisis in Greece. It investigates the *ETRs* from a micro backward-looking perspective, using elements of firms' financial statements to derive effective corporate taxation. It contributes to the existing empirical research in various ways. Firstly, this is, to our knowledge, the only empirical study that has ever analyzed *ETR*s and their determinants in Greece using firm-level data. The dataset used includes a large number of firms (a final sample of 4,936 firms) for an extended period (2000 - 2014), creating one of the largest samples ever studied in this field (74,040 observations) and thus substantially increasing the validity of our results. Furthermore, emphasis is placed on the way that the financial crisis period affected firms' *ETR*s and their determinants; an issue that, to the best of our knowledge, has not been empirically investigated in the past. Finally, econometric specification problems that usually exist in the literature are addressed by controlling for both

time - invariant variables and endogeneity (due to the bi-directional causality between *ETR*s and their determinants).

The remainder of the paper is organized as follows. In Section II, we review the prior research on the major determinants of *ETR*s. In Section III, we develop the hypotheses tested in our study based on the Greek tax legislation. In Section IV, we analyze the sample selection method, describe the variables and present the specification model and the estimation strategy. In Section V, we report and discuss the results. Finally, Section VI concludes by summarizing the results, presenting policy implications as well as potential limitations of the study that could be used as ideas for further research.

II. LITERATURE REVIEW: ETRs DETERMINANTS

Prior research has focused on *ETR* variance across different firms operating in the same jurisdiction as well as on the neutrality of income tax with regards to specific firm's characteristics such as size, financial leverage, capital and inventory intensity. The relationships that have been examined in the literature are reviewed below.

A. ETR and Firm's Size

The prevailing theories of the relationship between *ETR* and firm's size are two: the political cost theory and the political power theory. Under the political cost theory, large firms are expected to be taxed at a higher *ETR* as they are more easily targeted by the government, tax authorities and public opinion (Zimmerman, 1983; Watts and Zimmerman, 1986). As a result, law changes could be designed exclusively to re-distribute wealth from these firms to priority groups. A higher *ETR* can also occur for large firms as the goal of reducing their tax liability may be downplayed in favor of the impression of financial soundness that should be given to the firm's stakeholders (e.g. shareholders, creditors). Moreover, smaller firms usually receive favorable tax treatment for the benefit of

entrepreneurship and employment resulting in lower *ETR*s in comparison with larger firms (Buijink, Janssen and Schols, 1999). On the other hand, under the political power theory, large firms are expected to be taxed at a lower *ETR* as they have the resources to influence the legislative procedure to their benefit either directly or through their professional unions (Siegfried, 1972). Furthermore, large firms are better able to specialize in tax planning activities that can reduce their tax burden.

Researchers have repeatedly examined the relationship between firm's size and *ETR*. The results were conflicting, though, as there are supporting evidence for both the political cost theory (e.g., Zimmerman, 1983; Wilkie and Limberg, 1990; Kern and Morris, 1992) and the political power theory (e.g., Siegfried, 1972; Porcano, 1986). Nicodeme (2007), trying to interpret these conflicting results, argues that these studies were carried out in a univariate context with size as the sole explanatory variable which might have led to biased coefficients. On the contrary, recent studies were conducted in a multivariate context but, nonetheless, the degree of conflict in the results was not significantly reduced. There are recent researches that empirically confirmed the political power theory (e.g., Richardson and Lanis, 2007), others that confirmed the political cost theory (e.g., Vandenbussche and Tan, 2005), and still others with mixed results (e.g., Gupta and Newberry, 1997; Janssen and Buijink, 2000; Nicodeme, 2002; Vandenbussche, Crabbe and Janssen, 2005).

B. ETR and Firm's Financial Leverage

Firm's financial leverage is another factor that may affect its *ETR*. More specifically, a firm has three ways to finance its activities: equity financing (that is, raising money by issuing shares), debt financing (that is, raising money through loans) and, more often, a combination of these two types of financing. In each financing method, a fee must be paid back to the financiers either as a dividend (in the case of equity financing) or as interest (in the case of debt financing). Focusing on the way interest and dividends are treated in tax

legislation, a negative association between *ETR* and firm's leverage is expected as interest is usually deductible from taxable income whereas the distributed dividends are not. This distinction creates an apparently more favorable tax regime for firms that prefer debt financing leading to the reasonable assumption that firms with higher financial leverage face lower *ETR*s than firms that prefer equity financing. It is noteworthy that variations of this general rule may exist in tax systems across the world, such as, for example, in Belgium, where, as Crabbe (2010) notes, a certain percentage of equity may be deducted from the taxable income.

The effect of financial leverage on *ETR* has been empirically examined in the literature. The majority of studies confirm the expected negative relationship between these two variables, as firms with higher financial leverage exhibit lower effective tax rates (Stickney and McGee, 1982; Buijink, Janssen and Schols, 1999; Vandenbussche, Crabbe, Janssen, 2005; Richardson and Lanis, 2007; Crabbe, 2010). However, some studies demonstrate that there is a positive and significant relationship between *ETR* and financial leverage (Harris and Feeny, 2003; Janssen, 2005). Finally, it is worth noting that Gupta and Newberry (1997) conclude that the sign of this relationship is sensitive to the income measure used in the denominator of the *ETR*.

C. ETR and Firm's Capital Intensity

A firm's investment in fixed assets may also have an impact on its *ETR*. Fixed assets are assets "that are held for use in the production or supply of goods or services, for rental to others, or for administrative purposes and are expected to be used during more than one period" (IASB, 2016a). Firms can systematically allocate the depreciable amount of an asset over its useful life, that is, they can allocate the cost of the asset less its residual value over the period over which it is expected to be used by the firm. This allows firms to offset part of the cost undertaken against future profits, especially given the fact that losses can be carried

forward up to a specific amount of years. It is, therefore, expected, that, ceteris paribus, a firm which invests in increasing its fixed assets will exhibit lower effective tax rates. This hypothesis is further strengthened by the possible existence of tax incentives for firms that invest in fixed assets.

Empirical research typically confirms this negative relationship. Stickney and McGee (1982), Gupta and Newberry (1997), Vandenbussche, Crabbe and Janssen, (2005), Janssen (2005), Richardson and Lanis (2007) and Crabbe (2010) concluded, among others, that firms with higher fixed-assets ratios face lower *ETR*s.

D. ETR and Firm's Inventory Intensity

Inventories are "assets held for sale in the ordinary course of business, or in the process of production for such sale, or in the form of materials or supplies to be consumed in the production process or in the rendering of services" (IASB, 2016b). Gupta and Newberry (1997) were among the first to include an inventory ratio in their *ETR* study. They argue that to the extent that the inventory ratio is a substitute for the fixed - assets ratio, inventory-intensive firms should face relatively higher *ETR*s, as long as these firms use the same inventory method for both book and tax purposes. This hypothesis has been confirmed empirically by subsequent studies (e.g., Richardson and Lanis, 2007). However, there do exist other studies that didn't result in a statistically significant relationship between inventory intensity and *ETR* (e.g., Derashid and Zhang, 2003; Adhikari, Derashid and Zhang, 2006).

E. ETR and Firm's Sector

The sector in which a firm operates is another factor that may lead to varying *ETR*s. Although direct tax measures for specific sectors are generally difficult to be implemented, especially in the European Union context, as the aid granted by the Member States should not

distort competition, such measures may be applied under certain conditions to promote economic or social goals (e.g., increasing exports). As Nicodeme (2002) states, these measures may be of technical nature (e.g., depreciation rules), may be implemented as policy objectives (e.g., tax exemptions for R&D expenditures) or may be the result of specific discretionary administrative practices towards specific sectors. Moreover, there may exist provisions that are not targeted at specific sectors but have, nonetheless, similar effects. For example, the introduction of a tax credit for firms investing in new technologies may benefit the new sectors of the economy. In conclusion, different sectors may receive different tax treatment and, consequently, these differences may lead to different *ETR*s. Sector's impact on *ETRs* has been empirically confirmed in various studies (e.g., Stickney and McGee, 1982; Buijink, Janssen and Schols, 1999; Nicodeme, 2002; Derashid and Zhang, 2003; Vandenbussche, Crabbe and Janssen, 2005; Richardson and Lanis, 2007; Crabbe, 2010).

