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Explaining effective tax rates: the influence of Corporate Governance mechanisms and firms' characteristics

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Biographical Note

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Later, in September 2021, she joined Deloitte as a tax analyst.

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Abstract

Corporate income tax is one of the most important sources of revenue for governments, but it is also a crucial factor for companies, as it represents a cost for them and has an impact on major corporate decisions. Thus, studies on effective tax rates (ETRs) and their determinants are relevant not only for regulators and policy makers, but also for companies.

This investigation has two essential purposes. Firstly, to analyze how ETRs are determined by corporate governance mechanisms and, secondly, how ETRs are influenced by firms' operational and financial characteristics. We used a sample of 130 non-financial listed companies from 14 European Union countries for the period between 2009 and 2018.

The results, obtained by using Tobit as the estimation method, show that larger boards of directors and boards with a higher proportion of non-executive directors have lower ETRs. On the other hand, we found that the presence of female directors on boards of directors and greater ownership by managers increase ETRs. Regarding operational and financial characteristics, we concluded that larger firms, more capital-intensive firms, and more leveraged firms have higher ETRs. Conversely, more inventory-intensive firms have lower ETRs. Profitability is also relevant to explain ETRs, but with different consequences.

The relevance of this investigation is due to the importance of ETRs in corporate decision-making, especially in terms of investment and financing, and the fact that corporate governance mechanisms can influence the firms' tax burden, by reducing agency problems.

Keywords: Effective tax rates; Corporate Governance; Panel data models; Tobit model

Resumo

O imposto sobre o rendimento das sociedades é uma das mais importantes fontes de receita dos governos, mas também é um fator crucial para as empresas, pois representa um custo para as mesmas e tem impacto sobre as principais decisões corporativas. Assim, os estudos sobre as taxas efetivas de imposto (ETRs) e os seus determinantes são relevantes não só para reguladores e formuladores de políticas, mas também para as empresas.

Esta investigação tem dois objetivos fundamentais. Em primeiro lugar, analisar de que forma as ETRs são determinadas pelos mecanismos de governança corporativa e, em segundo lugar, como as ETRs são influenciadas pelas características operacionais e financeiras das empresas. Utilizamos uma amostra de 130 empresas cotadas, não financeiras, pertencentes a 14 países da União Europeia, para o período entre 2009 e 2018.

Os resultados, obtidos através da estimação pelo método Tobit, mostram que conselhos de administração de maior dimensão e conselhos com maior proporção de diretores não executivos apresentam ETRs mais baixas. Por outro lado, verificamos que a presença de mulheres diretoras nos conselhos de administração e a maior propriedade por parte dos gestores aumentam as ETRs. Relativamente às características operacionais e financeiras, concluímos que empresas de maior dimensão, empresas mais intensivas em capital e empresas mais endividadas têm ETRs mais elevadas. Contrariamente, empresas mais intensivas em inventários têm ETRs mais baixas. Também a rentabilidade é relevante para explicar as ETRs, mas com consequências diversas.

A relevância desta investigação deve-se à importância das ETRs na tomada de decisões corporativas, especialmente em termos de investimento e financiamento, e ao facto de os mecanismos de governança corporativa poderem influenciar a carga fiscal das empresas, através da redução dos problemas de agência.

Palavras-Chave: Taxas efetivas de imposto; Governança Corporativa; Modelos de dados em painel; Modelo Tobit

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1. Introduction

Studies that analyze effective tax rates (ETRs) and their determinants are beneficial for investors, researchers, regulators, as well as for managers, shareholders, and policy makers since corporate tax rate is an essential tax tool for the tax system of any country. More recently, the theme of Corporate Governance has gained prominence in this area since it may have an influence on the firms' tax burden. Therefore, this investigation aims to contribute to the literature on the determinants of ETRs. More particularly, we study the impact of corporate governance mechanisms and firms' operational and financial specific characteristics on ETRs.

Examining the impact the tax system has on business activity is very important, as tax rates can both encourage and create obstacles to business investment. On the one hand, corporate tax rate is one of the main sources of revenue for governments, creating incentives for its increase. On the other hand, increasing this rate can damage the attraction of foreign investment and, consequently, the attractiveness of a country.

In addition, corporate tax rates represent a significant expense for firms, decreasing their net income and influencing their decisions (Graham, 2003). Thus, there are incentives to reduce tax expenses, since the minimization of taxes benefits shareholders and firms by contributing to what is their main goal: creating value for shareholders. In line with this perspective, our research analyzes whether firms' financial and operational specific characteristics are determinants of ETRs. To fulfill this objective, we followed a similar approach of the studies of Richardson and Lanis (2007), Kraft (2014) and Barbera et al. (2020). In our study, we are interested in the impact of size, leverage, asset mix composition and profitability on effective tax rates.

Most studies only considered operational and financial characteristics as determinants of ETRs, ignoring the separation of ownership and control and the existence of the agency problem in firms. To overcome this limitation, this investigation establishes a link between corporate governance mechanisms and ETRs. We followed the perspective of Minnick and Noga (2010) and assumed corporate governance mechanisms as explanatory variables. In particular, we are interested in the impact of the board structure, the CEO duality, and the ownership structure on effective tax rates. The main reason for considering corporate governance mechanisms is due to the existence of the agency problem. As managers can act on behalf of shareholders, they may not manage the firms' tax burden in order to reduce ETRs, making decisions that do not reflect shareholders' interests and that do not contribute

to the maximization of the firm's value, creating agency costs (Jensen and Meckling, 1976). Corporate governance mechanisms are relevant, because they can help to reduce agency conflicts and to align the interests of both groups, promoting and influencing the firms' tax planning (Minnick and Noga, 2010; Lanis and Richardson, 2011).

The board of directors is one of the main corporate governance mechanisms, responsible for the allocation of resources, performance, and shareholders' wealth, playing an important role in the firm's tax strategy (Minnick and Noga, 2010; Wahab et al., 2017; Khaoula and Moez, 2019). In addition, it helps to solve agency conflicts through its supervisory role, protecting shareholders' interests (Fama and French, 1997; Minnick and Noga, 2010). However, the effectiveness with which it will play its functions depends on a set of characteristics, among which we highlight the board's size, its independence, and its gender diversity. Therefore, regarding the board structure, we are interested in studying the impact of the board's size, the board's independence, and its gender diversity on ETRs, as these mechanisms are mentioned in the literature as possible ways that help to reduce the agency problem.

We also included CEO duality as an explanatory variable of our regressions, such as Minnick and Noga (2010), as we believe that when the same person holds the positions of CEO and Chairman of the Board of directors, firms see the management of their tax burden weakened, leading to higher values of ETRs. Finally, we analyzed insider ownership. This variable is referred in the literature as a possible way to encourage the alignment of interests between shareholders and managers (alignment effect), through the reduction of managers' incentives for the consumption of advantages and participation in non-maximizing activities (Florackis, 2008). However, when managers have a certain level of ownership, they can entrench themselves at the expense of shareholders (entrenchment effect), satisfying their own interests.

To study the determinants of effective tax rates mentioned above, we selected a panel data sample of 130 non-financial listed companies, from 14 countries of the European Union, for the period between 2009 and 2018. In order to analyze whether corporate governance mechanisms and firms' operational and financial specific characteristics are determinants of effective tax rates, we estimated several regressions, using Tobit as the estimation method. By including corporate governance mechanisms as independent variables of our regressions, we intend to obtain a more complete model of the determinants of ETRs, as in the studies of Minnick and Noga (2010), Osebe et al. (2019) and Chythis et al. (2020).

Our results show that corporate governance mechanisms and operational and financial characteristics influence ETRs. We found evidence that larger boards of directors and boards of directors with a higher proportion of non-executive directors have lower ETRs, proving that the board structure influences ETRs. On the other hand, we concluded that boards of directors with a greater presence of female directors and greater ownership by managers are associated with higher ETRs. Regarding firms' characteristics, we concluded that larger, more leveraged, and more capital-intensive firms have higher ETRs. Conversely, firms that are more intensive in inventories have lower ETRs. Although we found a significant relationship between profitability and ETRs, the sign of the relationship varied between the measures chosen for ETRs.

Our research contributes to the literature on the determinants of effective tax rates both theoretically and empirically. The first contribution is related to the inclusion of corporate governance mechanisms as determinants of effective tax rates. Through the literature, we found that the separation between ownership and management in firms was ignored and, in order to overcome this limitation, we created a more complete model considering corporate governance mechanisms as explanatory variables. The main reason for including these mechanisms is because of the agency problem (Jensen and Meckling, 1976). The presence of these mechanisms can help to control and monitor managers' actions, who do not always act in accordance with shareholders' interests, reducing agency problems. The second contribution is related to the use of a sample of firms that belong to 14 countries of the European Union. The vast majority of studies that investigate ETRs and their determinants focus on American companies, which means the use of European firms is quite scarce. Then, the third contribution concerns the chosen time period. To analyze the determinants of ETRs, we selected a 10-year period (2009-2018), taking into account the choice of a more recent time period, in order to work with more recent data. In addition, all corporate governance variables used in this investigation present annual data. This contribution is extremely important since most studies work with corporate governance data assuming them as constant over the analyzed time periods. Therefore, this fact brings greater reliability to our results. Finally, we highlight the use of Research & Development Intensity, CEO duality and Board gender diversity as independent variables of our models, which are rarely used in investigations dedicated to effective tax rates, further enriching our data and results.

