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Investigating the Nexus between Financial Indicators and Corporate Income Tax in Europe

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Abstract. *Corporate taxation, reflected by the effective corporate tax rate, represents one of the main tools for assessing the efficiency of the tax system, being the real expression of tax burden borne by the companies. The study investigates the factors influencing the effective tax rate. The database consists of 396 non-financial companies from Europe, from the energy sector, over a 10-year period, respectively 2014-2023. The originality of the research is represented by the sample analyzed, as there are few previous studies which analyzed the determinants of the effective tax rate of the energy companies. The energy sector is a field deeply affected by economic, health and political crises, but also by the armed conflict in Ukraine. There are estimated multiple regression models, using panel data, with fixed effects and random effects. The dependent variable is represented by the effective corporate tax rate, while the independent variables include profitability indicators (return on equity), asset structure indicators (capital intensity, inventory intensity), liquidity indicators (current ratio, quick ratio), indebtedness indicators (total indebtedness ratio), as well as other financial indicators (research & development intensity, market capitalization). The research shows that the main factors that have a negative impact on the dependent variable are return on equity, capital intensity, research and development intensity, and liquidity ratios. Moreover, market capitalization and total indebtedness positively impact the effective tax rate of the energy sector companies. The results confirm the main research hypotheses formulated based on the findings from previous studies in the field.*

Keywords: effective tax rate, profitability, liquidity, indebtedness, market capitalization, panel data empirical models.

Introduction

The research is focused on analyzing the key factors influencing the effective corporate tax rate, which, in the economic reality, is often different from the statutory tax rate, due to fiscal adjustments made to accounting profit for the purpose of determining the taxable profit. Thus, through corporate income tax regulations specific to European countries, accounting profit can be adjusted either upward or downward through various categories of non-taxable income, non-deductible expenses, tax deductions, and other forms of fiscal facilities. These measures are commonly used as tools for tax optimization.

Since ancient times, taxation has played a crucial role in the economic development of a country, influencing both the business environment and the overall well-being of society. Thence, corporate income tax, reflected by the effective tax rate, represents a key element in the formation of state budget revenues. Moreover, corporate income tax serves as the primary measure of assessing the tax burden of the companies, due to fiscal policy decisions, as well as evaluating the efficiency of tax optimization measures implemented by financial directors. From this point of

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view, analyzing the determinants of the effective corporate tax rate is of great interest. Thus, the factors influencing the tax burden remain a focal point in research studies, being of interest not only to company directors, but also to policymakers responsible for developing fiscal policies. This research is even more relevant, given that the sector analyzed is significantly impacted by a series of global economic and financial events.

Given the importance of the effective tax rate in investigating the real tax burden borne by companies over a fiscal period, typically one year, the European Union has implemented the Council Directive (EU) 2022/2523 issued on 14 December 2022, which aims to ensure a global minimum level of taxation for multinational enterprise groups and large-scale domestic groups in the European Union. The adopted measures aim to strengthen the fight against aggressive tax planning within the internal market and to put an end to the fiscal practices of multinational enterprises that allow them to transfer profits to jurisdictions where they are subject to zero or very low taxation. This regulation seeks to set a limit on competition regarding corporate tax rates, by establishing a global minimum tax rate of 15%.

This research aims to analyze the determinants of the effective corporate tax rate in the energy sector, using data from European companies, for the period 2014-2023. Consequently, the study seeks to identify, through empirical analysis, the influence of various indicators—profitability (return on equity), asset structure (capital intensity, inventory intensity), indebtedness (total indebtedness ratio), liquidity (current ratio, quick ratio), and other factors (market capitalization, research and development intensity)—on the effective tax rate. In fact, the independent variables used in the empirical analysis represent relevant indicators for characterizing profitability, asset structure, liquidity, indebtedness, and market capitalization. These indicators are used in the financial reporting of companies worldwide, regardless of their industry.