F. ETR and Firm's Location

Although *ETR*s may also vary in relation to the geographical area that the firms operate in, this relationship has not been widely examined in the literature. Vandenbussche, Crabbe and Janssen (2005) were among the few who examined the firm's location as a determinant of the *ETR*. Specifically, they showed that a part of the variation of the Belgians firms' *ETR* can be attributed to the region that the firms operate in.

G. ETR and Firm's Legal Form

The firm's legal form may also differentiate its *ETR* as a result of different *STR*s and/or differences in the tax base on which the *STR* is applied. This relationship is usually not examined in depth probably because research cannot be extended to all types of legal entities but only to those obliged to publish their financial statements.

H. ETR and Firm's Profitability

A firm's *ETR* is a function of its tax to pretax income and, therefore, it may change simply due to changes in pretax income. To control for these changes, relevant studies add a profitability measure as a control variable. Given that holding a firm's tax preferences and total assets constant while increasing its profitability will increase its *ETR* (Wilkie, 1988), a positive relationship between profitability and *ETR*s can be expected (Gupta and Newberry, 1997; Harris and Feeny, 2003; Richardson and Lanis, 2007).

I. ETR and Events During the Reference Period

Specific events during the reference period may also cause variation in the firms' *ETR*s and their determinants. Such events may be, for example, a tax reform, a government change, or the outbreak of a financial crisis. Past studies focused on possible variations in firms' *ETRs* and their association with firms' specific characteristics in the periods following a tax reform. [1] On the other hand, there are no studies, at least to the extent of our knowledge, that focus on other events that may alter a firm's *ETR* such as the beginning of a financial crisis or a government change.

J. ETR and Other Variables

A firm's *ETR* could also be influenced by several other factors. For instance, the extent of the firm's foreign operations may differentiate its *ETR*. This was originally suggested by Stickney and McGee (1982) and was further examined by Gupta and Newberry (1997), Buijink, Janssen and Schols (1999), Harris and Feeny (2003), Janssen (2005) and others. Additionally, the firm's extent of involvement in research and development has been identified as another factor that may affect the firm's *ETR* as R&D expenditures are usually

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[1] For example, Gupta and Newberry (1997) studied the impact of the U.S. Tax Reform Act of 1986 and Richardson and Lanis (2007) the impact of the Australian Ralph Review of Business Taxation Reform.

associated with preferential tax treatment (Gupta and Newberry, 1997; Buijink, Janssen and Schols, 1999; Harris and Feeny, 2003; Richardson and Lanis, 2007). The effect of the auditor and tax advice expenses has also been studied in the past. Crabbe (2010), using Belgian firm-level data, concluded that spending money on tax advice does not reduce the firm's *ETR*, while hiring a big four auditor (Deloitte, KPMG, Ernst & Young and PWC) does. Furthermore, it has been noted that firms that are listed on the stock market (public companies) have more incentives to report higher book income relatively to taxable income, altering in that way their ETRs (Mills and Newberry, 2001; Cloyd, Pratt and Stock, 1996; Janssen, 2005; Crabbe, 2010). Finally, as Gupta and Newberry (1997) note, there are also some other factors that may have an impact on *ETR*s such as the firm's ownership structure, its compensation policies, its corporate culture as well as possible corporate reorganizations through mergers and acquisitions.

III. DEVELOPMENT OF HYPOTHESES

Based on the previous literature review, we proceed to the formulation of the following testable hypotheses taking into account the specific characteristics of the Greek tax system.

Regarding firm's size association with *ETR*s, it can be stated that, although there are no direct law provisions in the Greek Income Tax Code (Income Tax Code, 2013; Income Tax Code, 1994) that may cause variation in the *ETR*s of firms of different size, there are several other reasons why such a variation can be expected. In particular, *ETR* differences may occur due to other laws' provisions as, for example, the bookkeeping obligations that differ depending on firm's size (Greek Accounting Standards, 2014; Code of Tax Reporting of Transactions, 2012; Code for Books and Records, 1992). Similarly, the investment laws (e.g., Investment Law, 2011) provide that the aid percentage varies by firm's size. Moreover, the *ETR*s can be expected to be associated with firm's size considering the way tax legislation

is implemented in Greece. For example, we can refer to the existence of specific tax audit authorities that focus exclusively on large firms (e.g., the Audit Authority for Large Enterprises). All the above, if added to the general discussion that was presented in the previous section, can lead us to the hypothesis that there does exist a relationship between firms' *ETR* and their size in Greece. Taking furthermore into account that tax legislation seems to create a less demanding environment for small and medium-sized firms (allowing them, for example, to keep their accounting books in less detail), we can expect a positive relationship between *ETR* and firm's size.

H₁: Firm's ETR is positively related to its size

The Greek Income Tax Code allows the deduction of interest from taxable income which leads, as a result, to lower taxable income and lower tax. On the contrary, dividends are not tax deductible. The above combination creates, as a matter of fact, a more favorable tax environment for firms with higher financial leverage and therefore, a negative relationship between *ETR* and financial leverage is expected.

H₂: Firm's ETR is negatively related to its financial leverage

The Greek Income Tax Code allows firms to depreciate yearly their fixed assets allocating their cost over their useful life, giving firms the chance to offset part of the cost undertaken against future profits. Since fixed assets' useful life may extend up to 20 years and at the same time losses can be carried forward up to 5 years, there may exist a preferential treatment for firms that invest more in fixed assets in comparison, for example, with firms that have to recognize the total amount of their expenses immediately. Moreover, firms in Greece enjoy specific tax exemptions provided by investment laws when investing in property, plant and equipment. Based on the above law provisions, we can expect a negative relationship between firms' *ETR* and their capital intensity.

H₃: Firm's ETR is negatively related to its capital intensity

Before stating the hypothesis for *ETR's* association with firm's investment in its inventory, we should note that, under the Greek Income Tax Code, firms are obliged to use the same inventory method for both book and tax purposes, creating a tax - neutral environment with no signs of differential tax treatment for inventory intensive firms. Given, though, Gupta's and Newberry's (1997) hypothesis that inventory-intensive firms should face relatively higher *ETR*s to the extent that the inventory ratio is a substitute for the fixed - assets ratio, we can expect that the firm's *ETR* will be positively related to its inventory intensity.

H$_4$: Firm's ETR is positively related to its inventory intensity

The Greek Income Tax Code does not include any direct provisions that provide indications of preferential tax treatment of different sectors. There are provisions though that may indirectly alter the tax base depending on the firm's sector, such as the depreciation rates which may benefit firms of specific sectors (e.g., constructions) at the expense of others. Moreover, the investment laws may apply to investment plans in specific branches of economic activity or may exclude specific sectors (e.g., Investment Law of 2011 excludes the steel sector, the coal sector etc.). Last but not least, it should be noted that the tax framework in Greece is completely different for ship owning firms as Greek-flagged ships are taxed according to their gross tonnage and their construction year, regardless of their business income (Greek tonnage tax regime, 1975). All the facts mentioned above can lead us to the hypothesis that firms operating in different sectors in Greece may indeed face different *ETR*s.

H$_5$: Firm's ETR is related to the sector in which the firm operates

The tax law and its implementation in Greece may offer signs of preferential tax treatment depending on the location in which a firm operates. For example, the extent of the aid provided by investment laws in the form of tax reliefs is different for firms operating in different geographical areas of Greece. Moreover, there exists a provision in the Greek

Income Tax Code for a reduced statutory tax rate for firms that operate in islands with population less than 3,100 residents. Furthermore, it can be assumed that tax controls and audits are implemented differently in the various geographical areas of the country. This hypothesis is based on the varying efficiency of the regional tax offices, as expressed by the number of tax audits and the revenues generated (General Secretariat for Public Revenue, 2015). In conclusion, it can be expected that *ETR*s in Greece are related to the geographical area in which the firm operates.