The remainder of this paper is organized as follows. Section 2 presents a brief review of the literature related with the impact of firms' financial and operational specific characteristics and corporate governance mechanisms on effective tax rates. In this section we also develop our research hypotheses. The variables are described on Section 3. Section 4 describes the sample selection and the methodology. The results obtained related with our hypotheses and the univariate analysis are exhibited on Section 5. Finally, Section 6 presents a summary of this investigation.

2. Literature Review and Hypotheses Development

Taxes have become a critical variable within the business sphere, particularly in terms of corporate financial decisions. Some of the financial decisions affected by corporate income tax are dividend policies, capital structure decisions and capital budgeting decisions (Graham, 2003). In fact, Desai and Dharmapala (2006) report that taxes are one of the many factors that influence corporate decision-making, especially in terms of investment and financing policies. Taxes represent a significant cost for companies, which means they will affect their performance. Thus, it is intuitive to admit that firms will look for ways to reduce them. The reduction of the tax burden increases the value of earnings after taxes and the firm's value, benefiting shareholders and satisfying their interests, which means it represents an important investment for shareholders (Abdul Wahab and Holland, 2012; Gomes, 2016; Khaoula and Moez, 2019). However, the potential costs associated with tax planning can make shareholders no longer interested in investing in tax planning activities (Chen et al., 2010), meaning that companies will only invest on these activities if it is beneficial and adds value to the company (Minnick and Noga, 2010). Therefore, based on the literature, we believe that firms can improve their performance through tax planning (Desai and Dharmapala, 2006; Minnick and Noga, 2010).

The concept of tax planning is quite difficult to define. The literature presents different designations when referring to firms' attempts to reduce their tax burden, among which, Abdul Wahab and Holland (2012) and Khaoula and Moez (2019) use the term *tax planning* and Minnick and Noga (2010) use the term *tax management*. Dyreng et al. (2008) and Desai and Dharmapala (2006, 2009) refer the term *tax evasion* as the explicit reduction of taxes. Wahab et al. (2017) refer to *tax aggressiveness* as tax planning strategies used with the aim of reducing the tax burden. In our research, we understand the concept of tax planning as a legal way to reduce tax expenses whenever opportunities are identified in tax legislation (Desai and Dharmapala, 2006; Minnick and Noga, 2010).

Many investigations have been dedicated to the study of ETRs and their determinants (Gupta and Newberry, 1997; Derashid and Zhang, 2003; Rego, 2003; Richardson and Lanis, 2007; Lee and Swenson, 2012; Kraft, 2014; Stamatopoulos et al., 2019). ETRs are widely used by researchers, as they are considered the best measure to evaluate the effectiveness of tax planning activities (Wahab et al., 2017), since they reflect in a more real and reliable way the tax burden that firms bear. On the other hand, nominal tax rates are not suitable for this task, because they do not provide a complete view of the total tax expenses of companies and they do not consider the tax base of corporate income tax (Stamatopoulos et al., 2019). In

addition, taxable profit does not necessarily correspond to accounting profit, because tax laws differ from accounting rules, which reinforces the use of ETRs. Taxable profit is obtained from accounting profit to which deductions and additions are made in accordance with the tax laws of each country.

2.1. Firms' financial and operational specific characteristics

Effective tax rates have been explained through a set of determinants. Within the operational and financial characteristics, the firm's size is a variable widely used by researchers. However, it has produced contradictory results both at univariate and multivariate level. The literature points out two opposite theories. The political cost theory argues that larger companies are victims of greater regulatory actions by the government and transfers of wealth, due to their greater visibility and prosperity (Zimmerman et al., 1983). Therefore, as taxes are part of the total political costs borne by companies, this perspective suggests that these companies will be less likely to reduce ETRs, facing higher ETRs. On the other hand, the political power theory states that larger companies have at their disposal resources that allow them to manipulate the political process in their favor, invest in tax planning and optimize their activities to obtain tax savings. Thus, Siegfried (1972) argues that larger companies should have lower ETRs. Porcano (1986) also found a negative relationship between these variables. However, the first studies that focused on this relationship considered the firm's size as the only determining factor, which may have biased the results (Siegfried, 1972; Zimmerman et al., 1983; Porcano, 1986). In addition, Wilkie and Limberg (1990) stated that the opposite results of Zimmerman et al. (1983) and Porcano (1986) can be explained by the different empirical procedures used to represent size, the definition of effective tax rates, the method of data aggregation and the sample selection.

More recently, investigations have been carried out in a multivariate context. However, the results continued to be contradictory. Richardson and Lanis (2007), Dyreng et al. (2008) and Moreno et al. (2017) found an inverse relationship between firm's size and ETRs. Other studies have shown that there was a positive relationship between the variables (Holland, 1998; Rego, 2003; Kraft, 2014; Salaudeen and Eze, 2018; Stamatopoulos et al., 2019). For a sample of European firms, there was a negative association between the two variables (Lee and Swenson, 2012; Barbera et al., 2020). In addition, Gupta and Newberry (1997) showed that ETRs were not related with the firm's size, if this relationship was evaluated over time and in firms with longer histories, before or after the study of the United States Reform Act in 1986. Due to the ambiguous results, we anticipate that there is an

association between firm's size and ETRs, not predicting the sign of the relationship. Thus, we formulate the following hypothesis:

H1a: Firm's size is related with ETRs.

Financing decisions can have an impact on ETRs, since tax treatment differs depending on how a firm chooses its financing resources (Gupta and Newberry, 1997). Companies have three ways of financing their activities: debt financing, equity financing and a combination of these two types of financing. Any type of financing brings costs for firms. In the case of debt financing, they take the form of interest and in the case of equity financing they take the form of dividends. A negative association between leverage and ETRs is expected, since interest is tax deductible, unlike dividends. This fact promotes a more beneficial tax treatment for firms that finance themselves mainly through debt financing compared to those that prefer to finance themselves through equity financing. Kraft (2014) argues that increasing the firm's leverage aligns the interests of shareholders and managers through, for example, debt agreements. In these situations, managers are forced to negotiate future investments with their creditors, making it difficult to extract their own benefits and satisfy their interests, due to the restrictions present in these agreements. Therefore, an increase in efficiency and alignment of interests will result in lower ETRs.

The relationship between these variables has been examined empirically in several studies. Gupta and Newberry (1997), Richardson and Lanis (2007), Fernández-Rodríguez and Martínez-Arias (2014), Kraft (2014) and Salaudeen and Eze (2018) found a negative relationship between leverage and ETRs. Lee and Swenson (2012) also found a negative relationship between variables when analyzing a sample of companies from the European Union. However, Barbera et al. (2020) obtained a positive and significant relationship between the variables for a group of listed companies in the European Union. It should be noted that the sign of the relationship between these variables is sensitive to the measure used in the denominator of ETRs, which may justify the disagreement of the results (Gupta and Newberry, 1997; Barbera et al., 2020). Although there are opposite results, we anticipate that higher leveraged firms have lower ETRs, due to the more favorable tax treatment of interest. Therefore, we formulate the following hypothesis:

H1b: Higher leveraged firms are associated with lower ETRs.

A firm's asset mix can also have an impact on ETRs. Gupta and Newberry (1997) included in their model three variables related to investment decisions: capital intensity, inventory intensity and Research & Development intensity. Property, plant, and equipment can be depreciated over their useful lives. Depreciation consists of recording a cost, which corresponds to the acquisition value less the residual value, over the useful life of an asset. When assets have shorter depreciation periods than their economic life, this will lead to a tax advantage (Richardson and Lanis, 2007). In addition, due to the existence of different depreciation methods, more capital-intensive firms can more easily manage taxes, accelerating or deferring depreciation costs. Therefore, more capital-intensive firms are expected to have lower ETRs, due to the greater deductibility of depreciation (Gupta and Newberry, 1997). Some studies confirm the negative relationship between capital intensity and ETRs (Gupta and Newberry, 1997; Richardson and Lanis, 2007; Lee and Swenson, 2012; Salaudeen and Eze, 2018; Stamatopoulos et al., 2019). Inventories are defined as "assets held for sale in the normal course of business, or in the production process for such sale, or in the form of materials or consumables to be applied in the production process or in the delivery of services" (IAS2, NCRF 18). From the perspective of Gupta and Newberry (1997), inventory intensity acts as a substitute for capital intensity, offering no tax advantage. Therefore, they predict that more inventory-intensive firms will have higher ETRs. Gupta and Newberry (1997) and Richardson and Lanis (2007) confirm this prediction. However, there are studies that have not found a significant relationship between the variables (Derashid and Zhang, 2003) and others in which the relationship obtained was not linear (Delgado et al., 2018). Hanlon and Heitzman (2010) suggested that Research & Development expenses are sensitive to tax rates and credit incentives. According to Lee and Swenson (2012), there is a favorable tax treatment for these expenses. Some studies confirm the negative association between Research & Development intensity and ETRs (Gupta and Newberry, 1997; Richardson and Lanis, 2007; Lee and Swenson, 2012). Kraft (2014) does not include the asset mix variables as determinants of ETRs. This author argues that the tax benefits associated with more capital-intensive firms, which result in differences between book and tax accounts, will not have an impact on ETRs, because these differences will be captured by the deferred component of ETRs. In our investigation, we do not follow this author's view. Therefore, we formulate the following hypotheses:

H1c: Capital intensity has a negative impact on ETRs.

H1d: Inventory intensity has a positive impact on ETRs.

H1e: Research & Development intensity has a negative impact on ETRs.

