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Effective Corporate Income Tax Rates to the Economies of the European Union in the Light of the Impact of the Economic Crisis in the Eurozone

Dimitris Balios*, Stefanos Tantos, Nikolaos Eriotis, Dimitrios Vasiliou

Department of Economics, National and Kapodistrian University of Athens, Athens, Greece

Abstract

In the present study, we investigate the determinants of the effective corporate tax rate of some of the European Union (EU) member countries and other non-EU members. Only a few studies have analyzed the EU economies, unlike the case of the USA. In this study, we extend the analysis taking also into consideration some non-EU countries which appear strong economic cooperation with EU countries over time. The present study aims to analyze the period after the outbreak of the crisis in the Eurozone up today. More specifically, the period 2004-2016 is assessed. The empirical estimations are based on two-step generalized method of moments (GMM) transformed in first-differences in order to hand cross-section fixed effects. It seems that the effective corporate income tax rate is variously affected by firm-specific determining factors. More specifically, our empirical results indicate that the effective corporate income tax rate is negatively related to the firm size, capital intensity and return on assets. However, there is no statistically significant influence of financial leverage, inventory intensity, R&D intensity, participation of foreign investors to the equity ownership, participation of government to equity ownership, to the effective corporate income tax rate. Alternative estimation measures, as a robustness check, point out that the empirical findings are generally in agreement with the initial results.

Keywords

Effective Corporate Income Tax Rate, Accounting Policies, European Union, Financial Crisis

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1. Introduction

The significance of the effective corporate income tax rate seems to be great in many aspects of the research interest in the fields of corporate and public finance as well as tax accounting and managerial accounting. For instance, researchers have used the effective tax rates as an indicator of a firm's tax-paying behaviour [1]. They attempt to determine the factors that influence effective tax rates in order to explain the fact that the firm may present lower effective tax rates by adopting tax minimizing strategy. Furthermore, effective tax rates are analysed by tax policy makers in order to identify the equity of a tax system [2, 3]. In order words, they pursue to assess whether the tax burden is 'fair' across firms and what the tax incentive effect in firms is when corporate tax rates change [4, 5].

Based on the results of this empirical study, we attempt to expand the findings of this research area. We expect to contribute to the existent literature by identifying the factors that affect the effective corporate income tax rates for the economies of either Member State of the European Union or not. Within the investigated period, we are looking forward to having some significant conclusions regarding the impact that had or continues to have the financial crisis in the Eurozone to the firms' performance, particularly after 2010.

* Corresponding author
E-mail address: dbalios@econ.uoa.gr (D. Balios)

As it is well known, there is an indisputable and positive coexistence between business profitability and tax burden. The smooth operation of the market strengthens companies' desire to maximize their profits, which is reflected in the adoption of innovative business policies which in turn bring about an increase in economic transactions, added value and ultimately leads to acceleration in economic growth rate. On the other hand, the aforementioned smooth functioning of markets with increased turnover is ensured in a healthy economic environment with "friendly" corporate income tax rates. Taking into account these considerations, we try to investigate those factors that determine the effective corporate income tax rates that ensure the sustainability of businesses in a generally healthy and competitive business environment with a developmental trajectory.

The rest of the paper is organized as follows. Section 2 provides a literature review on the effective corporate income tax rate and its major determining factors. Section 3 describes the research design. Section 4 discusses the characteristics of the research sample. Section 5 analyses the empirical results. Section 6 summarizes major conclusions, discusses research limitations and makes suggestions for future research.

2. Literature Review

The conventional research has highlighted that the estimation of Effective Corporate Income Tax Rate (ECITR) is a crucial issue [6, 3, 7, 8]. It attempts to answer to questions like which taxes are taken into consideration, what is the measurement method of firm's profit and what is the robustness of these estimations [2, 9].

Prior research estimates the ECITR[1] based on a ratio where tax expenses of a firm are presented in the numerator, and firm's income (profits) is measured in the denominator. The tax burden of the firms may be biased, whether not appropriate definitions of both numerator and denomination are taken into consideration in the ECITR equation. Regarding numerator, some researchers take into account the income tax expense of firms without involving any adjustments for deferred tax expense [5, 6, 10, 11]. However, other researchers subtract the deferred tax expense portion from the total income tax expense, attempting to reduce any reporting differences resulted by changes in deferred tax liability [4, 9, 12, 13, 14, 15].

As it concerns the denominator of the ECITR equation, the relevant research has indicated that different financial data may be taken into consideration. This may be attributed to the differences between accounting (book) income, which may be estimated in different accounting policies, and taxable income [16]. For instance, some researchers, use accounting (book) income after interest and before tax as denominator [1, 10, 12, 17, 18]. Other researchers take into account the cash flow from operations [5, 14, 15]. Due to the fact that different adopted ECITR estimations may result to conflicting findings, latest studies take into consideration more than one ECITR method estimations into their empirical analysis, in order to control the robustness of their results [6, 16].