H_6: *Firm's ETR is related to the location in which the firm operates*

The tax framework in Greece provides also indications that the *ETR*s vary in relation to the firm's legal form. Firms operating as limited companies and partnerships face typically different statutory tax rates under the Greek Income Tax Code. More importantly, different statutory tax rates have been imposed in the past even between public limited liability companies (AE) and limited liability companies (EPE) (Income Tax Code, 1994) leading to the hypothesis that the legal form under which the firm operates may differentiate its *ETR*. It must be noted, though, that research is necessarily limited to public limited liability companies and limited liability companies as only these firms are obliged to publish their financial statements (balance sheet, profit and loss account etc.).

H_7: *Firm's ETR is related to its legal form*

Competitiveness of the goods and services on the international market and especially the company's export performance is one of the criteria that an investment plan should satisfy to receive tax reliefs and credits under investments laws in Greece (e.g., Investment Law of 2011). Given the favorable tax treatment towards export-oriented firms, it can be expected that a firm's *ETR* is related to whether the firm engages in exporting activities or not.

H_8: *Firm's ETR is related to whether the firm exports or not*

Considering that the conditions in the Greek market have deteriorated in the period after the beginning of the financial crisis, it is reasonable to expect that firms may have tried to adapt to the current financial situation by engaging more in tax planning activities. A decrease in the mean *ETR* can be therefore expected in the sub-period after the beginning of the financial crisis. Furthermore, it is also possible that the financial crisis period influenced *ETRs'* association with firm's specific characteristics (such as its size, capital intensity, inventory intensity and financial leverage). In more detail, it can be expected that larger firms may be more capable to adjust their strategy to the new circumstances, achieving, as a result, lower *ETRs*. The same holds true for inventory-intensive firms that are usually more flexible in comparison with capital − intensive firms that invest in the long-run and cannot easily adapt to the changing environment. Finally, firms with higher degree of financial leverage are expected to be influenced more by the liquidity problems after the beginning of the financial crisis, a fact that may alter, as a result, their taxable income and their ETRs. In conclusion, it can be expected that *ETR's* association with firm's specific characteristics is affected by the financial crisis period in Greece. It should be generally highlighted, though, that we examine the impact of the crisis period on corporate *ETRs* without isolating factors such as the impact of the global financial crisis or of changes in the political landscape in Greece.

H₉: Firm's ETR and its association with firm's specific characteristics are affected by the financial crisis period in Greece

IV. SAMPLE, DATA AND VARIABLES

A. Sample and Identification Strategy

Our sample was collected from the ICAP Databank, the largest company database in Southeast Europe. It consisted initially of 53,235 firms operating in Greece over the period

2000 - 2014. The initial sample was then reduced by excluding firms falling into the following categories:

Firms with missing data and/or no continuous activity in the reference period

The initial sample included firms with missing data for certain years. It also included firms that started or ceased their activity during the period under consideration (2000 - 2014). These firms were removed from the dataset resulting in a sample with firms that have data for the entire 15-year period.

Financial Firms and Insurance Companies

Firms operating in the financial and insurance sector are excluded from the final sample as they are subject to different regulation, a fact that may lead to misinterpretations and conflicting results (Gupta and Newberry, 1997; Kim and Limpaphayom, 1998; Buijink, Janssen and Schols, 1999; Richardson and Lanis, 2007).

Firms with ETRs negative, "false" positive or greater than 1

Based on the existing literature, we also excluded from the final sample:

1. Firms with negative *ETR*s, that is firms with negative tax (tax refunds) or negative income (loss) (Holland, 1998; Kim and Limpaphayom, 1998; Derashid and Zhang, 2003; Vandenbussche, Crabbe and Janssen, 2005; Richardson and Lanis, 2007). The exclusion of these firms was considered necessary as *ETR* is a ratio that can be negative either due to the numerator or the denominator, a fact that may lead to misinterpretation problems.

2. Firms with "false" positive *ETR*s, that is simultaneously negative tax (tax refund) and negative income (loss). Similarly, these firms were excluded from the final sample as "false" positive *ETRs* may also cause misinterpretation problems.

3. Firms with *ETR*s greater than 1, since these observations can cause model estimation problems (Stickney and McGee, 1982; Gupta and Newberry, 1997;

Kim and Limpaphayom, 1998; Derashid and Zhang, 2003; Richardson and Lanis, 2007)

The final sample, after the exclusion of the firms mentioned above, consists of 4,936 firms and 74,040 observations for the period 2000 - 2014. Table 1 summarizes the way the final sample was created.

[INSERT TABLE 1 ABOUT HERE]

B. Variables

1. Dependent variable

The *ETR*s, from a micro backward-looking perspective, are typically calculated as the ratio of a measure of income tax to an income measure. There are significant discrepancies, though, among researchers regarding the appropriate definition of both the numerator and the denominator of *ETR*s.

Considering the numerator, researchers are wavering whether a measure of current tax or a measure of income tax expense should be used. Current tax is "the amount of income taxes payable (or recoverable) in respect of the taxable profit (or tax loss) for a period" (IASB, 2016c). Income tax expense, on the other hand, is "the aggregate amount included in the determination of profit or loss for the period in respect of current and deferred tax" (IASB, 2016c). When firms do not recognize deferred taxation, the income tax expense may be identical to the current tax. Another decision that has to be made is whether the domestic income tax or the worldwide income tax should be included in the numerator. Researchers frequently use the worldwide income tax in the numerator and its related income measure in the denominator, even though, as Holland (1998) noted, the resulting *ETR*s may be sensitive to variations in the distribution of income across different jurisdictions. Finally, it is worth pointing out that other tax liabilities, besides income tax (e.g., VAT), are usually ignored as they are not entirely dependent on income levels (Holland, 1998).

As regards the denominator, numerous income measures can be used depending on the goals of the researcher and data availability. The alternatives that have been suggested in the literature include taxable income, operating cash flows, turnover, gross operating profit, EBITDA, operating result and net income before taxes. Taxable income is not preferred by researchers as its use will usually result in an *ETR* which is identical to the *STR* (Gupta and Newberry, 1997). Ratios formed with the use of turnover in the denominator lead to very small figures that hinder data analysis. Moreover, this measure may be misleading as information on major firm's costs is not taken into account. A small *ETR* with the turnover in the denominator does not necessarily mean that the firm is facing low taxation as a large turnover might be necessary to cover firm's costs (Nicodeme, 2001). The use of gross operating profit, operating result and EBITDA in the denominator is criticized on the same basis as these measures ignore important parts of the firm's expenses (e.g., depreciation, interest). These measures, though, are useful when comparing different countries, as their definition do not differ very much between countries (Nicodeme, 2001). Furthermore, these measures reduce some of the problems that occur due to differences in accounting methods. Net (Book) income before taxes is another frequently used measure in the denominator of the *ETR*. This measure incorporates the impact of all tax incentives on *ETR*s. Finally, the use of operating cash flows has the advantage of excluding the impact of accrual accounting procedures that vary with firm size (Zimmerman, 1983).

Given the available options for the definition of the *ETR*, it is considered necessary to use different proxies so as to improve the robustness of our results. In our study, three *ETR* measures are used to account for most of the factors discussed above. The three measures share the same numerator which is the current worldwide income tax. Deferred taxation was not taken into account as its recognition was not allowed in Greece until 31.12.2014 (with the exception of a small number of firms that prepare their financial statements in accordance

with IFRS). On the contrary, three different income measures have been used in the denominator of the *ETR* measures. More specifically, the first measure (*ETR$_1$*) is defined as the ratio of tax payable to net income before taxes; the second measure (*ETR$_2$*) is defined as the ratio of tax payable to operating result, and the third measure (*ETR$_3$*) is defined as the ratio of tax payable to earnings before interest, taxes, depreciation and amortization (EBITDA).