Profitability is another determinant often associated with ETRs, because the payment of taxes depends on the firm's profit. When we measure profitability based on pre-tax income, it is expected that most profitable companies will obtain a higher profit, which means they will pay more taxes. Several studies confirm this positive association (Gupta and Newberry, 1997; Richardson and Lanis, 2007; Minnick and Noga, 2010; Armstrong et al., 2012; Moreno et al., 2017; Salaudeen and Eze, 2018; Stamatopoulos et al., 2019). However, other authors, like Rego (2003), Kraft (2014), Delgado et al. (2018) and Barbera et al. (2020) found a negative association between the variables. According to Rego (2003), this association can be justified by the fact that the most profitable companies have more resources at their disposal to invest in tax planning, which contributes to the reduction of ETRs. Given the conflicting results, we predict that there is a relationship between the variables, but we do not predict the direction of the relationship. Therefore, we formulate the following hypothesis:

H1f: Firms' profitability is associated with ETRs.

2.2. The influence of Corporate Governance

The relationship between taxes and Corporate Governance has been the target of a greater number of studies in recent years, due to the growing interest of researchers in this topic (Florackis, 2008; Minnick and Noga, 2010; Abdul Wahab and Holland, 2012; Wahab et al., 2017; Bayar et al., 2018).

As already mentioned, taxes are one of the many factors that influence decision-making in firms, and it is in the interest of shareholders to reduce the payment of taxes, so that they can increase their remuneration and, consequently, the firm's value. However, tax planning is a very complicated task and can allow managers opportunism, which means that managers will not always manage the tax burden in order to reduce effective tax rates, that is, to maximize profit. In fact, Desai and Dharmapala (2006) state that when there is information asymmetry between shareholders and managers, tax activity can be used as a way of opportunism, in which managers are motivated to act in their own benefit. These facts point us to the agency problem (Jensen and Meckling, 1976). Considering the agency theory, the separation between ownership and control can lead to tax decisions that reflect managers' interests and that are not ideal from the point of view of shareholders. Therefore, we have to consider that the agency problem can have an effect on tax planning decisions and, consequently, on ETRs.

In the context of corporate tax behavior, corporate governance mechanisms act to shape managers' behavior, protecting shareholders' interests. Following the agency theory, we believe that corporate governance mechanisms can influence and promote tax planning, by reducing agency conflicts (Minnick and Noga, 2010; Lanis and Richardson, 2011). Therefore, the concern of corporate governance is to reduce the agency problem, through a set of efficient mechanisms, in order to align the interests of both groups. This alignment of interests will have implications for firms' operational and financial decisions, with tax planning being one of those decisions. Thus, in addition to including operational and financial characteristics as determinants of ETRs, we also consider that it is important to understand the role that corporate governance mechanisms have on tax planning and, consequently, on ETRs.

2.2.1. Board structure

The agency theory considers that, in large corporations, there is a separation between ownership and management, because not all shareholders are available to manage the company. To solve this problem, shareholders hire people who help them to manage their business in the best possible way, which results in the so-called agency relationship, in which managers are the agents and shareholders are the principals (Jensen and Meckling, 1976). Thus, it is expected that managers, when acting on behalf of shareholders, make decisions that satisfy shareholders' interests, that is, maximize shareholders' wealth. However, in reality, this does not always happen, because managers can satisfy their interests at the expense of shareholders, creating what is called the agency problem (Fama and Jensen, 1983).

The literature states that there are several alternatives that can help to solve this problem, with emphasis on boards of directors. It should be noted that Adams et al. (2010) claim that directors are agents of shareholders. The board of directors is one of the main corporate governance mechanisms that acts as a link in the relationships between shareholders and managers and between majority and minority shareholders (Fama and French, 1997; Gomes, 2016). Fama and Jensen (1983) state that adequate decision systems are needed to separate management from firm's control, with the board of directors being one of those systems, whose functions are to hire, dismiss and remunerate the firm's top managers and to ratify and monitor important decisions (Fama and Jensen, 1983). The board of directors helps to solve agency conflicts through its supervisory role, controlling and monitoring management, and its consultant role, with the goal of protecting shareholders' interests (Fama and French, 1997; Minnick and Noga, 2010). However, the effectiveness with

which the board will perform these functions depends on several factors, including the board's size, its independence, and its gender diversity (Khaoula and Ali, 2012).

In addition, it plays an essential role in choosing the firm's tax planning strategy, since it is responsible for the allocation of resources, performance, and shareholders' wealth (Minnick and Noga, 2010; Wahab et al., 2017; Khaoula and Moez, 2019). This means that the board of directors must choose an appropriate tax planning strategy and must ensure that the firm's environment is favorable to that strategy, in order to contribute to lower effective tax rates and to increase the firm's value (Aliani Khaoula and Ali, 2012). Thus, the literature shows the importance of the board of directors as a corporate governance mechanism, so we hope that, through the reduction of agency conflicts and the greater alignment of interests between managers and shareholders, this mechanism will contribute to the reduction of effective tax rates. Therefore, we included several characteristics of the board of directors in our models, in order to study the influence they have on ETRs.

One of the main characteristics of the board of directors is its size. Several studies suggest that the board's size affects corporate governance effectiveness in positive and negative ways (Florackis, 2008; Minnick and Noga, 2010; Abdul Wahab and Holland, 2012; Khaoula and Moez, 2019). Eisenberg et al. (1998) highlights two main effects associated with the larger size of the board. First, a larger board can intensify coordination, communication, and decision-making problems, having a negative impact on firms' performance (Florackis, 2008). Second, larger boards decrease the ability to control management, leading to agency problems (Yermack, 1996). On the other hand, smaller boards can make decision-making more agile, diverting resources to tax planning (Minnick and Noga, 2010). This ease of decision-making can prevent managers from hiding the rental extraction through tax evasion activities. Yermack (1996) analyzed the relationship between board's size and firm's value, finding a negative relationship between the variables. He argues that a smaller board increases the quality of activities and performance. However, other authors argue for a positive effect of the board's size. Larger boards can benefit from greater variability in academic and professional skills and experience (Pearce and Zahra, 1991), they have greater opportunities to obtain resources and more effective restriction of the CEO's domain (Abdul Wahab and Holland, 2012). These boards can take advantage of the variety of perspectives and knowledge to improve their corporate decisions, control tax planning (Khaoula and Moez, 2019), strengthen the link between firms and environment and provide advice on various strategic options for the firm (Pearce and Zahra, 1991).

Ribeiro (2015), Osebe et al. (2019) and Chytis et al. (2020) show that the board's size is positively associated with effective tax rates, that is, larger boards have higher ETRs. Lanis and Richardson (2011) also found that the level of corporate tax management is significantly affected by the board's size. Although there are countless investigations that have focused on the board's size, the results are quite contradictory and, therefore, we only predict that there is an association between the variables. Thus, we formulate the following hypothesis:

H2a: Board's size is associated with ETRs.

The composition of the board of directors also influences the effectiveness of Corporate Governance, being a critical factor for the board of directors (Fama and Jensen, 1983). An important feature of the composition of the board of directors is the board's independence. According to Adams et al. (2010), this is the most important corporate governance mechanism that affects the firm's performance.

Board members must be grouped into two categories: executive directors (inside) and non-executive directors (outside). Executive directors have access to more and better information about the company and non-executive directors act as mediators in disagreements between managers and shareholders (Fama and Jensen, 1983; Lanis and Richardson, 2011; Fraile and Fradejas, 2014). Fama and Jensen (1983) argue that the composition of the board has an impact on the effective monitoring of management. According to Adams and Ferreira (2007) and Lanis and Richardson (2011), the presence of independent directors on the board can increase the effectiveness of their control. Boards with a higher proportion of non-executive directors are considered more effective in controlling the managers' behavior, limiting managerial opportunism, and reducing agency conflicts (Fama and Jensen, 1983; Florackis, 2008). A contrary hypothesis that appears in the literature is that non-executive directors can be considered ineffective, due to the lack of information about the company, preferring to play a less conflicting role, contrary to the monitoring of managers (Florackis, 2008). In this sense, executive directors are considered important for the valuable information they have about the company. Independent directors are considered effective in mitigating agency problems due to their professional knowledge, experience, and independence (Pearce and Zahra, 1991; Abdul Wahab and Holland, 2012). It is noteworthy that Minnick and Noga (2010) argue that more independent boards may be willing to divert resources to tax planning, in order to guarantee a good performance, due to the knowledge of their own sector and their experience. Therefore, an independent board

can, in fact, improve the firm's value by advising managers on the design and execution of strategies and supervising management (Armstrong et al., 2012; Khaoula and Moez, 2019).

Studies have shown contradictory conclusions about the effect of the board's independence on effective tax rates. Ribeiro (2015) and Osebe et al. (2019) found a significant and positive relationship between board independence and ETRs. Chytis et al. (2020) found a statistically significant and negative relationship between board independence and ETRs, for a group of Greek firms, concluding that the greater the board independence the higher the level of tax planning. On the other hand, Khaoula and Ali (2012) did not find a significant relationship between the variables. Pratama (2017), in a study on tax evasion, for a group of listed firms in Indonesia, did not find a significant relationship between board independence and ETRs. Salhi et al. (2020) found that greater board independence reduces the likelihood of tax evasion. Although there are very different results, we argue that a greater proportion of non-executive directors on the board will contribute to the reduction of agency conflicts, through their supervisory role, resulting in a more efficient tax management, that is, in lower ETRs. Thus, we formulate the following hypothesis:

H2b: A higher proportion of non-executive directors is associated with lower ETRs.

The gender diversity of the board of directors is one of the corporate governance issues that has received great attention worldwide, being the subject of intense debate between researchers. This interest is the result of the increase in regulation in developed countries which advocate the presence of more women on boards of directors and the fact that gender diversity can improve economic and social performance.