Prior research in the field of ECITR has indicated that the ECITR may be differentiated, for instance, across either industrial sectors or the adopted corporate tax system [16, 19]. This fact may be attributed to specific firm characteristics, such as firm size, financial leverage, capital intensity, firm performance, usually in the form of return on assets [2, 5, 19]. Based on a multivariate approach and longitudinal data Researchers assess whether firm-size, profitability, capital structure, and asset mix influence the effective tax rates [5]. Scholars have determined these firm-specific variables by providing particular definitions for each one of them [6]. For instance, they consider that the firm size is measured as the natural logarithm of total assets, at book value. Financial leverage, which indicates the firms' capital structure, is measured as the long-term debt divided by total assets, both at book values. They also take into account the firm's asset mix in their analysis. They categorize it in three major proxies: i) Capital intensity which is measured as the net property, plant and equipment divided by total assets, both at book values, ii) Inventory intensity which is measured as inventory divided by total assets, both at book values and iii) Research and Development (R&D) intensity which is as R&D expenditure divided by net sales.

The empirical research in ECITR also takes into consideration some of the so-called control variables, which may contribute to ECITR fluctuations even in the same economy [6]. Studies have found that changes in book income may influence ECITR because the tax incentive (e.g. depreciation) is not related proportionately to book income [5, 18]. It is worth to be mentioned that the tax incentives are considered to be responsible for the divergence of book income from the taxable income [18]. Researchers use the Return on Assets (ROA) as indicator for firm operating results [6]. They measure ROA as pre-tax income divided by total assets being in agreement with other researchers' evidence that there is a positive relation between ROA and ECITR [5]. The prior research has also ascertained that industrial sector is another important control variable which is assessed in the empirical analysis of ECITR determination

1 To this point, we have to discriminate between average ECITR which is defined as the ratio of tax liability to firm's income and marginal ECITR which indicates the change in tax in case of income change. Researchers claim that average ECITR is more suitable when the research interest focuses on the distribution of tax burden across firms or industries [5]. Marginal ECITR is taken into consideration mostly in analysis of new investment incentives.

[6, 13, 16, 20]. The influence of industrial sector seems to be great considering the fact that some selected firms and sectors may have favourable treatment by the government as it concerns the tax burden due to developed lobby between these firms and government [16]. Some studies have pointed out this issue. More specifically, Researchers find that certain industrial sector (farming, textiles, petroleum, coal products, and real estate) have favourable tax treatment about other sectors [21, 22]. To similar findings conclude scholars who ascertain different tax treatment between firms in the pharmaceutical sector and those in the petroleum sector [13]. Researchers observe that there is a great variance of the effective tax rate among the industrial sectors in the U.S. Oil companies have the lowest effective tax rate than all the other industrial sectors [20].

Discussing initially about the relation ECITR and firm size, we find that there are two different major views about their association. According to the political cost theory, as a firm appears to be large and prosperous the greater is the possibility to be taxed heavier than the other firms. As researchers mention, this kind of firms seems to be the great 'victim' of regulatory actions implemented by the government [23]. Thereafter, scholar supports the view that since these 'prosperous' firms are taxed heavier, these high taxes are a kind of political cost borne by these firms [15]. Subsequently, this theory concludes that higher-income firms are charged with higher ECITR. According to the alternative view of the political power theory, the tax burden for the largest firms is not proportionally the same and "fair" for the tax system. This may be due to the fact that their owners or managers can influence the government decisions in their favour resulting to lower ECITR [24]. Researches in effective tax rates determination have indicated that the association between the firm size and ECITR may not always coincide. For instance, scholar claims that ECITR and firm size are positively related using a cash flows-based effective tax rate proxy [15]. Latest studies also indicate that there exists a positive relation between ECITR and firm size [19, 25]. Researchers are in agreement with the view that larger firms in Greece face higher ECITR due to their power to reduce their tax burden [19]. However, other studies conclude to a negative association [6, 10, 11, 16, 26]. Some studies have concluded to mixed results [27]. Scholars ascertain that large firms pay lower ETR than small firms in Taiwan, Korea, Malaysia, and Thailand, except Hong Kong [11]. Researchers argue that these differences are due to sample-specific characteristics [5]. Finally, there are studies which do not ascertain any significant relation between firm size and ECITR [1].