2. Independent and control variables

Firm-specific variables are included in our study by proxies for firm size, financial leverage, capital intensity, inventory intensity and profitability. Specifically, firm size *(SIZE)* is measured as the natural logarithm of total assets. Financial leverage *(LEVERAGE)* is measured as the ratio of medium/long - term liabilities to total assets. Capital Intensity *(CAPINT)* is measured as the ratio of net fixed assets to total assets. Inventory Intensity *(INVINT)* is measured as the ratio of end-year's inventory to total assets. Return on Assets *(ROA),* which is included to control for profitability, is measured as the ratio of net income before taxes to total assets. Additionally, dummy variables for sectors *(SECTOR)*, location *(REGION)*, legal forms *(LEGALFORM)* and exporting firms *(EXPORTS)* are included in the specification to account for time-invariant characteristics that may cause variation in firms' *ETR*. Finally, to assess the crisis period's impact on corporate *ETR*s, a period dummy variable *(CRISIS)* is included in our model. This variable will distinguish the observations that refer to the periods before and after the beginning of the financial crisis in Greece. The *CRISIS* variable is coded 1, if the observation is for the sub-period after the beginning of the financial crisis, that is 2008 to 2014 or 0 otherwise, that is 2000 - 2007. We define year 2008 as the year when the Greek economy showed the first signs of recession as Greece's GDP started to decrease after an extended period of high growth rates, by 0.2% (Bank of Greece, 2014). In the following years (2009 – 2014) GDP declined cumulatively by more than 25%.

In the same period, the unemployment rate shot up from 7.6% in 2008 to 26.1% in 2014. The cumulative decline in total and dependent employment exceeded 18% (18.40% and 18.34%, respectively).[2] Moreover, on the basis of previous literature, four interaction terms have also been formed. These interaction terms were calculated by multiplying the *CRISIS* dummy variable by each of the main independent variables *(SIZE, LEVERAGE, CAPINT, INVINT).*[3]

C. Descriptive Statistics

Table 2 presents some descriptive statistics (mean, median, standard deviation, minimum, maximum, number of observations) for the three selected *ETR*s and the main explanatory variables.

[INSERT TABLE 2 ABOUT HERE]

We notice that the ETR_1 has a mean of 15.2% and a median of 9.60%. ETR_2 has a mean of 14.4% and a median of 6.7% while ETR_3 has a mean of 8.8% and a median of 0.9%. Considering that the three *ETR* measures have the same numerator (current tax) and the denominators are respectively the net income before taxes (ETR_1), the operating result (ETR_2) and the EBITDA (ETR_3), it is reasonable that on average ETR_1 is greater than ETR_2 and ETR_2 is greater than ETR_3. These statistics indicate, in other words, that the sample's firms pay on average 15.2% of their net income before taxes, 14.4% of their operating result and 8.8% of their EBITDA as income tax.

Concerning the independent variables, *SIZE* has a mean of 14.28 and a median of 14.22, *LEVERAGE* has a mean of 0.066 and a median of 0, *CAPINT* has a mean of 0.41 and a median of 0.347, *INVINT* has a mean of 0.131 and median of 0.427, and finally, *ROA* has a mean of 0.025 and a median of 0.009.

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[2] Statistics derived from the Hellenic Statistical Authority (http://www.statistics.gr/en/statistics/eco)
[3] For an overview of the variables, see Tables A1 – A3 in the Appendix.

Moving on to the analysis of the categorical variables, we can also make some particularly interesting observations. For example, ETR_1 ranges on average from 4.6% in Arts, Entertainment and Recreation sector to 22.4% in Human Health and Social Work Activities sector. Similarly, ETR_1 appears to be lower on average in the Greek Islands (6.9% in the Ionian Islands, 7.8% in Crete and 9.5% in the Aegean Islands) and higher in Sterea Ellada, the area which includes, Athens, the capital city of Greece (18.6%). We also notice that the limited liability companies (EPE) face on average about 5% higher ETR_1 than the public limited liability companies (AE) (19.9% to 14.9%). Similar results are obtained when examining the other two *ETR* measures (detailed tables are available upon request).

Another interesting point to consider is that the mean ETR_1 decreases from 18.1% in the pre-crisis period (2000 - 2007) to 12.9% in the period after the beginning of the financial crisis (2008 – 2014). Building on this observation, we notice that the dependent variables (ETR_1, ETR_2, ETR_3) differ between the two periods (2000 – 2007 and 2008 – 2014) significantly at the 1% level (see two-sample tests in Table 2 above).

Considering the correlations among the variables (Table 3), it is worth emphasizing that there is a positive correlation between *SIZE* and *ETRs* as well as between *INVINT* and *ETRs*. On the other hand, there is a negative correlation between *CAPINT* and *ETRs* and *LEVERAGE* and *ETRs*. A conclusion that can be reached is that *CAPINT* and *INVINT* which are negatively correlated may act as substitutes in our sample, a finding that may be useful for explaining *ETR*'s and inventory intensity's relationship.

[INSERT TABLE 3 ABOUT HERE]

V. METHODOLOGY AND RESULTS

A. The Empirical Specification

The test of our hypotheses will be based on the following empirical specifications:

(1) $ETR_{zit} = a_0 + a_1 SIZE_{it} + a_2 LEVERAGE_{it} + a_3 CAPINT_{it} + a_4 INVINT_{it} + a_5 ROA_{it}$

$+ a_6 CRISIS_t + a_7 LEGALFORM_i + a_8 EXPORTS_i + \sum_{j=1}^{q-1} a_{9j} SECTOR_{ij} + \sum_{k=1}^{l-1} a_{10k} REGION_{ik} + \omega_i + \varepsilon_{it}$

$ETR_{zit} = a_0 + a_1 SIZE_{it} + a_2 LEVERAGE_{it} + a_3 CAPINT_{it} + a_4 INVINT_{it} + a_5 ROA_{it}$

(2) $+ a_6 CRISIS_t + a_7 LEGALFORM_i + a_8 EXPORTS_i + \sum_{j=1}^{q-1} a_{9j} SECTOR_{ij} + \sum_{k=1}^{l-1} a_{10k} REGION_{ik}$

$+ a_{11} CRISIS_t * SIZE_{it} + a_{12} CRISIS_t * LEVERAGE_{it} + a_{13} CRISIS_t * CAPINT_{it}$

$+ a_{14} CRISIS_t * INVINT_{it} + \omega_i + \varepsilon_{it}$

where the dependent variable, ETR_{zit}, is the corporate effective tax rate proxy. The independent variables include proxies for firm size *(SIZE)*, financial leverage *(LEVERAGE)*, capital intensity *(CAPINT)*, inventory intensity *(INVINT)*, profitability *(ROA)*, sector *(SECTOR)*, location *(REGION)*, legal form *(LEGALFORM)*, exports (*EXPORTS*), crisis *(CRISIS)* and interaction terms *(CRISIS*SIZE, CRISIS*LEVERAGE, CRISIS*CAPINT, CRISIS*INVINT)*. The unobserved specific error is denoted by ω_i and ε_{it} is the usual error term (observation specific error). The subscripts denote the three alternative proxies that are used for effective tax rates (*z*), the sector (*j*), the location (*k*), the time dimension (*t*), and the firm (*i*). Finally, *q* and *l* denote the number of sectors and the number of regions, respectively.