Several studies claim that the presence of women on the boards increases creativity, innovation, and the quality of decision-making, improving the resolution of problems through the greatest number of ideas and perspectives that flow in the board (Shrader et al., 2003; Campbell and Mínguez-Vera, 2008; Khaoula and Moez, 2019). Another benefit is the improvement in the level of strategic planning, because according to Shrader et al. (2003) and Khaoula and Moez (2019), the experience of women is usually aligned with the needs of the company. Overall, studies show that women have higher ethical and moral standards, are more risk-averse, have more independent thinking and provide more effective control of the board (Campbell and Mínguez-Vera, 2008; Richardson et al., 2015; Kirsch, 2018; Salhi et al., 2020).

As we know, the supervisory role played by the board of directors is one of the most important corporate governance mechanisms, with several characteristics that can affect its

effectiveness, like gender diversity. Considering the agency theory, the presence of female directors can be seen as a supervisory and control mechanism of the board, because women are more likely to closely supervise management than men, are more diligent and are more independent than male directors (Adams and Ferreira, 2009; Kirsch, 2018; Jarboui et al., 2020). Kim and Starks (2016) add that another way for women directors to improve the effectiveness of the board is through their advisory role, due to their additional knowledge and unique skills. In addition, Fama and Jensen (1983) refer that the greater variety of perspectives that women bring reduces agency costs, increases the board's independence and, consequently, increases the firm's value (Hillman and Dalziel, 2003). Adams and Ferreira (2009), Richardson et al. (2015) and Kim and Starks (2016) confirm that gender diversity is positively related to the effectiveness of the board, appearing to have the same impact as board's independence, as it also improves the board's monitoring. Thus, if we adopt this perspective, we will defend that this mechanism would align the interests between managers and shareholders, reduce the tax burden and, consequently, ETRs.

However, there are studies that show that gender diversity has a negative effect on tax planning. Khaoula and Ali (2012) concluded that the presence of women on the board positively affects ETRs, due to the low percentage of women on boards, for a group of firms in Tunisia. Aliani et al. (2011) analyzed the effect of gender diversity on fiscal optimization, concluding that there was a negative relationship between ETRs and gender diversity. The authors justified these results by stating that women are against strategies that reduce tax rates, trying to increase tax compliance. Osebe et al. (2019) concluded that board gender diversity has a positive and significant effect on ETRs, for a group of firms in Kenya, due to the higher levels of tax compliance that women show compared to men. Adams and Ferreira (2009), Jarboui et al. (2020) and Salhi et al. (2020) show that the presence of female directors on the boards negatively affects tax evasion, which confirms the greater risk aversion of women and the reduction of illegal activities on firms. Considering these results, we anticipate that there is a positive association between board gender diversity and ETRs, which means that gender diversity does not favor tax planning. Thus, we formulate the following hypothesis:

H2c: Board gender diversity is associated with higher ETRs.

2.2.2. CEO duality

CEO duality occurs when the same person occupies the positions of Chairman of the Board of Directors and CEO. There are two conflicting views about how this mechanism affects firm's performance. The agency theory (Jensen and Meckling, 1976) argues that CEO duality promotes the consolidation of authority power, which favors the CEO's entrenchment and reduces the board's monitoring effectiveness (Fama and Jensen, 1983). In this perspective, the individual who occupies the positions acts according to his interests and in an opportunistic way, diverting shareholders' wealth to his own benefit (Wahab et al., 2017; Khaoula and Moez, 2019). Therefore, there is a negative relationship between CEO duality and firm's performance and an increase in agency conflicts (Florackis, 2008). The management theory states that agents are not necessarily motivated by their goals (Donaldson et al., 1997). A dual CEO promotes strong power and leadership in firms' management, favoring quick decision-making and greater coordination (Rashid, 2010; Khaoula and Moez, 2019). This theory states a positive association between CEO duality and firm's performance. Additionally, Minnick and Noga (2010) also include this mechanism in their study and argue that it is characterized by the low management of the firm's tax burden, which leads to higher values of ETRs. Khaoula and Ali (2012) showed that there was a negative and significant relationship between CEO Duality and tax planning, which means that this mechanism has an impact and helps to reduce effective tax rates. Aliani et al. (2011) also showed that there was a positive relationship between this mechanism and fiscal optimization, for a sample of Tunisian companies. These results diverge from the findings of Minnick and Noga (2010) and Chytis et al. (2020), which showed that CEO duality makes efficient tax burden management and tax planning difficult, leading to higher ETRs. Therefore, we argue that CEO duality stimulates a less efficient management of the tax burden, due to the entrenchment of managers and the increase in agency problems, resulting in higher ETRs. Thus, we formulate the following hypothesis:

H2d: CEO duality is associated with higher ETRs.

2.2.3. Ownership structure

Insider ownership is suggested as one of the mechanisms that encourages the alignment of interests between shareholders and managers and the reduction of agency conflicts. This alignment effect is achieved by reducing managers' incentives to consume benefits and participate in non-maximizing activities (Florackis, 2008). According to Ozkan and Ozkan (2004), increasing managerial ownership decreases the likelihood that managers will divert resources from maximizing value, because they bear the costs of their actions. In contrast, other authors claim that when corporate decision-making and shareholding focus on a small number of managers-owners, they will be more risk averse (Fama and Jensen, 1983; Badertscher et al., 2013). This means they are less willing to invest in risky projects, such as tax evasion activities (Fama and Jensen, 1983), with less incentives to manage the firm's tax burden (Badertscher et al., 2013). This is not the view we follow in this investigation, as we are not interested in tax evasion activities.

However, after a certain level of insider ownership, managers have entrenched themselves at the expense of shareholders and reap private benefits (Florackis, 2008). In fact, Fraile and Fradejas (2014) admit that when managers have a substantial proportion of shares, they may have the necessary power to pursue their interests at the expense of shareholders' interests. Therefore, as we do not know which of the two effects will prevail over the other (alignment effect versus entrenchment effect), we do not predict the direction of the relationship between this variable and ETRs. Thus, we formulate the following hypothesis:

H2e: Insider ownership is associated with ETRs.

3. Variable Definition

3.1. Dependent Variables

The main goals of this investigation are to study the influence of firms' operational and financial specific characteristics and corporate governance mechanisms on ETRs. Therefore, effective tax rate is our dependent variable. The definitions of the numerator and the denominator are open to debate. As for the numerator, the question of what taxes we should include is extremely relevant since any significant omission could bias the results. In fact, tax expenses include current tax expenses, but also deferred tax expenses. Deferred tax expenses include all tax effects that arise from accounting and tax differences that may result from temporary differences and from the use of tax credits or tax losses. In addition, they reflect the impact of operational and financial characteristics on firm's tax burden. As IAS 12 refers (IASB, 2005), "current and deferred tax is recognized as income or expense and included in profit or loss for the period". The omission of deferred taxes can significantly bias the tax burden, and, for that reason, they are included in the numerators of our two measures (Richardson and Lanis, 2007; Chen et al., 2010; Minnick and Noga, 2010; Armstrong et al., 2012; Kraft, 2014). Deferred tax expenses can be used by firms as a tool to disguise tax planning, since firms can currently reduce tax payments and increase them in the future, by adding deferred taxes (Gomes, 2016). Regarding the denominator, the literature refers three options: taxable profit, pre-tax income, and operational cash flow. Gupta and Newberry (1997) and Richardson and Lanis (2007) state that taxable profit should not be used, because if the numerator and denominator are computed after taxes, then it will not be possible to identify the impact of tax preferences on ETRs. Thus, we chose pre-tax income and operational cash flow as the denominators of our measures. Operational cash flow is the denominator of our second measure since it allows us to control the differences of different accounting methods (Zimmerman et al., 1983). Operational cash flow is obtained by adding the profit to the depreciation and amortization expenses. Therefore, we use the following measures for ETRs, in order to improve the robustness of our results:

$$ETR1 = \frac{Total\ Tax\ Expense_{it}}{Pre - tax\ Income_{it}}$$

$$ETR2 = \frac{Total\ Tax\ Expense_{it}}{Operational\ Cash\ Flow_{it}}$$

where i denotes the firm and t denotes the year.

There are some situations that we have to pay attention to. For example, a firm that has a loss (negative denominator) and tax refunds (negative numerator) results in a positive ETR, even though it has not paid any tax amount. Another case is when a firm had a loss or a negative operational cash flow (negative denominator) and has paid taxes (positive numerator), which results in a negative ETR. These types of problems can be solved if we apply restrictions to ETRs. Thus, we define an ETR as 0 if the firm has had tax refunds (negative numerator) and ETR1 or ETR2 as 1, respectively, if the firm presents a negative pre-tax income or a negative operational cash flow and a positive total tax expense (positive numerator), according to Gupta and Newberry (1997) and Kraft (2014), in order to control possible bias.

However, ETRs have some limitations. Dyreng et al. (2008) and Abdul Wahab and Holland (2012) report that ETRs are not good measures of long-term tax evasion, due to their annual variability. This limitation does not affect this investigation, as it does not study long-term tax evasion.

3.2. Independent Variables

3.2.1. Firms' specific variables

In order to analyze how ETRs are determined by firms' operational and financial specific characteristics, we chose size, leverage, asset mix and profitability as explanatory variables of the regressions of our investigation.