The financing structure of a firm or financial leverage is another important factor which can influence the ECITR. Researchers assert that the financing decisions of a firm may change its tax treatment [5]. For example, in the case of debt financing of business operations, where the interest expenditure is tax-deductible, a firm which appears high leverage may pay lower ECITR. On the contrary, this may not occur in the case of equity financing, where dividends are not tax-deductible. Empirical studies have found that financial leverage is negatively associated with ECITR [5, 6, 10, 12, 16, 25]. However, Researchers claim that leverage and ECITR could be positively related in the case that firms, highly-based on debt financing, have high marginal tax rates [5]. Scholars find the expected negative association between ETR and financial leverage only for the under-leveraged firms in Greece [19]. Finally, there are studies which do not ascertain any significant relation between financial leverage and ECITR [1].

The asset mix of a firm may also affect ECITR. Studies argue that firms with higher capital intensity appear lower ECITR [12, 19, 25]. They support this argument by mentioning that taxpayers may write-off the cost of depreciable assets due to tax incentives in the case of accelerated depreciation provisions and investment allowances. After that, as higher is the proportion of fixed assets to total assets the higher is the cost of depreciable assets and finally the lower is the ECITR [5, 6, 12, 10, 16].

On the contrary, since inventory and capital intensity are substitutes, firms characterized by inventory intensity have higher ECITR [5, 6, 15, 25]. Other studies (such as:) indicate that exists a significant and negative association between inventory intensity and ECITR [19]. Researchers attribute this relation to the fact that increases in inventory (if inventory growth is higher than sales growth) may result to lower prices and subsequently to lower sales revenue, lower net income and finally lower tax returns [19]. However, Scholars find no evidence of a significant relation between ECITR and inventory intensity [16].

Finally, the empirical research has indicated that R & D-intensive firms appear lower ECITR due to the relevant investment tax shield [5, 6]. Researchers assess the effect of are operating Intellectual Property (IP) Box regimes on effective average tax rates for 12 European countries [28]. They find out that these regimes allow expenses to be deducted at the ordinary corporate income tax rate resulting in large reductions in effective average tax rates.

Previous studies have also proved that the firm's performance, measured by return on assets, influences the ECITR. However, according to empirical evidence, the results vary. For instance, researchers find that the firm's performance affects in the opposite direction the ECITR [16]. Nevertheless, scholars claim that more profitable firms pay

higher ECITR [1, 25].

The investment opportunities of a firm is another important factor which has been indicated by the relevant literature [16, 29]. It is defined as the Market-to-Book (MktBook) value i.e. (market price of share)/(book value of outstanding shares), [16]. They ascertain that Market-to-Book Value ratio and ECITR are positively related signalling that high-MktBook firms have higher ECITR than other firms.

Regarding the association between ECITR and industrial sector there seems to be extended empirical research on this field (such as: [4, 5, 13, 15, 19, 20, 25]). However, most of these studies concern U.S. firms. Researchers, being one of the exceptions, study the relation between industrial sectors and ECITR based on Malaysian firms sample trading in the Kuala Lumpur Stock Exchange during the 1990–1999 [16]. They find that there is significant relation, but it depends on the industrial sector. For instance, they observe that manufacturing firms, as well as hotels, appear lower effective tax rates in Malaysia during the assessed period. Scholars support this argument by mentioning that the adopted industrial policy by the Malaysian government protects the manufacturing as well as the tourism - industrial sector [16]. The participation (percentage) of government to equity ownership is also analysed, since government ownership may contribute to lower ECITR in the case, for example, of lobby facilitation. However, studies indicate that tax haven operation results to lower effective tax rates for both private and public firms, but the effect is greater for private firms [30]. There are also empirical studies which indicate that there is not any statistically significant relation to ECITR [16].

The role of foreign investors to the equity ownership is recognized to affect the ECITR significantly. Empirical research has dealt with this issue. Researchers assessing the dividend imputation[2] effects on New Zealand firms have ascertained that firms, characterized by high-foreign ownership and high dividend payouts, have lower ECITR [1]. This may be justified by the fact that the tax rate for a dividend of foreign shareholders is higher than that imposed on undistributed profits. However, after the extension of dividend imputation to foreign shareholders, they find that the tax minimizing incentive reduced. Subsequently, the ECITR increased. Scholars also argue that in the case that the firm is highly owned by foreign investors and the dividend payout ratio is low, then the disparity between resident and foreign shareholders tax treatment is not great [1]. Thereafter, the incentives of foreign investors to minimize tax decline. However, other studies indicate that corporate effective tax rates may decline at approximately the same rate either for multinational or domestic firms [31].

2 The elimination of double taxation on dividends by notifying that the income tax on distributed income to the shareholders as dividends has already by paid without need the shareholders to pay again income tax for their dividends.