Given the fact that our specification contains four time-invariant variables *(SECTOR, REGION, LEGALFORM, EXPORTS)* the most appropriate estimation method is the one proposed by Hausman and Taylor (1981). A fixed-effects model is not suitable for this case as all time-invariant characteristics will be eliminated and absorbed by the fixed-effects in the specification. On the other hand, a random-effects model allows the inclusion of time-invariant variables in the specification. It is based, though, on the hypothesis that the independent variables are uncorrelated with the unobserved time-invariant random variable, which is not true in our case; according to the literature, a bi-directional causality between *ETR* and some of the independent variables most probably exists. At first, analyzing the relationship between *ETR* and *LEVERAGE* and, given that interest expenses are tax deductible, it is possible that firms with high marginal tax rates are more likely to use debt

financing, reversing in that way the cause – effect examined relationship. In the same context, it has been noted that low *ETRs* may cause lower levels of some of the firm-level investment variables (Vandenbussche, Crabbe and Janssen, 2005). Moreover, it has been empirically proved that the *ETRs* affect the size distribution of firms (Heshmati, Johansson, Bjuggren, 2010). Moreover, we believe that total assets as a proxy for firm's size are most probably correlated with the unobserved time-invariant random variable. For example, unobserved variables such as the firm's corporate culture that cannot be included in our model due to data constraints may be correlated with the firm's size leading to a potential endogeneity problem. For all the reasons mentioned above, *SIZE*, *LEVERAGE*, *CAPINT*, *INVINT* and *ROA* should be all treated as endogenous variables. The same holds for the interaction terms created using these variables.

Taking into account all the facts mentioned above, we decided to use a Hausman-Taylor random effects model which allows the inclusion of time-invariant variables accommodating simultaneously the potential endogeneity problems that may occur.

B. Results and Discussion

Table 4 summarizes the Hausman-Taylor random effects model results. The results are based on a sample of 4,936 firms operating in Greece for the period of 2000 to 2014 (74,040 observations). The test of our hypotheses is based on equations (1) and (2).

<div align="center">**[INSERT TABLE 4 ABOUT HERE]**</div>

All of the regression models in Table 4 are statistically significant at less than the 0.01 level as the Wald tests reported reject the hypothesis that the estimated coefficients are jointly equal to zero.

As regards the *ETR* determinants, we find that the corporate *ETRs* in Greece vary with specific firm characteristics such as its size, financial leverage, its capital and inventory intensity. More specifically, the results indicate that larger firms face higher *ETRs* than

smaller firms. This positive association between *ETR* and *SIZE*, which is significant at the 1% level ($p < 0.01$), is consistent with the hypothesis H_1 and the political cost theory, implying that larger firms in Greece are not capable of exploiting their power to reduce their tax burden, at least not to a considerable degree. As a result, they end up being taxed at a higher *ETR* than smaller firms. In contrast, financial leverage *(LEVERAGE)* has a negative association with *ETR*, as expected, confirming H_2 hypothesis. This suggests that firms that prefer debt to equity financing face lower effective tax rates; a conclusion that is reasonable, considering that interest is deductible from taxable income whereas dividends are not. It has to be noted though that the statistical significance of this association varies and seems to be sensitive to the empirical specification used. For the capital intensity measure *(CAPINT)*, the results indicate that it also has a significant negative association with *ETR* ($p < 0.01$). This finding is consistent with H_3 hypothesis, proving that there exists a preferential tax treatment for firms that invest in their fixed assets in Greece. We believe that Income Tax Code's provisions for assets' depreciation and the tax exemptions provided by investment laws have a key role in this association. Furthermore, it is noteworthy that the magnitude of the *CAPINT's* coefficient is of considerable size comparing to the coefficients of the other main independent variables. Regarding the inventory intensity *(INVINT)*, there appears to be a significant negative association between *INVINT* and *ETR* ($p < 0.01$), a finding that contradicts H_4 hypothesis and consequently Gupta's and Newberry's (1997) hypothesis. This negative association is observed despite the fact that the underlying assumption of Gupta's and Newberry's hypothesis, that inventory intensity ratio is a substitute for the capital intensity ratio, does also apply to our sample (see Table 3). It needs to be mentioned though that there are also other factors that may have an impact on the relationship between *ETR* and *INVINT*, which were not taken into account in previous research as, for example, inventory's relationship with sales. Specifically, it is reasonable to expect that if inventory grows faster

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than sales, a price reduction will follow leading to lower sales revenue and income and consequently to lower tax. This relationship has been confirmed empirically in the past when Bernard and Noel (1991) found that increases in inventory translate into lower prices and lower net income. Examining this relationship in our dataset, we notice that inventory growth is about two times greater on average than sales growth (see Table A4 in the Appendix), a finding that could probably explain the negative association between *ETR* and *INVINT*. Furthermore, it should be noted that an increase in *INVINT* will automatically lead to increased storage costs, reducing therefore the firm's taxable income and its income tax. Last but not least, it can be stated that an increase in *INVINT* is a sign of inefficient use of firm's resources. In this context, firms seem not to be able to allocate their resources in more profitable investments, a fact that will probably lead to lower profits and lower income tax. The facts mentioned above should be taken into consideration, among others, when examining inventory's association with *ETRs*. Finally, as regards the firm's profitability *(ROA)* which is included in our model as a control variable, it is significantly and positively associated with *ETR*, as expected, with varying, though, statistical significance.

It is important to highlight the fact that the coefficients of three independent variables *(SIZE, CAPINT, INVINT)* maintain their sign and statistical significance at the 1% level for all three *ETR* measures (see Table 4) whereas *LEVERAGE* and *ROA* retain their sign with varying statistical significance. This observation is important in assessing the robustness of our regression results.

Considering the categorical variables examined *(SECTOR, REGION, LEGALFORM, EXPORTS)*, there also appears to exist some significant associations. First, sector seems to have a significant impact on *ETRs* in agreement with hypothesis H_5 as most sectors appear to significantly differ from the reference sector (agriculture, forestry and fishing) at the 1% level. Specifically, firms in Human Health and Social Work Activities sector as well as firms

in the Education sector face in general significantly higher effective tax rates than firms in other sectors. On the contrary, firms in the Agriculture, Forestry and Fishing sector face the lowest ETRs in the Greek economy. As regards the location in which the firm operates, it appears that it is also significantly associated with the firm's *ETR*. In particular, firms that operate in Sterea Ellada (the region in which Athens, the capital city of Greece, is located in) and the Peloponnese face higher *ETR*s than firms in other geographical areas. On the contrary, firms that operate in Thrace and the Islands (Crete, Aegean Islands) face the lowest *ETR*s. This variation is not surprising since, as described in hypothesis H_6, there are different law provisions and indications of favorable administrative treatment for firms that operate in specific areas of Greece (for a detailed presentation of sector and location variables, see Tables A5 and A6 in the Appendix).

The firm's legal form also seems to have a significant impact on *ETR* in line with hypothesis H_7. More specifically, limited liability companies (EPE) appear to face higher *ETR*s than public limited liability companies (AE). Considering that the tax law framework was almost the same for these two types of firms in the reference period, this difference could be attributed to the fact that the directors of the public limited liability companies are accountable to the shareholders to a greater extent than the directors of limited liability companies who are usually simultaneously the sole shareholders of the company. In this context, public limited liability companies are expected to engage more aggressively in tax planning activities in an effort to reduce the firm's tax burden and maximize the shareholders' wealth.

Finally, the association between *ETR*s and whether the firm exports or not is, in general, insignificant, preventing us from confirming hypothesis H_8.

The examination of the crisis variables can also lead to some interesting conclusions. At first, in Equation (1), the *CRISIS* variable has a negative and significant coefficient at the

1% level for all three *ETR* measures. This result denotes that firms' *ETR*s decreased in the post − crisis period (2008 − 2014), comparing with the pre − crisis period (2000 − 2007), showing that, in accordance with hypothesis H_9, the financial crisis period affected significantly firms' *ETR*s.