The firm's size is measured through the variable Size (SIZE), which is computed as the logarithm of Total Assets. This variable is one of the most analyzed and used in investigations dedicated to the study of the determinants of ETRs (Zimmerman et al., 1983; Gupta and Newberry, 1997; Rego, 2003; Richardson and Lanis, 2007; Lee and Swenson, 2012; Fernández-Rodríguez and Martínez-Arias, 2014; Kraft, 2014; Delgado et al., 2018; Stamatopoulos et al., 2019; Barbera et al., 2020; Chytis et al., 2020). In order to understand the impact of the most beneficial tax treatment that arises from debt financing, when compared to equity financing, we have included Leverage (LEV), measured through the ratio between Long-term Debt and Total Assets. Gupta and Newberry (1997), Richardson and Lanis (2007), Lee and Swenson (2012), Kraft (2014), Fernández-Rodríguez and Martínez-Arias (2014), Delgado et al. (2018) and Barbera et al. (2020) used leverage as a *proxy* for the capital structure. Investment decisions can also have an impact on effective tax rates. Therefore, we included the asset mix as explanatory variables in our investigation, namely

Capital Intensity (CAP_INT), Inventory Intensity (INV_INT) and Research & Development Intensity (RD_INT). Capital Intensity (CAP_INT) is measured as the ratio between Net Property, Plant and Equipment and Total Assets, in order to determine the influence of depreciations and amortizations expenses on ETRs. Inventory Intensity (INV_INT) is the ratio between Total Inventories and Total Assets and is expected to have a substitution effect with Capital Intensity. Still within the asset mix, we included Research & Development Intensity (RD_INT) in order to capture the impact of the tax advantage related with these expenses. Research & Development Intensity (RD_INT) is the ratio between Research & Development expenses and Net Sales. These variables are used in the literature related with the determinants of effective tax rates (Gupta and Newberry, 1997; Richardson and Lanis, 2007; Lee and Swenson, 2012; Fernández-Rodríguez and Martínez-Arias, 2014; Kraft, 2014; Delgado et al., 2018; Barbera et al., 2020). Finally, we chose Profitability (PROF) as an independent variable for our research since it is often used in this type of studies (Rego, 2003; Minnick and Noga, 2010; Armstrong et al., 2012; Fernández-Rodríguez and Martínez-Arias, 2014; Kraft, 2014; Delgado et al., 2018; Stamatopoulos et al., 2019; Barbera et al., 2020). Profitability is determined as the ratio between Pre-tax income and Total Assets, commonly acknowledged as Return on assets (ROA).

In addition, the market-to-book ratio is used as a control variable in order to control the growth potential of firms (Chen et al., 2010; Armstrong et al., 2012; Kraft, 2014; Ribeiro, 2015; Wahab et al., 2017). The market-to-book (MB) variable is measured through the ratio between market capitalization and the book value of equity. Moreover, as the negative results of firms can bias our analysis, the *dummy* variable earnings (D_EARN) is also included, which is defined as 1 if the company presents positive results and 0 otherwise. Minnick and Noga (2010) and Ribeiro (2015) included this variable in their studies.

3.2.2. Corporate Governance variables

One of the aims of this investigation consists of evaluating the role of corporate governance mechanisms as determinants of effective tax rates. As we can conclude for the literature review presented, corporate governance mechanisms can have an impact on ETRs. Therefore, we included Board's size, Non-executive directors, Board gender diversity, CEO duality and Insider Ownership as explanatory variables of equations (4.ii) and (4.iv).

Regarding the board's structure, the first variable included is the Board's size (BOARD). This variable is obtained through the total number of current directors on the board of directors, being widely used in the literature, as it is recognized as an important

feature of board of directors (Eisenberg et al., 1998; Florackis, 2008; Minnick and Noga, 2010; Abdul Wahab and Holland, 2012; Wahab et al., 2017; Salhi et al., 2020). Still in relation to the board's structure, we added a variable that considers the composition of the board. We introduced Board Independence (NON-EXEC) based on the ratio between the number of non-executive directors and the total number of directors (Florackis, 2008; Abdul Wahab and Holland, 2012), since we expect the board's independence to have an impact on ETRs. In addition, we included Board gender diversity (B_DIV). This variable measures the proportion of female directors on the board of directors, being a variable that has been given greater importance in corporate governance studies (Shrader et al., 2003; Campbell and Mínguez-Vera, 2008; Salhi et al., 2020). Regarding the CEO, we included the *dummy* variable CEO duality (D_CEO), to which we assign the value 1 if there is a dual CEO, and 0 otherwise (Florackis, 2008; Minnick and Noga, 2010; Wahab et al., 2017). We hope this variable will influence ETRs. Finally, related with ownership structure, we included Insider Ownership (INS_OW) which is calculated through the ratio between closely held shares and common shares outstanding. According to the Datastream database, closely held shares represent the number of shares that are held by insiders and common shares outstanding represent the number of shares outstanding at the firm's year-end (they represent the difference between issued shares and treasury shares). This variable is used by Florackis (2008), Huang et al. (2013) and Fraile and Fradejas (2014).

Although most investigations that analyze corporate governance mechanisms assume their values as constant for the periods under study, all of our corporate governance variables have annual data, producing more accurate and reliable results. Table 1 summarizes all the variables used in this investigation, their sources, their definitions, and the expected signs of their estimated coefficients.

Table 1: Variables, their measures, sources, and predicted signs of estimated coefficients

Variable	Measure	Database	Predicted sign
Tax Variables			
ETR1	Total Tax expense/Pre-tax income	Datastream	
ETR2	Total Tax expense/Operational Cash Flow	Datastream	
Firm's specific operational and financial variables			
SIZE	Log (Total Assets)	Datastream	+/-
LEV	Long-term debt/Total Assets	Datastream	-
CAP_INT	Net Property, Plant and Equipment/Total Assets	Datastream	-
INV_INT	Total Inventories/Total Assets	Datastream	+
RD_INT	R&D expenses/Net Sales	Datastream	-
PROF	Pre-tax income/Total Assets	Datastream	+/-
MB	Market capitalization/Shareholder's equity	Datastream	
D_EARN	Equals to 1 if earnings > 0; 0 otherwise.	Datastream	
Corporate Governance variables			
BOARD	Total number of current directors on the board.	Datastream	+/-
NON_EXEC	Number of non-executive directors/Number of directors	Datastream	-
B_DIV	Number of female directors/Number of directors	Datastream	+
D_CEO	Equals to 1 if there is CEO duality; 0 otherwise.	Datastream	+
INS_OWN	Closely held shares/Common shares outstanding	Datastream	+/-

This table shows all variables under study, their measures, sources, and predicted signs of estimated coefficients. Source: author's elaboration.

4. Sample Selection and Methodology

4.1. Sample Selection

We collected data for non-financial companies listed on European stock exchanges for the period 2009-2018 through the Datastream - Thomson Reuters database, only for the primary market. We selected listed companies for our sample as they are subject to greater scrutiny and rules, are required to disclose more information, and there are more stakeholders interested in their information. The selected companies belong to the 28 member states of the European Union, also including the United Kingdom, which until 2018 had not yet left the European Union. Our sample is a panel sample, as we have examined different companies over several years.

Table 2 describes the sample selection process. Through this table we realize that, after selecting the companies listed on European stock exchanges (27 309), companies in a “Dead” state (19 769) were excluded, in order to work only with companies in an active state. In addition, companies that belonged to the “Banks” (184), “Financial Services” (661), “Life Insurance” (14), “Nonlife Insurance” (56) and “Unclassified” (45) sectors were also eliminated, due to the fact that the legislation applied to financial companies affects ETRs in a different way, when compared to other companies. At the end of these steps, we are left with an initial sample of 6580 companies. In order to work with companies that had data for all variables under study and for the selected time period, we excluded companies with missing data (6450). It is worth noting that we only maintained companies with consolidated accounts in our sample, in order to obtain unbiased data, using the “Accounting Method for long term” variable from Datastream. After all this process, our final sample consists of 130 companies for the selected 10 years, which represents 1300 year-firm observations. These companies belong to 14 countries of the European Union, namely Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Poland, Spain, Sweden, and United Kingdom.

Tables 3 and 4 summarize the classification of the sample by country and by industry, respectively. Through Table 3 we conclude that the majority of our firms belong to the United Kingdom (33%), followed by France (24%) and Germany (12%). The Manufacturing (45%), Technology (17%) and Life Sciences (16%) sectors are the most significant sectors in our sample. The least representative sectors are Mining (1%) and Services (1%).

Table 2: Sample selection process

Sampling procedure	Number of firms
Companies listed on European stock exchanges in the Datastream – Thomson Reuters database	27 309
Companies with “Dead” state	(19 769)
Companies belonging to the “Banks”, “Financial Services”, “Life Insurance”, “Nonlife Insurance” and “Unclassified” sectors	(960)
Initial sample	6580
Companies with missing data	(6450)
Final sample	130
Number of firm-year observations	1300

This table shows our sampling procedure.

Table 3: Sample distribution by country

Country	Number of firms	% of total firms
Austria	2	2%
Belgium	2	2%
Denmark	5	4%
Finland	9	7%
France	31	24%
Germany	15	12%
Ireland	3	2%
Italy	2	2%
Luxembourg	1	1%
The Netherlands	4	3%
Poland	1	1%
Spain	4	3%
Sweden	8	6%
United Kingdom	43	33%
Total	130	100%

This table classifies the firms of our sample by countries of the European Union.

Table 4: Sample distribution by industry

Industry	Number of firms	% of firms
Energy and Transportation	12	9%
Life Sciences	21	16%
Manufacturing	58	45%
Mining	1	1%
Real Estate and Construction	5	4%
Services	1	1%
Technology	22	17%
Trade and Services	10	8%
Total	130	100%

This table classifies the firms of our sample by industry sector, according to the SIC classification. The SIC code is a system that classifies companies by industry using a four-digit system.