3. Research Design

In the present study, we investigate what are the determinants of an effective corporate tax rate of some of the European Union (EU) member countries and other non-EU members. Considering the literature, we ascertain that only a few studies have analyzed the EU economies, unlike the case of the USA. One of the most recent studies to be involved in assessing the economies of the EU countries is that of scholars that assess how various factors affect the ECITR in 15 Member States of the European Union during the period 1992-2009 [32]. In this study, we extend the analysis taking also into consideration some non-EU countries which appear strong economic cooperation with EU countries over time. Previous literature has pointed out that effective tax rate level varies across EU countries [33, 34]. A recent study of researchers studying the convergence of the effective corporate tax rates in the European Union (EU-27), classifies the 27 Member States into three clubs: first club comprises France, Malta, Spain and Portugal, with high effective tax rates, second club with medium tax rates, includes Belgium, Germany, Greece, Luxembourg, Italy, Austria, Slovakia, Hungary, Poland and the Czech Republic and finally the third club of low effective rates comprises the rest of the EU countries [34]. Even though a comparative analysis among the EU countries firms' sample is very interesting, our analysis focuses on the EU countries sample as a whole. Scholars examine the period from 1992 to 2009, just before the financial crisis's burst in Eurozone and the debt crisis in the Greek economy [32]. The present study aims to analyze the period after the outbreak of the crisis in the Eurozone up today, but including some years before 2009 in the assessed period, for comparative analysis purposes. More specifically, the period 2004-2016 is assessed.

In this study, we take into account additional determinants, as highlighted by the aforementioned relevant literature [1, 6, 16, 19]. Dataset firms come from industrial sectors according to the classification that scholars have used: 1. Agriculture, forestry, fishing, 2. Mining, 3. Construction, 4. Manufacturing, 5. Transportation, Telecommunications, Electricity, Gas and Healthcare, 6. Wholesale Trade, 7. Retail Trade and 8. Services [32].

Regarding the dependent variable, i.e. the ECITR, we take into account that the ECITR1 is determined by the ratio of the tax liability of the company (tax liability or current expenditure on corporate tax) to the accounting profits before tax.

In our empirical analysis, the following regression model is adopted:

$$ECITR_{i,t} = \alpha_1 + \alpha_2 FSIZE_{i,t} + \alpha_3 FLEVE_{i,t} + \alpha_4 CAPINT_{i,t} + \alpha_5 INVINT_{i,t} + \alpha_6 RDINT_{i,t}$$
$$+\alpha_7 ROA_{i,t} + \alpha_8 MKBOOK_{i,t} + \alpha_9 FOREQUITY_{i,t} + \alpha_{10} GOVEQUITY_{i,t} + \varepsilon_{i,t} \quad (1)$$

where:

ECITR: Effective corporate income tax rate.

FSIZE: Firm size, which is defined as the natural logarithm of total assets, at the book value.

FLEVE: Financial leverage, which is defined as the ratio of borrowings to the total assets of the firm, at the book value.

CAPINT: Capital Intensity, determined as the ratio of net fixed assets (land, buildings-facilities and equipment) to total assets, at the book value.

INVINT: Inventory Intensity, determined as the ratio of inventories to total assets, at the book value.

RDINT: Research and Development Intensity, which is defined as the ratio of Research and Development expenditure to net sales.

ROA: It is the firm's profitability and it is determined as the ratio of earnings before taxes to total assets of the firm.

MKBOOK: It indicates the investment opportunities of the firm, which are defined as the ratio of current market / commercial value to the book value of the company.

FOREQUITY: Participation (percentage) of foreign investors to the equity ownership.

GOVEQUITY: Participation (percentage) of government to equity ownership.

i: countries

t: period

ε: error term

4. Research Sample

4.1. Sample Selection

We investigate the determinants of ECITR assessing a sample of firms from all the aforementioned industrial sectors for 13 member countries of the European Union and four non-member countries.

Table 1. Sample Selection Countries.

EU Members												
Austria	Belgium	Finland	France	Germany	Greece	Hungary	Italy	Netherlands	Poland	Portugal	Spain	Sweden
NON-EU Members												
Switzerland	Norway	Russia	Ukraine									

Sample data come from Reuters Database. The initial database consists of 81926 firm's data yearly (row series) which is reduced to 20501, due to the exclusion of firm outliers with negative total equity, covering the period 2004-2016, a period covering both growth and recession.

4.2. Sample Data Analysis

The variables were first analyzed for their location and their dispersion through their parameters: mean value, standard deviation, median, minimum and maximum value. The higher moments (kurtosis and skewness) are also calculated in order to test through the Jarque Bera test the variables' normality. In Table 2 we present the descriptive statistics of all the variables for the years 2004-2016 for the whole data sample.

Table 2. Descriptive Statistics for the period 2004-2016.