Regarding the research structure, it is important to note that it begins with a literature review, highlighting the main findings of previous empirical studies on the determinants of effective corporate tax rate and establishing the research hypotheses. The next part of the study consists of an empirical analysis of the factors affecting the effective corporate tax rate in the energy sector, conducted using panel data regression models, with fixed effects and random effects. The study concludes with the statistical and economic interpretation of the results, the validation of the research hypotheses, and the formulation of conclusions.

Literature review

The factors influencing the effective corporate tax rate (ETR) have been studies by numerous researchers, and the results indicate significant differences across countries. There have been identified several variables as impacting the effective tax rate, including company size, indebtedness, profitability, inventory intensity, capital intensity, liquidity, and others.

In an interesting study (Huang et al., 2013) there are analyzed the determinants of taxation for companies listed on the Shanghai and Shenzhen stock exchanges in China, using ordinary least squares and fixed effects estimation methods. Their main findings suggest that company size and capital intensity have a positive impact on the effective tax rate, while return on assets negatively influences ETR, contradicting the research by Richardson and Lanis (2007). Additionally, Richardson and Lanis (2007), and Ciobanu et al. (2024) demonstrate that research and development intensity has a negative impact on companies taxation. Interesting findings on the determinants of effective corporate tax rate are also highlighted in other studies. For instance, Vintilă et al. (2018), using a sample of companies listed on five Eastern European stock exchanges—Romania, Bulgaria, Poland, Hungary, and Slovenia—show that performance indicators—ROA, ROE, ROIC—

inventory intensity, and company size positively affect ETR, being consistent with Păunescu and Vintilă (2018). Furthermore, the positive impact of return on equity contradicts the findings of Barbera et al. (2020), and Ciobanu et al. (2024). Regarding the indicator reflecting the variation in market capitalization, Păunescu and Vintilă (2018) observe a positive impact on ETR.

In another research, Garmendia-Lazcano and Baselga-Pascual (2024) argue that capital intensity and leverage have a negative influence on tax evasion, measured as effective tax rate of Spanish companies, these results aligning with the findings of Pu et al. (2015). Moreover, their study supports the idea that return on assets positively impacts ETR, with similar results obtained by Richardson and Lanis (2007), and Panda and Nanda (2020). However, these findings contradict the studies by Greeff (2019), Cao and Cui (2017), and Poli (2019). Furthermore, the empirical analysis by Ann and Manurung (2019) is focused on the determinants of tax aggressiveness, expressed through effective tax rate, for manufacturing companies listed on Indonesia Stock Exchange. The results indicate that current liquidity, company size, and return on assets negatively impact ETR, contradicting Vintilă et al. (2018). Additionally, Ann and Manurung (2019) identify a positive influence of inventory intensity on ETR, being consistent with the findings of Huang et al. (2013), and Bubanić and Šimović (2021), but contradicting the studies by Stamatopoulos et al. (2019), and Ciobanu et al. (2024).

Furthermore, Fernández-Rodríguez et al. (2021) examine the determinants of the effective corporate tax rate in BRICS—Brazil, Russia, India, China, and South Africa—and MINT—Mexico, Indonesia, Nigeria, and Turkey—countries, using two methods for calculating ETR, namely cash effective tax rate, and modified effective tax rate – expressed as the ratio of cash effective tax rate to the statutory tax rate. Using both methods, the results indicate that company size and inventory intensity have a positive impact, while leverage, capital intensity, return on assets, and sales growth have a negative influence on the dependent variables. Using the same approach for determining the dependent variable, Pulungan et al. (2023) demonstrate that company size and return on assets negatively affect ETR. In addition, Hendayana et al. (2024), Barbera et al. (2020), Păunescu and Vintilă (2018), and Ciobanu et al. (2024), the financial leverage positively impacts the cash effective tax rate. Moreover, using the same measure of ETR, respectively cash effective tax rate, Dyreng et al. (2017) suggest that asset tangibility, leverage, and research and development intensity negatively impact the dependent variable.