4.2. Methodology

In this chapter, we will detail the methodology. It includes the specification of the regression models, a brief explanation of the variables and their measures for each model and a discussion of which estimation methods we will use in our investigation.

Our data is classified as a balanced panel data and, for this reason, we chose to use a panel data model, in order to obtain the best possible results. This type of data allows us to work with more information, greater variability, and less collinearity between the variables,

as we are analyzing several sectional units over a period of time. In addition, we were able to control individual heterogeneity and the unobservable effects that are hidden in exclusively temporal or sectional series. We also benefit from a greater number of degrees of freedom and greater efficiency in estimation (Gujarati and Porter, 2011).

The estimation method chosen was the Tobit method, and this method was used for all of our regressions. For our investigation, this proved to be the most suitable method, since our dependent variables (ETR1 and ETR2) are limited between 0 and 1, that is, they are not freely distributed. When estimating the regressions, we cannot use the Ordinary Least Squares method (OLS), as we would get inconsistent parameters due to censored data. Thus, our estimates were obtained using the Maximum Likelihood method (Gujarati and Porter, 2011).

In order to test our hypotheses, that is, the hypotheses that address firms' operational and financial specific characteristics and corporate governance mechanisms, two regression models were created for each dependent variable. The first two regression models differ in terms of the explanatory variables presented, that is, the first model presents the operational and financial characteristics as independent variables, and the corporate governance mechanisms were added to the second model. The first two equations are as follows:

$$ETR1_{it} = \beta_0 + \beta_1 SIZE_{it} + \beta_2 LEV_{it} + \beta_3 CAP_INT_{it} + \beta_4 INV_INT_{it} + \beta_5 RD_INT_{it} + \beta_6 PROF_{it} + \beta_7 MB_{it} + \beta_8 D_EARN_{it} + Year\ Indicators + \varepsilon_{it} \quad (4. i)$$

where ETR_{it} is the effective tax rate of firm i in year t , $SIZE_{it}$ is the size of firm i in year t , LEV_{it} is the leverage of firm i in year t , CAP_INT_{it} is the capital intensity of firm i in year t , INV_INT_{it} is the inventory intensity of firm i in year t , RD_INT_{it} is the R&D intensity of firm i in year t and $PROF_{it}$ is the return on assets of firm i in year t . We use MB_{it} , the market-to-book ratio, and D_EARN_{it} , which is a dummy variable equal to 1 if the firm has positive results and 0 otherwise, as control variables.

$$\begin{aligned}
ETR1_{it} = & \beta_0 + \beta_1 SIZE_{it} + \beta_2 LEV_{it} + \beta_3 CAP_INT_{it} + \beta_4 INV_INT_{it} + \beta_5 RD_INT_{it} + \\
& \beta_6 PROF_{it} + \beta_7 MB_{it} + \beta_8 D_EARN_{it} + \beta_9 BOARD_{it} + \beta_{10} NON_EXEC_{it} + \\
& \beta_{11} B_DIV + \beta_{12} D_CEO_{it} + \beta_{13} INS_OWN_{it} + Year\ Indicators + \varepsilon_{it}
\end{aligned}
\tag{4. ii}$$

where $BOARD_{it}$ represents the board's size of firm i in year t , NON_EXEC_{it} is the ratio between the number of non-executive directors and the total number of directors of firm i in year t , B_DIV_{it} is the ratio between the number of female directors and the number of directors on the board of firm i in year t , D_CEO_{it} is the dummy variable equal to 1 when there is CEO duality and 0 otherwise for firm i in year t , INS_OWN_{it} is the ratio between closely held shares and common shares outstanding of firm i in year t , and ε_{it} is the error term. As previously mentioned, ETR1 is the ratio between total tax expense and pre-tax income.

Then, to test the robustness of the results, we analyzed exactly the same equations described above, with the difference that we changed the dependent variable, that is, instead of ETR1 we used ETR2. Therefore, the second set of regression models are as follows:

$$\begin{aligned}
ETR2_{it} = & \beta_0 + \beta_1 SIZE_{it} + \beta_2 LEV_{it} + \beta_3 CAP_INT_{it} + \beta_4 INV_INT_{it} + \beta_5 RD_INT_{it} + \\
& \beta_6 PROF_{it} + \beta_7 MB_{it} + \beta_8 D_EARN_{it} + Year\ Indicators + \varepsilon_{it}
\end{aligned}
\tag{4. iii}$$

$$\begin{aligned}
ETR2_{it} = & \beta_0 + \beta_1 SIZE_{it} + \beta_2 LEV_{it} + \beta_3 CAP_INT_{it} + \beta_4 INV_INT_{it} + \beta_5 RD_INT_{it} + \\
& \beta_6 PROF_{it} + \beta_7 MB_{it} + \beta_8 D_EARN_{it} + \beta_9 BOARD_{it} + \beta_{10} NON_EXEC_{it} + \\
& \beta_{11} B_DIV + \beta_{12} D_CEO_{it} + \beta_{13} INS_OWN_{it} + Year\ Indicators + \varepsilon_{it}
\end{aligned}
\tag{4. iv}$$

where the explanatory variables have the same meaning as explained previously and ε_{it} is the error term. ETR2 is equal to the ratio between total tax expense and operational cash flow.

5. Results

5.1. Univariate Analysis

Table 5 presents the descriptive statistics of the dependent variables and the explanatory variables analyzed during the period 2009-2018. The aggregate average value of ETR1 is 37,8%, which represents almost two fifths of the pre-tax income of the firms. In turn, the aggregate average value of ETR2 is 32,63%, which represents almost a third of the value of the firms' operational cash flow. On the subject of the explanatory variables, we verified that our firms are mostly large, which is concluded through the average value of size (6,81). Long-term debt represents, on average, 17,45% of the total assets of the firms of our sample. Non-current assets represent, on average, around 24% of the total assets and the proportion of inventories on total assets is approximately 12,63%. Regarding the Research & Development Intensity, it presents, on average, a low value of around 4%. However, it has a maximum value of 163%, which indicates a huge disparity in the use of Research & Development expenses as tax incentives by firms. Pre-tax income is approximately, on average, 7% of the total assets, showing a good return on asset. The market value is about 2,10 times higher than the book value of equity, which indicates a relatively high market capitalization. In addition, about 88,31% of the pre-tax income reported by firms were positive during the analyzed period. Concerning the corporate governance variables, we found that the boards of directors have, on average, 11 directors. It should be noted that the composition of the board of directors varies between a minimum of 5 directors and a maximum of 23 directors. Non-executive directors represent approximately 82% of the total number of directors on the boards. On the other hand, the average value of Board gender diversity is around 22%, suggesting a low presence of female directors on boards of directors. Regarding the CEO duality, around 29% of the firms, during the period under study, presented a situation in which the CEO of the firm also hold the position of Chairman of the Board of Directors. Finally, in relation to the ownership structure, we noticed that, on average, about 23,4% of common shares outstanding are held by insiders. Their values vary between 0% and about 97% of common shares outstanding held by insiders.

Table 5: Descriptive statistics

Variables	Mean	Median	Maximum	Minimum	Standard Deviation
ETR1	0,3780	0,2856	1,0000	0,0000	0,3686
ETR2	0,3263	0,2350	1,0000	0,0000	0,3368
SIZE	6,8103	6,7319	8,4440	5,3204	0,6934
LEV	0,1745	0,1636	0,5772	0,0000	0,1166
CAP_INT	0,2419	0,1943	0,9925	0,0035	0,1825
INV_INT	0,1263	0,1145	0,9303	0,0000	0,1154
RD_INT	0,0416	0,0166	1,6314	0,0000	0,0927
PROF	0,0681	0,0665	0,4429	-0,6330	0,0786
MB	2,1028	2,3181	68,2348	-964,2421	27,1959
D_EARN	0,8831	1,0000	1,0000	0,0000	0,3215
BOARD	11,0715	11,0000	23,0000	5,0000	3,6200
NON_EXEC	0,8166	0,8333	1,0000	0,1667	0,1494
B_DIV	0,2153	0,2222	0,6000	0,0000	0,1314
D_CEO	0,2877	0,0000	1,0000	0,0000	0,4529
INS_OWN	0,2340	0,1439	0,9667	0,0000	0,2335

This table summarizes the univariate descriptive statistics for the dependent variables and for the explanatory variables. ETR1 is the ratio of total tax expense to pre-tax income. ETR2 is the ratio between total tax expense and operational cash flow. SIZE is the logarithm of total assets, LEV is the ratio between long-term debt and total assets, CAP_INT is net property, plant and equipment divided by total assets, INV_INT is inventories divided by total assets, RD_INT is R&D expenses divided by sales, PROF is pre-tax income divided by total assets, MB is the market-to-book ratio, D_EARN is a dummy variable equal to 1 when pre-tax income is positive and 0 otherwise, BOARD is the current total number of directors on the board, NON_EXEC is the number of non-executive directors divided by the total number of directors, B_DIV is the number of female directors divided by the total number of directors, D_CEO is a dummy variable equal to 1 when there is CEO duality and 0 otherwise and INS_OWN is the number of closely held shares divided by the number of common shares outstanding. The descriptive statistics presented are the average (mean values of the variables), median (median values of the variables), maximum, minimum and the standard deviation (standard deviation of the variables). The sample consists of 130 firms for the period 2009-2018, which represents 1300 firm-year observations.