	Ecitr1	Fsize	Fleve	Capint	Invint	Rdint	Roa	Mkbook	Forequity	Govequity
Mean	0.268588	12.64357	0.220439	0.232385	0.125359	0.022569	0.080132	1.479443	0.065786	0.011556
Median	0.276395	12.35608	0.205700	0.187550	0.099095	0.000000	0.055600	0.894499	0.000000	0.000000
Maximum	0.912680	19.80698	0.908500	0.971891	0.821063	1.529152	1.464600	59.70330	1.000000	0.930000
Minimum	0.000000	4.844187	0.000000	0.000000	0.000000	0.000000	0.000000	0.000195	0.000000	0.000000
Std. Dev.	0.168066	2.298467	0.170029	0.200207	0.122653	0.084525	0.095815	2.363749	0.160401	0.071474
Skewness	0.683167	0.393630	0.611073	1.018595	1.060135	9.715706	4.684316	8.363472	3.322090	7.628599
Kurtosis	4.175628	2.807176	2.894336	3.550338	4.041855	126.2598	36.48388	118.2072	14.50349	67.45383
Jarque-Bera	2775.294	561.1808	1285.418	3803.802	4767.342	13300509	1019037.	11576644	143643.5	3570899.
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	5506.325	259205.9	4519.219	4764.129	2569.977	462.6884	1621.071	30330.05	1285.130	225.7500
Sum Sq. Dev.	579.0500	108300.5	592.6542	821.6943	308.3983	146.4603	185.7111	114539.8	502.5831	99.79109
Observations	20501	20501	20501	20501	20501	20501	20230	20501	19535	19535

Where ECITR: Effective corporate income tax rate. FSIZE: Firm size. FLEVE: Financial leverage. CAPINT: Capital Intensity. INVINT: Inventory Intensity. RDINT: Research and Development Intensity. ROA: Return on assets. MKBOOK: current market / commercial value to the book value of the company. FOREQUITY: Participation (percentage) of foreign investors to the equity ownership. GOVEQUITY: Participation (percentage) of government to equity ownership.

Table 2 depicts that the firm size as well as investment opportunities of the firm variables appear the highest standard deviation. Research and Development Intensity variable and investment opportunities of the firm variables exhibit the highest rate of kurtosis. Furthermore, the degree of deviation of the time series distribution from normality is assessed. We examine the existence of positive or negative asymmetry (kurtosis), i.e. the presence of extreme values which not compatible with the normal distribution, using the Jarque-Bera test. This test calculates the asymmetry and kurtosis based on the sample data and then compares them with the theoretical values of the normal distribution that is zero since in the normal distribution there is no asymmetry and kurtosis. The basic assumption is H_0: Asymmetry and kurtosis equal to zero (normal distribution of time series) and the alternative H_1: Asymmetry and kurtosis different from zero (abnormal distribution of time series). According to Table 2, for all assessed variables, the probability is less than 5%, so the H_0 case of normality is rejected.

In Table 3, we present the coefficients of correlation between the variables used in the econometric model.

Table 3. Correlation coefficients of the sample data variables.

Correlation	Ecitr1	Fsize	Fleve	Capint	Invint	Rdint	Roa	Mkbook	Forequity	Govequity
ECITR	1.000000									
FSIZE	0.119264	1.000000								
FLEVE	0.033323	0.268562	1.000000							
CAPINT	0.016308	0.207711	0.361975	1.000000						
INVINT	0.046241	-0.023489	0.037455	-0.022756	1.000000					
RDINT	-0.112061	-0.052255	-0.124797	-0.134015	-0.060989	1.000000				
ROA	-0.274323	-0.228438	-0.212041	-0.164860	-0.076732	0.156849	1.000000			
MKBOOK	-0.093044	-0.119863	-0.055003	-0.156094	-0.082615	0.126749	0.394208	1.000000		
FOREQUITY	-0.030376	0.074680	-0.025474	0.019228	-0.011853	0.008653	0.018747	-0.039754	1.000000	
GOVEQUITY	0.015081	0.213260	0.029271	0.145230	-0.084370	-0.025538	-0.036229	-0.033127	-0.020482	1.000000

Where ECITR: Effective corporate income tax rate. FSIZE: Firm size. FLEVE: Financial leverage. CAPINT: Capital Intensity. INVINT: Inventory Intensity. RDINT: Research and Development Intensity. ROA: Return on assets. MKBOOK: current market / commercial value to the book value of the company. FOREQUITY: Participation (percentage) of foreign investors to the equity ownership. GOVEQUITY: Participation (percentage) of government to equity ownership.

Table 3 indicates that there is a strong positive correlation between a firm's size and financial leverage. Capital Intensity is also positively correlated to the firm's size and financial leverage. Instead, firm's profitability is noticed to be negatively correlated to effective tax rate, firm's size and financial leverage. The investment opportunities of the firm are substantial positively correlated to firm's profitability. The participation of government to equity ownership is also positively correlated to firm's size.