To analyze further the crisis' period impact on *ETR*s, we included in equation (2) the *CRISIS* dummy variable as well as four interaction terms. These interaction terms that have been formed by multiplying the *CRISIS* dummy variable by each of the main independent variables (*SIZE, LEVERAGE, CAPINT, INVINT*) allow us to examine whether the association between these variables and *ETR*s changed after the beginning of the financial crisis. Firstly, it is worth noting that the coefficients of the main independent variables *(SIZE, LEVERAGE, CAPINT, INVINT)* keep their sign and statistical significance, despite the inclusion of the interaction terms in the specification. More specifically, *SIZE, CAPINT and INVINT* coefficients maintain their sign and statistical significance at the 1% level while the negative association between *ETR* and *LEVERAGE* holds true with increased statistical significance. On the other hand, the CRISIS dummy variable becomes less significant while three of the four interaction terms (specifically, *CRISIS*SIZE, CRISIS*CAPINT* and *CRISIS*INVINT*) are significant at the 1% level for all three ETR measures. In particular, *CRISIS*SIZE* is negative and significant ($p < 0.01$), implying that larger firms experienced a decrease in *ETR*s in the sub-period after the beginning of the financial crisis. This result can be attributed to the fact that these firms may have decided to engage more aggressively in tax planning in their effort to ensure that they will not pay more than the tax law requires in the financial crisis period. Moreover, *CRISIS*INVINT* is also negative and significant ($p < 0.01$) suggesting that inventory intensive firms face lower *ETR*s in the sub-period after the beginning of the financial crisis. On the other hand, *CRISIS*CAPINT* is positive and significant ($p < 0.01$) which means that firms with higher degrees of investment in fixed assets encountered higher

*ETR*s in the 2008 – 2014 period. Inventory – intensive firms seem to be better able to adapt in the sub-period after the beginning of the financial crisis in comparison with capital intensive firms. This may be due to the fact that capital intensive firms are investing in the long-term and cannot easily alter their activities to reduce their taxable income and their income tax. Finally, *CRISIS*LEVERAGE* is positive implying that firms with higher financial leverage faced an increase in *ETR*s in the sub-period after the beginning of the financial crisis. It has to be noted, though, that this association is significant only at the 10% level.

To assess the possible bias that we would have experienced without using a Hausman – Taylor random effects model, we also estimate a pooled OLS regression for all three *ETR* measures, for both specifications (1) and (2), an estimation method that was widely used in the previous literature. This estimation, though, ignores the potential endogeneity problems described in the previous subsection resulting therefore in different results in various ways. At first, there are variables with the opposite coefficient sign such as the crisis interaction terms *CRISIS*SIZE, CRISIS*CAPINT, CRISIS*INVINT*. Moreover, the pooled regression results include variables with higher statistical significance (e.g. *LEVERAGE, EXPORTS)* as well as variables with lower statistical significance *(e.g. CRISIS*SIZE, CRISIS*LEVERAGE).* Finally, the coefficients' magnitude differs considerably from the Hausman-Taylor estimates as there are variables with coefficients almost four times larger in absolute terms. All the above lead to the conclusion that a simple pooled OLS regression may have led to biased results, given the endogeneity problems ignored in such estimation. Due to space limitations, detailed results of this analysis are available upon request.

VI. CONCLUSION

In this paper, we examined the determinants of the variability in corporate effective tax rates (*ETR*s) before and after the beginning of the financial crisis (2000 – 2014) in Greece using elements of firms' financial statements.

We find that the corporate *ETR*s in Greece vary with several firm-specific characteristics such as the firm's size, its financial leverage, its capital and inventory intensity. More specifically, we find that larger firms in Greece face higher *ETR*s than smaller ones, a result that implies that these firms are not capable of exploiting their power to reduce their tax burden, at least not to a considerable degree. The results also indicate a negative association between financial leverage and *ETR*, in accordance with the hypothesis that the tax regime is favorable for firms that prefer debt to equity financing. It should be noted though that the statistical significance of this association varies and seems to be sensitive to the empirical specification used. Moreover, the firm's capital intensity is negatively associated with *ETR*, confirming the hypothesis that the tax framework is favorable for firms that invest in fixed assets. A negative and significant association also exists between inventory intensity and *ETR*, a finding that denotes that firms that invest in their inventory face, ceteris paribus, lower *ETRs*. Moreover, there appears to exist significant associations between *ETR* and the sector in which the firm operates, its location and its legal form. With regard to the effect of the financial crisis period on *ETR*s, we observed at first that the firms' *ETR*s decreased in the sub-period after the beginning of the financial crisis (2008 – 2014). Analyzing further this effect, we concluded that larger firms, as well as inventory intensive firms, experienced a decrease in *ETR*s in the sub-period after the beginning of the financial crisis. On the contrary, firms with higher degrees of investment in fixed assets encountered, in the same period, higher *ETR*s.

The above findings point to the conclusion that the corporate income tax burden in Greece is unequally distributed across different types of firms as we find strong evidence that specific firm characteristics such as the firm's size, its financial leverage and its capital and inventory intensity, influence the level of the corporate effective tax rates. Policymakers can build on this analysis whether their goal is to secure tax revenue or to remove distortions that

undermine the neutrality of the tax system and adversely affect the creation of a more investment-friendly environment. At first, emphasis should be put on firms that face lower *ETRs* on a regular basis; a broadening of the tax base is of crucial importance especially during the recession period that Greece is currently going through. Moreover, firms that face regularly higher *ETRs* should be as well brought into focus as the presence of disincentives to investment in specific activities must be made explicit to policymakers. Given the conclusion reached that the corporate income tax in Greece is not levied neutrally, it needs to be investigated whether this "departure" from neutrality is desirable (for example to promote specific activities) or if it occurred over time and needs to be corrected. The preceding analysis could also be useful from the firms' point of view, as the factors that determine the corporate *ETRs* such as the sector and location in which a firm operates should be taken into consideration by firms investing or planning to invest in Greece. Finally, our research methodology could be also applied to other European countries that are experiencing similar challenges regarding the effectiveness of their tax systems during the current financial crisis such as Italy, Spain, and Portugal.

Several issues can be incorporated in future research. Firstly, this study could be extended to general and limited partnerships that make up the majority of firms operating in Greece. Given that these data are not publicly available as these firms are not obliged to publish their financial statements, that kind of research requires data extraction from various administrative sources (e.g. Ministry of Finance, General Secretariat for Public Revenue). Furthermore, apart from the independent and control variables that we incorporated in our study, there may also exist other factors that have an impact on corporate *ETR*s. For example, the effect of the firm's ownership structure (e.g. whether it is a domestic or a foreign-owned firm), its international operations, its involvement in research and development or its auditor

and tax advice expenses were not examined in this study due to data constraints. Future research could address these issues.

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TABLES

Table 1

Sample Construction

All firms in ICAP Databank	53,235
- Firms with missing data and/or no continuous activity in the reference period	43,362
- Financial Firms, Insurance Companies	228

-    Firms
   o   with negative ETRs
   o   with negative tax (tax refund) and negative income (loss)
   o   with ETRs>1
	4,709

Final sample (number of firms)	**4,936**
Final sample (number of observations)	**74,040**

Table 2

Descriptive Statistics

	Mean	*Standard Deviation*	*Median*	*Min*	*Max*	*Two - sample t-value test*	*Two - sample Wilcoxon - Mann - Whitney test*
ETR_1	0.152	0.166	0.096	0	1	30.191***	28.682***
ETR_2	0.144	0.161	0.067	0	1	32.237***	29.894***
ETR_3	0.088	0.11	0.009	0	1	29.408***	27.492***
SIZE	14.28	1.41	14.22	7.396	20.718	-40.062***	-38.626***
LEVERAGE	0.066	0.234	0	0	46.551	-11.831***	-11.650***
CAPINT	0.41	0.315	0.347	0	1	-2.250**	-0.552
INVINT	0.131	0.177	0.427	0	0.999	3.272***	8.137***
ROA	0.025	0.47	0.009	-93.257	7.453	4.785***	20.056***

Notes: ETR_1 is defined as the ratio of tax payable to net income before taxes. ETR_2, is defined as the ratio of tax payable to operating result. ETR_3, is defined as the ratio of tax payable to earnings before interest, taxes, depreciation and amortization (EBITDA). *SIZE* is measured as the natural logarithm of total assets. *LEVERAGE* is measured as the ratio of medium – long –term liabilities to total assets. *CAPINT* is measured as the ratio of net fixed assets to total assets. *INVINT* is measured as the ratio of end-year's inventory to total assets. *ROA* is measured as the ratio of net income before taxes to total assets.