Table 6 shows Pearson's and Kendall's Tau correlations between the dependent variables, ETR1 and ETR2, and the explanatory variables of our investigation. First, we detected a positive correlation between the dependent variables ETR1 and ETR2. The sign of this relationship proved to be what was expected, since these variables only differ in relation to the denominator used. Concerning ETR1, we found a positive correlation with size (SIZE), which means that the firm's size has a positive impact on effective tax rates and validates the political cost theory. Research & Development Intensity (RD_INT) shows a negative relationship with ETR1, which confirms the positive effect of the deductibility of Research & Development expenses on effective tax rates. Board size (BOARD) and board independence (NON_EXEC) also have a negative correlation with ETR1, showing that larger boards and boards with a higher proportion of non-executive directors decrease effective tax rates, respectively. Additionally, the CEO duality (D_CEO) has a negative effect on effective tax rates. On the other hand, board gender diversity (B_DIV) has a positive impact on effective tax rates. The correlations obtained between ETR2 and the explanatory

variables are similar to those obtained with ETR1, except for profitability (PROF). Regarding the correlations between the explanatory variables, we highlight the negative relation between Capital Intensity (CAP_INT) and Inventory Intensity (INV_INT), which confirms the substitution effect between these variables. In addition, we find that larger firms are more capital-intensive and have larger boards of directors. More capital-intensive firms are also more leveraged. In general, the correlation values are relatively low, which indicates that we will probably not have multicollinearity problems with our sample.

Table 6: Pearson's and Kendall's Tau correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
ETR1 (1)	1														
ETR2 (2)	0,83*** (53,589)	1													
SIZE (3)	0,044 (1,594)	0,052* (1,860)	1												
LEV (4)	0,139*** (5,061)	0,101*** (3,678)	0,242*** (8,966)	1											
CAP_INT (5)	0,254*** (9,458)	0,189*** (6,941)	0,189*** (6,914)	0,342*** (13,103)	1										
INV_INT (6)	-0,149*** (-5,444)	-0,103*** (-3,726)	-0,173*** (-6,344)	-0,268*** (-10,022)	-0,156*** (-5,670)	1									
RD_INT (7)	-0,032 (-1,138)	-0,021 (-0,762)	-0,196*** (-7,200)	-0,225*** (-8,317)	-0,254*** (-9,456)	-0,153*** (-5,588)	1								
PROF (8)	-0,094*** (-3,389)	0,103*** (3,732)	-0,059** (-2,124)	-0,193*** (-7,086)	-0,021 (-0,750)	0,015 (0,545)	-0,089*** (-3,212)	1							
MB (9)	0,019 (0,678)	0,023 (0,839)	-0,049* (-1,768)	-0,028 (-1,008)	-0,014 (-0,504)	0,0004 (0,015)	-0,008 (-0,292)	0,046 (1,643)	1						
D_EARN (10)	0,070***	0,034	0,062*	-0,019	0,012	0,009	-0,018	0,304***	0,217***	1					
BOARD (11)	-0,065** (-2,328)	-0,055** (-1,974)	0,585*** (25,962)	0,100*** (3,605)	0,113*** (4,093)	-0,135*** (-4,914)	-0,138*** (-5,007)	-0,076*** (-2,729)	-0,015 (-0,550)	0,030 (1,094)	1				
NON_EXEC (12)	-0,051* (-1,822)	-0,065** (-2,331)	0,337*** (12,873)	-0,016 (-0,574)	0,049* (1,765)	-0,057** (-2,072)	0,044 (1,588)	-0,143*** (-5,205)	0,021 (0,764)	-0,030 (-1,096)	0,379*** (14,748)	1			
B_DIV (13)	0,028 (0,990)	0,003 (0,104)	0,282*** (10,572)	0,124*** (4,510)	-0,080*** (-2,903)	-0,034 (-1,215)	-0,077*** (-2,765)	-0,065** (-2,335)	-0,042 (-1,525)	0,038 (1,352)	0,100*** (3,635)	0,137*** (4,966)	1		
D_CEO (14)	-0,052**	-0,059**	0,175***	-0,147***	-0,082***	-0,006	0,133***	-0,033	-0,075***	-0,001	0,273***	0,096***	0,128***	1	
INS_OWN (15)	-0,010 (-0,366)	-0,006 (-0,201)	-0,019 (-0,689)	-0,323*** (-12,313)	0,041 (1,485)	0,056** (2,011)	-0,002 (-0,075)	0,019 (0,678)	0,021 (0,752)	0,027 (0,958)	0,133*** (4,823)	0,229*** (8,468)	-0,001 (-0,024)	0,221*** (8,166)	1

This table shows the correlation matrix between the dependent variables and the explanatory variables. ETR1 is the ratio between total tax expense and pre-tax income. ETR2 is the ratio between total tax expense and operational cash flow. SIZE is the logarithm of total assets, LEV is the ratio between long-term debt and total assets, CAP_INT is net property, plant and equipment divided by total assets, INV_INT is the inventories divided by total assets, RD_INT is R&D expenses divided by sales, PROF is pre-tax income divided by total assets, MB is the market-to-book ratio, D_EARN is a dummy variable equal to 1 when pre-tax income is positive and 0 otherwise, BOARD is the current total number of directors on the board, NON_EXEC is the number of non-executive directors divided by the total number of directors, B_DIV is the number of female directors divided by the total number of directors, D_CEO is a dummy variable equal to 1 when there is CEO duality and 0 otherwise and INS_OWN is the number of closely held shares divided by the number of common shares outstanding. For the dummy variables D_EARN and D_CEO, Kendall's Tau correlations are presented and for the remaining metric variables, Pearson's correlations are presented. The sample consists of 130 firms for the period 2009-2018, which represents 1300 firm-year observations. * means 10% individual significance, ** means 5% individual significance and *** means 1% individual significance. In parenthesis are observed t-statistic values.

5.2. Multivariate Analysis

5.2.1. Firms' operational and financial specific characteristics

In this section, we will analyze the results obtained for equations (4.i) and (4.ii). Equation (4.i) allows us to investigate the impact that firms' operational and financial specific characteristics have on effective tax rates. In order to create a more complete model, we estimated equation (4.ii) which, in addition to the operational and financial characteristics, includes corporate governance mechanisms as independent variables. These equations have the same dependent variable (ETR1) and were estimated using Tobit method.

Columns 1 and 2 of Table 7 show the results of the estimation of equations (4.i) and (4.ii) that present ETR1 as the dependent variable. ETR1 is calculated as the ratio between total tax expense and pre-tax income. Regarding the influence of size on ETRs, we found a negative and statistically significant relationship ($\beta=-0.0450$, $z=-1.6794$). These results suggest that larger firms have lower effective tax rates, which is in line with the political power theory. This theory argues that larger firms have more resources at their disposal, that allow them to invest in tax planning, which leads to the reduction of ETRs. The results are consistent with Richardson and Lanis (2007), Dyreng et al. (2008), Lee and Swenson (2012), Moreno et al. (2018) and Barbera et al. (2020). Thus, the hypothesis H1a was validated, as a statistically significant relationship was found.

Examining the relationship between leverage (LEV) and ETR1, we found a positive and insignificant association ($\beta=0.1813$, $z=1.0492$), which was not the expected. Barbera et al. (2020) also found a positive association between the variables, justifying the results with the fact that the sign of the relationship between the variables is sensitive to the measure used in the denominator of ETRs. Additionally, firms with high effective tax rates may exhibit higher leverage values (showing a positive association), as they may be motivated to borrow precisely to reduce ETRs (now causing a negative association), being that the final result regarding the sign depends on the induced variation amounts (Fernández-Rodríguez and Martínez-Arias, 2014; Delgado et al., 2018). Therefore, we did not find support for our hypothesis H1b.

To test the influence of the asset mix, we started by analyzing the relationship between Capital Intensity (CAP_INT) and ETR1. We found that the association is positive and statistically significant ($\beta=0.7907$, $z=7.4995$), which indicates that more capital-intensive firms have higher ETRs. Although this is not the expected result, the association may be positive, because firms with higher ETRs and lower capital intensity may be motivated to

increase their non-current assets, in order to reduce ETRs, through the tax deductibility of depreciation and amortization expenses (Delgado et al., 2018). In conclusion, we do not validate the hypothesis H1c. There are authors who argue that there is a substitution effect between capital intensity and inventory intensity and, therefore, a positive coefficient between Inventory Intensity (INV_INT) and ETR1 would be expected (Gupta and Newberry, 1997). However, there is a negative and statistically significant relationship between the variables ($\beta=-0.6506$, $z=-3.7532$), opposite to our predictions. Thus, we did not validate the hypothesis H1d. Also, in relation to the asset mix composition, we observed a positive and insignificant relationship between Research & Development intensity (RD_INT) and ETR1 ($\beta=0.0458$, $z=0.2119$). However, we expected a negative and significant association between the variables since Research & Development expenses are tax deductible. These results may be due to the discrepant use of these expenses by the firms in our sample, since its average value was quite low, which indicated a low average use of these expenses. Therefore, we did not support the hypothesis H1e.

Lastly, we found a negative and insignificant relationship between profitability (PROF) and ETR1 ($\beta=-0.3745$, $z=-1.5247$). These results can be justified by the fact that firms with higher profitability have more resources at their disposal to invest in tax planning activities, which allows them to obtain lower ETRs. Our results are in line with Rego (2003), Kraft (2014), Delgado et al. (2018) and Barbera et al. (2020). However, if the test is unilateral, the coefficient becomes statistically significant at the 10% level ($p\text{-value}=0.1273/2=0.06365$). Under these conditions, and with due reservations, we can validate the hypothesis H1f.