5. Empirical Results

We estimate model (1) with the two-step generalized method of moments (GMM) of researchers transformed in first-differences in order to hand cross-section fixed effects [35, 36]. We account for cross-section fixed effects by performing the first difference estimation. We use one lag for the instruments in the GMM estimation and robust (to small samples) standard errors of Windmeijer [37]. The estimation method is designed for big N and small T dynamic panels with high autoregressive parameter, and while it requires the error term $\varepsilon_{i,t}$ to have no autocorrelation (so that the moments conditions are satisfied for performing GMM), it does not restrict it to be homoskedastic.

Having determined the appropriate panel data model, we estimate it based on the two-step system generalized method of moments (GMM) with 13482 total panel (unbalanced) observations. The results are presented in Table 4.

Table 4. Results of the estimation of two-step GMM unbalanced paned data model.

Dependent variable is ECITR1			
Period panel data estimation 2004-2016 (13482 observations)			
Explanatory variables	**Coefficient**	**Standard errors**	**t-Statistic**
ECITR1(-1)	0.0969	0.0200	4.8343 (0.0000)*

Dependent variable is ECITR1			
Period panel data estimation 2004-2016 (13482 observations)			
Explanatory variables	**Coefficient**	**Standard errors**	**t-Statistic**
FSIZE	-0.1617	0.0347	-4.65263
			(0.0000)
FLEVE	0.1405	0.2038	0.6893
			(0.4906)
CAPINT	-0.9591	0.4260	-2.2512
			(0.0244)
INVINT	-0.6091	0.3886	-1.5673
			(0.1170)
RDINT	0.1669	0.1674	0.9968
			(0.3189)
ROA	-0.3559	0.1774	-2.0060
			(0.0449)
MKBOOK	0.0074	0.0062	1.2057
			(0.2279)
FOREQUITY	0.1203	0.1480	0.8132
			(0.4161)
GOVEQUITY	0.1311	0.5297	0.2475
			(0.8045)
Mean dependent var	-0.0018	S.D. dependent var	0.1626
S.E. of regression	0.1978	Sum squared resid	527.3799
J-statistic	65.3308	Instrument rank	74
Prob (J-statistic)	0.4302		

*p-value

Where ECITR: Effective corporate income tax rate. FSIZE: Firm size. FLEVE: Financial leverage. CAPINT: Capital Intensity. INVINT: Inventory Intensity. RDINT: Research and Development Intensity. ROA: Return on assets. MKBOOK: current market / commercial value to the book value of the company. FOREQUITY: Participation (percentage) of foreign investors to the equity ownership. GOVEQUITY: Participation (percentage) of government to equity ownership.

The estimation results from Table 4 show that the effective corporate income tax rate is negatively related to the firm size. This finding is in agreement with previous literature which also concludes to a negative association [6, 10, 11, 16, 26]. The effective corporate income tax rate is not significantly related to the financial leverage. There are studies, such as that of scholars which do not also ascertain any significant relation between financial leverage and ECITR [1]. However, several studies find that effective corporate income tax rate is negatively related to the financial leverage [5, 6, 10, 12, 16, 19, 25].

Furthermore, there is a statistically significant negative relationship between the effective corporate income tax rate and capital intensity. This evidence is in agreement with the findings of other studies [5, 6, 10, 12, 16, 19, 25]. The effective corporate income tax rate is negatively related to return on assets. This finding is in agreement with previous literature that points out an opposite relation between ROA and ECTR [16, 25].

The effective corporate income tax rate is not significantly related to inventory intensity. Researchers find no evidence of a significant relation between ECITR and inventory intensity [16]. However, this finding is in contrast with other researchers, who have pointed out that firms characterized by inventory intensity have higher ECITR [5, 6, 15, 25]. Moreover, there is not any significant relation between effective corporate income tax rate and research and development (R&D) intensity. However, other studies has indicated that R & D-intensive firms appear lower ECITR due to the relevant investment tax shield [5, 6, 28]. The investment opportunities of a firm, expressed by the market to book value index, are not related to effective corporate income tax rate being in disagreement with other studies which indicate that high-MktBook firms have higher ECITR than other firms [16, 29].

The effective corporate income tax rate is not significantly influenced by the participation of foreign investors to equity ownership. This finding is in agreement with previous literature indicate that corporate effective tax rates may decline at approximately the same rate either for multinational or domestic firms [31]. However, our evidence in contrast with other studies which claims that the incentive of foreign investors to minimize tax declines since the dividend payout ratio is low [1].

The participation of government to equity ownership does not also affect the effective corporate income tax rate. There are empirical studies which result in the same argument indicating that there is not any statistically significant relation to ECITR [16].

As regards diagnostic tests, we evaluate the Wald statistic for goodness-of-fit, the Arellano and Bond statistic for autocorrelation in the first-differenced residuals $\Delta\varepsilon_{i,t}$ and the Sargan statistic for overidentifying restrictions Sargan [38, 39].

Table 5. Diagnostic Tests.