The two – sample tests were conducted as a hypothesis test for the difference between the means of the dependent and independent variables before and after the beginning of the financial crisis (periods 2000 – 2007 and 2008 – 2014, respectively). The tests were conducted after the calculation of the dependent and independent variables' means for each firm for the two periods under consideration. ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Table 3

Pairwise Correlations among variables

	ETR_1	ETR_2	ETR_3	SIZE	LEVERAGE	CAPINT	INVINT	ROA
ETR_1	1.000							
ETR_2	0.910***	1.000						
ETR_3	0.780***	0.822***	1.000					
SIZE	0.141***	0.137***	0.065***	1.000				
LEVERAGE	-0.097***	-0.099***	-0.125***	0.136***	1.000			
CAPINT	-0.344***	-0.337***	-0.360***	-0.045***	0.135***	1.000		
INVINT	0.132***	0.128***	0.065***	0.152***	-0.045***	-0.463***	1.000	
ROA	0.133***	0.138***	0.230***	0.041***	-0.035***	-0.062***	0.001	1.000

Notes: ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

Table 4

Hausman – Taylor Estimates of effective tax rates on various firm characteristics over the period 2000 - 2014 (n = 4,936)

	Predicted Sign	Equation (1)			Equation (2)		
		ETR_1	ETR_2	ETR_3	ETR_1	ETR_2	ETR_3
Intercept	**+/-**	-0.279***	-0.273***	-0.191***	-0.279***	-0.290***	-0.179***
		(-10.08)	(-10.43)	(-7.78)	(-9.55)	(-10.50)	(-7.02)
SIZE	**+**	0.028***	0.027***	0.020***	0.028***	0.029***	0.019***
		(17.58)	(17.95)	(12.27)	(16.12)	(17.31)	(11.36)
LEVERAGE	**-**	-0.017*	-0.017*	-0.008	-0.042**	-0.040**	-0.023*
		(-1.34)	(-1.33)	(-1.19)	(-1.92)	(-1.90)	(-1.62)
CAPINT	**-**	-0.140***	-0.142***	-0.127***	-0.156***	-0.163***	-0.148***
		(-27.23)	(-28.20)	(-29.26)	(-26.91)	(-28.96)	(-29.94)
INVINT	**+**	-0.067***	-0.070***	-0.093***	-0.031***	-0.039***	-0.072***
		(-7.83)	(-8.54)	(-14.97)	(-3.19)	(-4.29)	(-9.83)
ROA	**+**	0.011**	0.011**	0.020*	0.010**	0.011***	0.020*
		(1.76)	(1.75)	(1.40)	(1.76)	(1.75)	(1.40)
CRISIS	**+/-**	-0.055***	-0.057***	-0.034***	-0.021**	0.004	-0.020**
		(52.33)	(-54.77)	(-36.56)	(-1.72)	(0.34)	(-2.29)
Sector 15 (Human, Health & Social Work Activities)	**+/-**	0.133***	0.132***	0.095***	0.136***	0.136***	0.098***
		(7.59)	(8.08)	(7.48)	(7.77)	(8.27)	(7.69)
Sector 18 (Education)	**+/-**	0.111***	0.100***	0.054***	0.113***	0.102***	0.056***
		(5.28)	(5.23)	(4.08)	(5.41)	(5.36)	(4.22)
Sector 11 (Real Estate Activities)	**+/-**	0.103***	0.107***	0.099***	0.103***	0.107***	0.100***
		(6.98)	(7.88)	(9.73)	(7.03)	(7.90)	(9.78)
Sector 6 (Wholesale & Retail Trade)	**+/-**	0.090***	0.088***	0.054***	0.092***	0.090***	0.056***
		(7.01)	(7.55)	(7.05)	(6.91)	(7.67)	(7.23)
Region 4 (Sterea Ellada)	**+/-**	0.066***	0.061***	0.037***	0.068***	0.063***	0.039***
		(5.93)	(5.68)	(4.67)	(6.15)	(5.90)	(4.93)

	Exp. sign						
Region 5 (Peloponnese)	+/-	0.063*** (4.96)	0.058*** (4.67)	0.031*** (3.48)	0.065*** (5.10)	0.059*** (4.82)	0.033*** (3.64)
LEGAL FORM	+/-	0.033*** (5.87)	0.031*** (5.62)	0.038*** (7.06)	0.032*** (5.69)	0.030*** (5.48)	0.037*** (6.90)
EXPORTS	-	-0.001 (-0.12)	-0.003 (-0.81)	-0.009*** (-2.89)	0.002 (0.40)	-0.001 (-0.26)	-0.007** (-2.22)
CRISIS * SIZE	-				-0.003*** (-3.64)	-0.005*** (-6.45)	-0.002*** (-3.33)
CRISIS * LEVERAGE	+/-				0.032* (1.44)	0.030* (1.41)	0.019* (1.35)
CRISIS * CAPINT	+				0.040*** (9.61)	0.052*** (12.70)	0.041*** (13.70)
CRISIS * INVINT	-				-0.059*** (-8.72)	-0.049*** (-7.40)	-0.028*** (-5.57)
Sargan – Hansen test		0.435	1.599	0.667	0.614	2.063	0.645
[p-value]		[0.510]	[0.206]	[0.414]	[0.435]	[0.151]	[0.422]
R^2		0.095	0.101	0.122	0.103	0.111	0.135
No. of firms		4,928	4,928	4,927	4,928	4,928	4,927
No. of observations		62,800	62,796	53,176	62,800	62,796	53,176

Notes: **Dependent variables**: ETR_1, ETR_2, ETR_3. ETR_1 is defined as the ratio of tax payable to net income before taxes; ETR_2, is defined as the ratio of tax payable to operating result; ETR_3, is defined as the ratio of tax payable to earnings before interest, taxes, depreciation and amortization (EBITDA). ETRs cannot be defined when the denominator (net income before taxes, operating result or EBITDA) is equal to zero. **Independent and control variables**: *SIZE, CAPINT, INVINT, CAPINT, ROA*. *SIZE* is measured as the natural logarithm of total assets; *LEVERAGE* is measured as the ratio of medium – long –term liabilities to total assets; CAPINT is measured as the ratio of net fixed assets to total assets; INVINT is measured as the ratio of end-year's inventory to total assets; *ROA* is measured as the ratio of net income before taxes to total assets. **Categorical variables**: *SECTOR, REGION, LEGALFORM, EXPORTS, CRISIS*. The sectors and regions presented in this table are the ones with the highest coefficient. For a detailed sector – location analysis, see tables A5 and A6 in the Appendix.

LEVERAGE, SIZE, CAPINT, INVINT, ROA and the interaction terms are treated as endogenous variables.

***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. *t*-statistics are reported in parentheses (robust standard errors were used so as to correct for the presence of heteroscedasticity and autocorrelation within panels). Coefficients are rounded to the third decimal place.

Variables used as instruments: *SECTOR, REGION, LEGALFORM, EXPORTS, CRISIS*

The validity of our instruments is tested by Sargan-Hansen test. The null hypothesis indicates that the over-identified restrictions are valid (a *p*-value greater than 0.01 signifies that the null is not rejected at 1% level of significance).