Based on the research framework outlined above, the following research hypotheses are formulated:

Hypothesis 1: Return on equity negatively influences the effective corporate tax rate (Barbera et al., 2020; Ciobanu et al., 2024).

Hypothesis 2: Capital intensity negatively impacts the effective corporate tax rate (Richardson & Lanis, 2007; Garmendia-Lazcano & Baselga-Pascual, 2024; Fernández-Rodríguez et al., 2021).

Hypothesis 3: Inventory intensity positively influences the effective corporate tax rate (Vintilă et al., 2018; Păunescu & Vintilă, 2018; Ann & Manurung, 2019; Fernández-Rodríguez et al., 2021).

Hypothesis 4: Research & development intensity negatively impacts the effective corporate tax rate (Richardson & Lanis, 2007; Dyreng et al., 2017; Ciobanu et al., 2024).

Hypothesis 5: Liquidity negatively influences the effective corporate tax rate (Ann & Manurung, 2019).

Hypothesis 6: Market capitalization positively impacts the effective corporate tax rate (Păunescu & Vintilă, 2018).

Hypothesis 7: Indebtedness positively influences the effective corporate tax rate (Barbera et al., 2020; Hendayana et al., 2024; Poli, 2019; Păunescu & Vintilă, 2018; Ciobanu et al., 2024).

Methodology

The database is collected from Thomson Reuters Eikon platform, and consists of 396 companies, representing all the European companies in the energy sector, over a period of 10 years, from 2014 to 2023. As for the research hypotheses, the dependent variable and the independent variables are established based on previous studies presented in the state of knowledge.

The dependent variable—that captures the company taxation—is represented by the effective corporate tax rate (ETR), expressed as corporate income tax to earnings before taxes.

The independent variables, that are used in the empirical analysis, are represented by: capital intensity (CAPINT)—determined as tangible assets to total assets, inventory intensity (INVINT)—calculated as inventory to total assets, research & development intensity (RDINT)—expressed as R&D expenses to total revenue, return on equity (ROE)—determined as net income to equity, current ratio (CRTR)—measured as current assets to current liabilities, quick ratio (QUICKR)—calculated as current assets less inventory to current liabilities, total indebtedness (TDTA)—measured as total debt to total assets, company size (MCAP)—expressed as natural logarithm of market capitalization.

In Table 1 there are presented the descriptive statistics for energy companies from countries located in Europe and, separately, for companies in Romania.

Table 1. Descriptive statistics

Variable	Mean	Median	Min	Max	SD
Europe					
ETR	0.2339	0.2000	0.0000	0.6100	0.1812
CAPINT	0.3926	0.3900	0.0100	0.8200	0.2756
INVINT	0.0740	0.0400	0.0000	0.2400	0.0799
RDINT	0.0011	0.0000	0.0000	0.0100	0.0031
ROE	-0.0478	0.0100	-0.5500	0.2500	0.2402
CRTR	2.3963	1.4850	0.4500	7.4300	2.1802
QUICKR	2.0576	1.1900	0.3200	6.7800	2.0301
TDTA	0.2890	0.2400	0.0000	0.7500	0.2689
MCAP	18.1758	18.0708	14.5787	22.1006	2.4555
Romania					
ETR	0.1611	0.1500	0.0000	0.5800	0.0839
CAPINT	0.4227	0.4600	0.0800	0.7900	0.1931
INVINT	0.0945	0.0500	0.0100	0.2400	0.0838
RDINT	0.0007	0.0000	0.0000	0.0100	0.0026
ROE	0.0291	0.0500	-0.5500	0.2500	0.1698
CRTR	2.6735	2.0800	0.4500	7.4300	2.0270
QUICKR	2.1020	1.2800	0.3200	6.7800	1.9849
TDTA	0.1468	0.0750	0.0000	0.6700	0.1759
MCAP	17.6879	17.2497	14.5787	22.1006	2.6970

Source: Authors' own research.