Wald Test				
Test Statistic	Value	df	Probability	
t-statistic	29.7637	13472	0.0000	
F-statistic	885.8816	(1, 13472)	0.0000	
Chi-square	885.8816	1	0.0000	
Arellano-Bond Serial Correlation Test				
Test order	m-Statistic	rho	SE(rho)	Prob.
AR(1)	-19.48597	-195.0537	10.0099	0.0000
AR(2)	-0.2472	-1.1629	4.7026	0.8047
Sargan Statistic				
$x^2(65.33085, 65)$	p-value			
	0.465154			

Arellano-Bond (AB) estimates are based on the assumption that there should not be a second-order serial correlation in the residuals of the first-difference equation. Researchers develop test statistics to test for serial correlation. The results of the Arellano-Bond statistics indicate that the test probability (0.0000) for 1st-order autocorrelation in the error term allows us to reject the null hypothesis and therefore there seems to be an autocorrelation in the residuals [38]. Instead, we find that the test probability (0.8047) for 2nd-order autocorrelation in the error term does not reject the null hypothesis and therefore there seems not to be an autocorrelation in the residuals for 2st-order autocorrelation. Therefore, we used the 2nd lag of the predetermined regressors for instruments in order to secure that the moment conditions are satisfied for GMM estimation.

The Wald test computes a test statistic based on the unrestricted regression. The Wald statistic measures how close the unrestricted estimates come to satisfying the restrictions under the null hypothesis. If the restrictions are, in fact true, then the unrestricted estimates should come close to satisfying the restrictions. Table 5 results indicate that the Wald statistic implies a very good fit.

The Sargan–Hansen test or Sargan's test is a statistical test used for testing over-identifying restrictions in a statistical model. The Sargan test is based on the assumption that model parameters are identified via a priori restrictions on the coefficients and tests the validity of over-identifying restrictions. The test statistic can be computed from residuals from instrumental variables regression by constructing a quadratic form based on the cross-product of the residuals and exogenous variables. Sargan statistic contributes to assessing the assumption that the involved instruments are uncorrelated with the errors. More specifically, the Sargan test is a test of the validity of instrumental variables. It is a test of the overidentifying restrictions. The hypothesis being tested with the Sargan test is that the instrumental variables are uncorrelated to some set of residuals, and therefore they are acceptable, healthy instruments.

Furthermore, Sargan Statistic implies that the distance evaluated at the efficient GMM estimator under conditional homoscedasticity, δ_{2SLS} is asymptotically chi-squared. This distance is called Sargan's statistic. Our H_0 hypothesis is H_0: Uncorrelation between instruments with the residuals.

Since the reported J-statistic is simply the Sargan statistic (value of the GMM objective function at estimated parameters), and the instrument rank of 74 is higher than the number of estimated coefficients (9), we may use it to construct the Sargan test of over-identifying restrictions. Under the null hypothesis that the over-identifying restrictions are valid, the Sargan statistic is distributed as an x(p-k), where k is the number of estimated coefficients and p is the instrument rank. Noticing our results, we can mention that the H_0 hypothesis is rejected since the Sargan statistic is very significant and the p-value of the chi-square (p-value= 0.465154[3]) is higher than 0.05 (5% significance level). So, the assessed instruments are valid.

A robustness check is also taken into consideration in our empirical analysis. As we have already mentioned, because different adopted ECITR estimations may result to conflicting findings, studies take into consideration more than one ECITR method estimations into their empirical analysis, in order to control the robustness of their results.

After that, two alternative estimations of the effective corporate income tax rate are employed in our empirical research. The first alternative ECITR (ECITR2) estimation method is based on the ratio of income taxes to the net cash flow from operating activities, taking into account the Richardson and Lanis robustness check analysis [6]. According to scholars, cash flow from operating activities is

3 The *p*-value may be computed using "scalar pval = @chisq(65.33085, 65)" command in EVIEWS program.

used as the alternative denominator of the ECITR ratio, since it contributes to the restriction for any systematic differences in accounting method choices that are related to firm size [15]. The second alternative ECITR (ECITR3) estimation method is based on the ratio of income taxes to earnings before interest and taxes (EBIT). This ECITR measure has already taken into account in previous empirical studies [10, 16].

Previous studies have also taken into consideration in their analysis time effects in order to control the effect of the economic conditions during the assessed period [16]. Researchers assessing the effect of the financial crisis period on ECITR in Greece, ascertain that the ECITR increases after the beginning of the financial crisis in Greece, period 2018-2014 [19]. Therefore, since our analysis focuses on the impact of the economic crisis in the Eurozone, the sample dataset is separated into two sub-sample periods. The first one concerns the 2004-2009 period, the so-called pre-crisis years. The second sub-sample concerns the 2010-2016 period since 2010 is the starting-point year of the Memorandum in Greece, Member of the Eurozone, and that of the diffusion of the economic crisis in the Eurozone.