APPENDIX

Table A1

Variables

ETR_1	Current Worldwide Income Tax / Net Income Before Taxes
ETR_2	Current Worldwide Income Tax / Operating Result
ETR_3	Current Worldwide Income Tax / EBITDA
SIZE	LN (Assets)
LEVERAGE	Medium – Long term liabilities / Total Assets
CAPINT	Net Fixed Assets / Total Assets
INVINT	Inventory / Total Assets
ROA	Net Income Before Taxes / Total Assets
SECTOR	See Table A2
REGION	See Table A3
CRISIS	1, if year = 2008 – 2014, 0 if year = 2000 - 2007
CRISIS * SIZE	Interaction Term
CRISIS * LEVERAGE	Interaction Term
CRISIS * CAPINT	Interaction Term
CRISIS * INVINT	Interaction Term
LEGALFORM	1 for Limited Liability Companies (EPE), 0 for Public Limited Liability Companies (AE)=0
EXPORTS	1, if the firm is exporting, 0 otherwise

Table A2

Sectors

Sector 1	Agriculture, Forestry and Fishing
Sector 2	Mining and Quarrying
Sector 3	Manufacturing
Sector 4	Electricity, gas, steam and air conditioning supply
Sector 5	Water supply; sewerage, waste management and remediation activities
Sector 6	Wholesale and retail trade; repair of motor vehicles and motorcycles
Sector 7	Transportation and Storage
Sector 8	Accommodation and food service activities
Sector 9	Information and Communication
Sector 10	Financial and Insurance Activities
Sector 11	Real Estate Activities
Sector 12	Professional, scientific and technical activities
Sector 13	Administrative and support service activities
Sector 14	Public administration and Defence; compulsory social security
Sector 15	Human health and social work activities
Sector 16	Arts, Entertainment and Recreation
Sector 17	Other Service Activities
Sector 18	Education
Sector 20	Construction

Table A3

Regions

Region 1	Thrace
Region 2	Macedonia
Region 3	Epirus
Region 4	Sterea Ellada
Region 5	Peloponnese
Region 6	Aegean Islands
Region 7	Ionian Islands
Region 8	Crete
Region 9	Thessaly

Table A4

Statistics for Firms' Sales Growth & Inventory Growth

Variable	Obs	Mean	Std. Dev.	Min	Max
Sales Growth	63,351	0.395	31.479	-1	7,149
Inventory Growth	48,885	0.882	42.774	-1	6,028

Notes: *Sales Growth* is calculated as the annual percentage change of firm's turnover. *Inventory Growth* is calculated as the annual percentage change of firm's end-of-year's inventory

Table A5

Hausman – Taylor Estimates of effective tax rates on various sectors over the period 2000 - 2014 (n = 4,936)

Sector	*Equation (1)*			*Equation (2)*		
	ETR_1	ETR_2	ETR_3	ETR_1	ETR_2	ETR_3
2	0.037 * (1.52)	0.054** (1.88)	0.021* (1.29)	0.039* (1.62)	0.057** (1.97)	0.023* (1.41)
3	0.068*** (5.28)	0.071*** (6.01)	0.035*** (4.46)	0.07*** (5.42)	0.073*** (6.14)	0.036*** (4.63)
4	0.063** (2.26)	0.087*** (2.73)	0.052*** (2.62)	0.065*** (2.38)	0.089*** (2.84)	0.054*** (2.80)
5	0.081** (2.32)	0.094** (2.05)	0.074*** (2.51)	0.085*** (2.44)	0.099** (2.15)	0.078*** (2.64)
6	0.09 *** (7.01)	0.088*** (7.55)	0.054*** (7.05)	0.092*** (7.14)	0.09*** (7.67)	0.056*** (7.23)
7	0.057*** (3.90)	0.063*** (4.44)	0.047*** (4.59)	0.06*** (4.09)	0.066*** (4.63)	0.05*** (4.80)
8	0.051*** (3.92)	0.057*** (4.83)	0.043*** (5.49)	0.052*** (4.00)	0.058*** (4.89)	0.044*** (5.55)
9	0.061*** (4.01)	0.062*** (4.39)	0.033*** (3.33)	0.063*** (4.10)	0.063*** (4.48)	0.034*** (3.41)

11	0.103*** (6.98)	0.107*** (7.88)	0.099*** (9.73)	0.103*** (7.03)	0.107*** (7.90)	0.100*** (9.78)
12	0.074*** (5.07)	0.076*** (5.65)	0.057*** (5.75)	0.077*** (5.25)	0.079*** (5.84)	0.059*** (5.93)
13	0.036*** (2.56)	0.037*** (2.84)	0.03*** (3.23)	0.038*** (2.68)	0.039*** (2.97)	0.031*** (3.37)
14	0.067** (2.00)	0.069** (2.14)	0.061** (2.21)	0.071** (2.11)	0.073** (2.24)	0.065** (2.34)
15	0.133*** 19.59)	0.132*** (8.08)	0.095*** (7.48)	0.136*** (7.77)	0.136*** (8.27)	0.098*** (7.69)
16	-0.023 (-0.99)	-0.017 (-0.85)	-0.009 (-0.78)	-0.02 (-0.87)	-0.014 (-0.72)	-0.007 (-0.59)
17	0.049* (1.51)	0.054* (1.58)	0.026 (1.21)	0.049* (1.48)	0.055* (1.56)	0.026 (1.17)
18	0.111*** (5.28)	0.100*** (5.23)	0.054*** (4.08)	0.113*** (5.41)	0.102*** (5.36)	0.056*** (4.22)
20	0.057*** (4.00)	0.059*** (4.51)	0.049*** (5.17)	0.06*** (4.16)	0.062*** (4.68)	0.051*** (5.35)

Notes: Dependent variables: ETR_1, ETR_2, ETR_3. ETR_1 is defined as the ratio of tax payable to net income before taxes; ETR_2, is defined as the ratio of tax payable to operating result; ETR_3, is defined as the ratio of tax payable to earnings before interest, taxes, depreciation and amortization (EBITDA). Sector 1 is the reference sector. For sectors' definition, see Table A2.

***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. *t*-statistics are reported in parentheses (robust standard errors were used so as to correct for the presence of heteroscedasticity and autocorrelation within panels).

Table A6

Hausman – Taylor Estimates of effective tax rates on various regions over the period 2000 - 2014 (n = 4,936)

	Equation (1)			Equation (2)		
Region	*ETR₁*	*ETR₂*	*ETR₃*	*ETR₁*	*ETR₂*	*ETR₃*
2	0.053*** (4.61)	0.046*** (4.16)	0.021*** (2.62)	0.055*** (4.80)	0.048*** (4.36)	0.023*** (2.83)
3	0.061*** (3.69)	0.06*** (3.84)	0.029*** (2.54)	0.063*** (3.81)	0.062*** (3.97)	0.03*** (2.66)
4	0.066*** (5.93)	0.061*** (5.68)	0.037*** (4.67)	0.068*** (6.15)	0.063*** (5.90)	0.039*** (4.93)
5	0.063*** (4.96)	0.058*** (4.67)	0.031*** (3.48)	0.065*** (5.10)	0.059*** (4.82)	0.033*** (3.64)
6	0.044*** (3.67)	0.036*** (3.12)	0.017** (2.05)	0.046*** (3.87)	0.038*** (3.34)	0.019** (2.27)
7	0.035*** (2.72)	0.026** (2.13)	0.013* (1.41)	0.037*** (2.89)	0.028*** (2.33)	0.014* (1.59)
8	0.03*** (2.52)	0.024** (2.11)	0.009 (1.12)	0.032*** (2.69)	0.026** (2.29)	0.011* (1.30)
9	0.041*** (3.10)	0.036*** (2.84)	0.011 (1.18)	0.043*** (3.24)	0.038*** (3.00)	0.012* (1.36)

Notes: Dependent variables: ETR_1, ETR_2, ETR_3. ETR_1 is defined as the ratio of tax payable to net income before taxes; ETR_2, is defined as the ratio of tax payable to operating result; ETR_3, is defined as the ratio of tax payable to earnings before interest, taxes, depreciation and amortization (EBITDA). Region 1 is the reference region. For regions' definition, see Table A3.

***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. *t*-statistics are reported in parentheses (robust standard errors were used so as to correct for the presence of heteroscedasticity and autocorrelation within panels).