At the level of European companies, the average effective corporate tax rate is 23.39%, with a maximum of 61%. Return on equity ranges from -55% to 25%, with an average value of -4.78%. both the current ratio and the quick ratio have average values greater than 1 (2.40, respectively 2.06), indicating that these companies have the ability to cover their current liabilities using current assets. Additionally, the average total indebtedness ratio of 28.90% suggests that the analyzed companies use debt as a tool to reduce the effective corporate tax rate, through the deductibility of interest expenses from the profit tax calculation base.

At the level of Romanian companies, the effective corporate tax rate ranges from a minimum of 0% to a maximum of 58%, a range similar to that recorded for European companies. It is observed that the minimum and maximum limits of the indicators R&D intensity, return on equity, current ratio, quick ratio, and market capitalization coincide with the extreme minimum and maximum values of European companies, suggesting that these extreme values at the European level are driven by Romanian companies.

Table 2 highlights the results of the multicollinearity analysis, which is essential to prevent autocorrelation among the independent variables.

Table 2. Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) ETR	1.000								
(2) CAPINT	-0.099	1.000							
(3) INVINT	-0.021	-0.333	1.000						
(4) RDINT	0.162	-0.109	-0.062	1.000					
(5) ROE	-0.275	-0.048	0.092	0.007	1.000				
(6) CRTR	-0.082	-0.186	0.044	-0.030	-0.130	1.000			
(7) QUICKR	-0.067	-0.157	-0.159	-0.005	-0.123	0.963	1.000		
(8) TDTA	0.132	0.063	-0.092	-0.004	0.063	-0.498	-0.459	1.000	
(9) MCAP	0.156	0.187	-0.142	0.269	0.138	-0.211	-0.170	0.121	1.000

Source: Authors' own research.

A strong correlation (0.963) is observed between the current ratio and the quick ratio. However, to ensure that this correlation does not impact the results, the explanatory variables are included in separate regression models, to avoid the occurrence of multicollinearity phenomenon among the factors.

Results and discussions

There are estimated, using Stata 18 software, empirical models (Table 3), with unbalanced panel data, with fixed effects and with random effects, to capture the impact of the financial indicators on the effective tax rate of the European energy companies. Hausman test is also used to select between the fixed effects and the random effects, indicating that the fixed effects regressions are preferred, because the probability associated with the Hausman test is lower than 5%.

The general form of the estimated regression models is: $Y_{it} = \beta_0 + \sum \beta_i X_{it} + \varepsilon_{it}$, where Y_{it} represents the dependent variable, X_{it} represents the independent variable, and ε_{it} represents the error term.

Table 3. Factors affecting the effective corporate tax rate

Variable	Model 1		Model 2	
	Fixed effects	Random effects	Fixed effects	Random effects
CAPINT	-.136***	-.1199***	-.1341**	-.1203***
	(.052)	(.0337)	(.0522)	(.034)
INVINT	.0846	.0698	.0386	.0258
	(.1431)	(.103)	(.1456)	(.1058)
RDINT	-5.0058***	-1.1972	-5.0035***	-1.1747
	(1.8696)	(1.6304)	(1.8707)	(1.6313)
ROE	-.6761***	-.682***	-.6738***	-.6797***
	(.0549)	(.0508)	(.0549)	(.0508)
CRTR	-.0101**	-.01**		
	(.005)	(.0041)		
QUICKR			-.0093*	-.0097**
			(.0054)	(.0045)
TDTA	.0439	.072**	.0489	.077**
	(.0411)	(.0323)	(.0409)	(.032)
MCAP	.01	.0176***	.0096	.0176***
	(.0081)	(.004)	(.0081)	(.004)
_CONS	.2014	.0313	.2053	.0276
	(.1584)	(.0789)	(.1585)	(.079)
Observations	1152	1152	1152	1152
R-squared	.1501	.1448	.1491	.1437

Note: Significance level: *** p<.01, ** p<.05, * p<.1. Standard errors are displayed in brackets.

Source: Authors' own research.