The two-step system GMM methodology is repeated for both sub-sample periods based on ECITR1. Furthermore, alternative ECITR estimation measures are adopted in the econometric model for the total sample as well as for both sub-sample datasets. Our empirical findings indicate, in general, that the results of the 2010-2016 period, i.e. crisis period, are closer to those of the initial findings of the total sample (2004-2016) rather than those of the pre-crisis years. During the period 2004-2009, it seems that, due to the high market turnover and economic prosperity in most of the EU countries, the determinants of firm's performance are not strongly related to income tax rates. Moreover, the ECITR1 empirical findings are ascertained to be almost in agreement with those of the ECITR3 estimation approach. Financial leverage is pointed out to be significantly related to ECITR, according to ECITR3. This may be due to the fact that interest payments are taken into account in the estimation of ECITR3. ECITR2 estimation results also appear minor differences with the initial ECITR1 empirical findings which may be attributed to the fact that only cash flow from operating activities[4] is taken into consideration in the ECITR estimation.

6. Concluding Remarks

In this study, we investigate what are the determinants of an effective corporate tax rate of some of the European Union (EU) member countries considering that in the relevant literature only a few studies have analyzed the EU economies, unlike the case of the USA. We extended the analysis taking also into consideration some non-EU countries which appear strong economic cooperation with EU countries over time. We have assessed a sample of firms from the main industrial sectors for 13 member countries of the European Union and four non-member countries. Previous studies examine the period from 1992 to 2009, just before the financial crisis's burst in Eurozone and the debt crisis in the Greek economy [32]. Our study has focused on the analysis of the period after the outbreak of the crisis in the Eurozone up today, but including some years before 2009 in the assessed period, for comparative analysis purposes. More specifically, the period 2004-2016 has been assessed. The initial database consisted of 81926 firm's data yearly (row series) which was reduced to 20501, due to the exclusion of firm outliers with negative total equity.

We ascertained that the effective corporate income tax rate is variously affected by firm-specific determining factors. More specifically, our empirical results have indicated that the effective corporate income tax rate is negatively related to the firm size, capital intensity and return on assets. However, there no seems to be any statistically significant influence of financial leverage, inventory intensity, R&D intensity, participation of foreign investors to the equity ownership, participation of government to equity ownership, to the effective corporate income tax rate.

As it concerns the alternative estimation measures (ECITR2, ECITR3), as a robustness check, the empirical findings are generally in agreement with the initial ECITR results. Minor differences are noticed but they may be due to the ECITR estimation approach itself. Furthermore, the relation between ECITR and determining factors is ascertained to be less significant (sensitive) during the pre-crisis period in comparison with the respective empirical findings after the outburst of the economic crisis in the European Union.

In general, our estimation results point out that the effective corporate income tax rate is variously affected by firm-specific determining factors. This fact seems to be in agreement with the literature above but our empirical analysis is paid attention to the period after the outbreak of the financial crisis in Eurozone. Within the investigated period, we attempted to have some significant conclusions regarding the impact that had or continues to have the financial crisis in the Eurozone to the firms' performance, particularly after 2010. As we have already mentioned, there is an indisputable and positive coexistence between business profitability and tax burden. The smooth functioning of markets with increased turnover is ensured in a healthy economic environment with "friendly" corporate income tax rates. Taking into account these considerations, we

4 Cash flow from investing and financing activities are not taken into account.

investigated those factors that determine the effective corporate income tax rates that ensure the sustainability of businesses during the pre-crisis as well as after the outburst crisis period indicating differences which may result to beneficial managerial accounting decisions.

Even though this study has focused on the sample selection of firms by the majority of industrial sectors, our dataset does not include firms by all EU member-countries, limiting our conclusion to be generalized for the whole EU economy. Thereafter, we may be cautious about the conclusions of this study.

Summarizing, this study points out that the effective corporate income tax rate is variously affected by firm-specific determining factors. More significantly, we found that the relation between ECITR and determining factors is ascertained to be less significant (sensitive) during the pre-crisis period in comparison with the respective empirical findings after the outburst of the economic crisis in European Union. We consider that the present study may be repeated in the future, taking into consideration firms by the rest of the EU member-countries enriching the initial firm's database. Also, the empirical analysis may be modified by classifying the firms by industrial sector attempting to identify the determinants of the effective corporate tax rate by each sector. This may provide useful conclusions about the differences in firms' performance among various industrial sectors.

Furthermore, our research design may be focused on specific European areas which appear similar economic conditions. For instance, we may classify European economies in two main country-groups: North (and central) country-group and South country-group. As it is well known, northern EU countries are characterized by more stable and flourishing economies in relation to southern EU countries, which have dealt with financial as well as fiscal adverse conditions appearing prolonged periods of recession and deflation.

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