Therefore, although the inventory intensity variable is statistically insignificant, capital intensity, and R&D intensity have a negative influence on the corporate taxation, suggesting that companies that have more tangible assets and are involved in several research & development activities tend to register lower effective tax rates. This implies that for investments in research % development projects there are granted additional facilities in the calculation of taxable profit, that will implicitly lead to a reduction in corporate income tax. These results confirm hypothesis 2 (Richardson & Lanis, 2007; Garmendia-Lazcano & Baselga-Pascual, 2024; Fernández-Rodríguez et al., 2021) regarding the influence generated by capital intensity, and hypothesis 4 (Richardson & Lanis, 2007; Dyreng et al., 2017; Ciobanu et al., 2024) regarding the impact of R&D intensity, and lead to the rejection of hypothesis 3 regarding inventory intensity.

The same negative impact is obtained in the case of return on equity and liquidity—expressed as current ratio and quick ratio, showing that the more profitable and liquid the companies are, the lower the effective corporate tax rate is, results that are in accordance with hypothesis 1 (Barbera et al., 2020; Ciobanu et al., 2024) regarding return on equity, and hypothesis 5 (Ann & Manurung, 2019) regarding liquidity. From an economic perspective, the increase in return on equity—resulting from higher net income due to a lower corporate tax rate—will lead to a reduction in the effective corporate tax rate. Moreover, the negative influence of liquidity on the effective tax rate could explain that there is sufficient liquidity to pay the corporate tax due, which would result in a decrease in the cash effective tax rate.

Although bigger companies and the ones that prefer debt financing should register lower effective tax rates—as a result of the tax savings generated by the deductibility of interest expenses from the profit tax calculation base—in the case of European energy companies, total indebtedness and company size exert a positive impact on the effective tax rate. Even though increased

indebtedness generates tax savings that reduce the effective tax rate, an increase in debt from various borrowed financing sources could lead to a limitation of interest expenses, resulting in a higher taxable profit base and, implicitly, a higher corporate income tax and effective tax rate. In this regard, the recommendations of the Council Directive (EU) 2022/2523 suggest establishing a global minimum tax rate of 15%. Thereby, there are accepted hypothesis 7 (Barbera et al., 2020; Hendayana et al., 2024; Poli, 2019; Păunescu & Vintilă, 2018; Ciobanu et al., 2024) regarding indebtedness, and hypothesis 6 (Păunescu & Vintilă, 2018) regarding market capitalization.

Conclusion

The research focused on analyzing the determining factors of the effective tax rate of European energy companies, the energy sector being a field strongly influenced by the general economic situation, characterized by political and economic uncertainties that affect the volatility of natural resources prices.

A retrospective analysis of the empirical results show that six out of seven research hypotheses were accepted, confirming the positive impact of market capitalization (Păunescu & Vintilă, 2018) and indebtedness (Barbera et al., 2020; Hendayana et al., 2024; Poli, 2019; Păunescu & Vintilă, 2018; Ciobanu et al., 2024), as well as the negative influence of capital intensity (Richardson & Lanis, 2007; Garmendia-Lazcano & Baselga-Pascual, 2024; Fernández-Rodríguez et al., 2021), research & development intensity (Richardson & Lanis, 2007; Dyreng et al., 2017; Ciobanu et al., 2024), return on equity (Barbera et al., 2020; Ciobanu et al., 2024) and liquidity (Ann & Manurung, 2019) on the effective tax rate. The hypothesis regarding inventory intensity was rejected, as the independent variable was statistically insignificant.

Considering that tax burden—represented by the corporate income tax—is the result of fiscal policy decisions and those decisions made by company management, this study is relevant for company managers seeking tax optimization through profit maximization, for public authorities regulating fiscal policies, and for other researchers or investors concerned with identifying the determinants of the effective corporate tax rate.

This study is limited by data availability; however, future research directions could explore the impact of other factors on the effective tax rate, as well as expanding the sample by including in the analysis companies from other sectors or geographical areas.

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