5.2.2. Corporate governance

In order to obtain a more complete model of the determinants of effective tax rates, we added, in addition to firms' operational and financial specific characteristics, the corporate governance mechanisms as explanatory variables of equation (4.ii).

Observing the results in Column 2 of Table 7, we concluded that the sign of the relationship between size (SIZE) and ETR1 is positive and not significant ($\beta=0.0329$, $z=0.9734$), which means that our results are now according to the political cost theory, as larger firms have higher ETRs. Although the sign is positive, the coefficient is not significant and, therefore, the hypothesis H1a was not validated. Regarding the impact of financing decisions on ETRs, we found a positive and insignificant coefficient between leverage (LEV) and ETR1 ($\beta=0.0969$, $z=0.5169$). Therefore, we did not validate the hypothesis H1b.

Regarding the influence of investment decisions on ETRs, there was a positive and statistically significant relationship between Capital intensity (CAP_INT) and ETR1 ($\beta=0.8134$, $z=7.5294$), a negative and statistically significant relationship between Inventory intensity (INV_INT) and ETR1 ($\beta=-0.6762$, $z=-3.9682$) and a positive and non-significant relationship between Research & Development intensity (RD_INT) and ETR1 ($\beta=0.0513$, $z=0.2375$). Thus, the hypotheses H1c, H1d and H1e were not supported.

Additionally, there was a negative and statistically significant coefficient between profitability (PROF) and ETR1 ($\beta=-0.4847$, $z=-1.9706$), a relationship that can be justified by the argument that firms with higher profitability have more resources to invest in tax planning, causing the reduction of ETRs (Rego, 2003; Kraft, 2014; Delgado et al., 2018; Barbera et al., 2020). Thus, we corroborated the hypothesis H1f, as we obtained a statistically significant coefficient.

Regarding corporate governance variables, we obtained a negative and statistically significant association between board size (BOARD) and ETR1 ($\beta=-0.0222$, $z=-3.4823$), which indicates that larger boards favor the reduction of ETRs. This is in line with the view that these types of boards benefit from a variety of skills and experience, facilitate corporate decision-making and control tax planning (Pearce and Zahra, 1991; Abdul Wahab and Holland, 2012; Khaoula and Moez, 2019). Thus, we validated the hypothesis H2a, as we found a significant relationship between the variables.

We also found a negative and statistically significant coefficient between board independence (NON_EXEC) and ETR1 ($\beta=-0.2366$, $z=-1.8110$). The sign of the relationship is in line with our expectations, suggesting that a higher proportion of non-executive directors favors the reduction of ETRs. A possible justification is that non-executive directors, by acting as mediators in disagreements between shareholders and managers, limit managerial opportunism and align the interests of both groups, through their professional knowledge and experience (Fama and Jensen, 1983; Pearce and Zahra, 1991; Florackis, 2008; Minnick and Noga, 2010; Abdul Wahab and Holland, 2012; Chythis et al., 2020). Thus, we corroborated the hypothesis H2b.

Regarding board gender diversity, despite obtaining a positive coefficient with ETR1, it is not statistically significant ($\beta=0.2051$, $z=1.4662$). The sign of the relationship shows that the presence of female directors does not favor the reduction of ETRs, as we had predicted, possibly because they have higher tax compliance levels than men (Aliani et al., 2011; Osebe et al., 2019). The non-significant results at the 5% significance level in the bilateral test may be related to the low percentage of female directors on boards of directors. Khaoula and Ali

(2012) and Osebe et al. (2019) also achieved similar results. However, using the unilateral test, this coefficient becomes statistically significant at the 10% level ($p\text{-value}=0.1426/2=0.0713$). Thus, with due reservations, the hypothesis H2c was validated.

CEO duality (D_CEO) presented a negative and insignificant relationship ($\beta=-0.0207$, $z=-0.4881$) with ETR1, which means that a dual CEO leads to the reduction of ETRs. Contrary to our predictions, the result is in line with the management theory, which argues that a dual CEO brings greater coordination, facilitates decision-making and strengthens the firm's leadership (Donaldson et al., 1997; Rashid, 2010; Khaoula and Moez, 2019). Therefore, we did not confirm the hypothesis H2d.

Finally, we found a positive and non-significant relationship between Insider ownership (INS_OWN) and ETR1 ($\beta=0.0573$, $z=0.6972$). This mechanism is one of the main ways to reduce conflicts between shareholders and managers. However, Florackis (2008) and Fraile and Fradejas (2014) claim that, from a certain level of ownership, managers can entrench themselves at the expense of shareholders, satisfying their own interests (entrenchment effect). The results suggest that this mechanism, instead of reducing ETRs, through the alignment effect, causes their increase. The coefficient is not statistically significant in the bilateral test with a significance level of 5%. However, it is noteworthy that the unilateral test at the 10% level ($p\text{-value}=0.1263/2=0.06315$) makes the coefficient of the relationship statistically significant. Under these conditions, and with due reservations, we can validate the hypothesis H2e.

Both models are globally significant ($p\text{-value}=0.000$, corresponding to the F test of global significance). Therefore, these regressions show the importance of firms' operational and financial specific characteristics and corporate governance mechanisms as determinants of ETRs.

Table 7: Estimation results for ETR1

VARIABLE	ETR1 (1)	ETR1 (2)
C	0.3611* (1.8526)	0.2433 (1.1663)
SIZE	-0.0450* (-1.6794)	0.0329 (0.9734)
LEV	0.1813 (1.0492)	0.0969 (0.5169)
CAP_INT	0.7907*** (7.4995)	0.8134*** (7.5294)
INV_INT	-0.6506*** (-3.7532)	-0.6762*** (-3.9682)
RD_INT	0.0458 (0.2119)	0.0513 (0.2375)
PROF	-0.3745 (-1.5247)	-0.4847** (-1.9706)
MB	0.0013 (1.0001)	0.0013 (1.1108)
D_EARN	0.1605*** (2.6234)	0.1545** (2.5495)
BOARD	-	-0.0222*** (-3.4823)
NON_EXEC	-	-0.2366* (-1.8110)
B_DIV	-	0.2051 (1.4662)
D_CEO	-	-0.0207 (-0.4881)
INS_OWN	-	0.0573 (0.6972)
COEFFICIENT	0.5854	0.5785
STD.ERROR	0.0176	0.0174
Z-ESTATISTIC	33.2923	33.3168
PROB	0.0000	0.0000

This table presents the estimation results for equations (4.i) and (4.ii). The dependent variable is ETR1 for both equations. The independent variables for equation (4.i) are firms' operational and financial characteristics. For equation (4.ii), in addition to the variables mentioned above, we added the corporate governance mechanisms. ETR1 is the ratio between total tax expense and pre-tax income. SIZE is the logarithm of total assets, LEV is the ratio between long-term debt and total assets, CAP_INT is net property, plant and equipment divided by total assets, INV_INT is inventories divided by total assets, RD_INT is R&D expenses divided by sales, PROF is pre-tax income divided by total assets, MB is market capitalization divided by the book value of equity, D_EARN is a dummy variable equal to 1 when pre-tax income is positive and 0 otherwise, BOARD is the current total number of directors on the board, NON_EXEC is the number of non-executive directors divided by the total number of directors, B_DIV is the number of female directors divided by the total number of directors, D_CEO is a dummy variable equal to 1 when there is CEO duality and 0 otherwise and INS_OWN is the number of closely held shares divided by the number of common shares outstanding. The equations were estimated using the Tobit method. * means 10% individual significance, ** means 5% individual significance and *** means 1% individual significance. In parenthesis are observed z-statistic values.

5.3. Robustness Analysis

5.3.1. Firms' operational and financial specific characteristics

In this subsection, we will analyze the estimation of equations (4.iii) and (4.iv), which differ from the equations presented in the previous section, because they have ETR2 as their dependent variable. ETR2 is the ratio between total tax expense and operational cash flow. We believe that we can obtain better and more reliable results using operational cash flow as the denominator of ETRs, as we can control the different accounting methods used related to firm's size (Zimmerman et al., 1983).

Columns 1 and 2 of Table 8 show the results of the estimation of equations (4.iii) and (4.iv). The coefficient of the relationship between size (SIZE) and ETR2 is positive in equation (4.iii), but it is not statistically significant ($\beta=0.0052$, $z=0.2286$). Our results are in line with the political cost theory, in which larger firms have higher effective tax rates, as they are subject to greater political scrutiny (Zimmerman et al., 1983). Therefore, we were unable to validate the hypothesis H1a, as the coefficient is not statistically significant. As for the influence of financing decisions, we continued to verify a coefficient with a positive sign, but statistically significant ($\beta=0.2685$, $z=1.8590$) in equation (4.iii). Therefore, in our investigation we verified that, despite using different measures in the denominator of ETRs, the sign of the relationship between leverage and the dependent variable (ETR1 or ETR2) is always positive. This means that we have not verified the justification given by Barbera et al. (2020). Even so, we did not validate the hypothesis H1b.

Capital Intensity ($\beta=0.4875$, $z=5.5551$) and Inventory Intensity ($\beta=-0.3585$, $z=-2.4584$) continued to have coefficients with the same signs and statistically significant. Although the coefficients have opposite signs, as would be expected because of the substitution effect between the variables, the signs still do not agree with our hypotheses. Therefore, the use of ETR2 as the dependent variable in equation (4.iii) led us to the same conclusions and we still do not validate the hypotheses H1c and H1d. The results on Research & Development Intensity remain practically the same, that is, its association with ETR2 is positive and not significant ($\beta=0.0959$, $z=0.5309$), as in equation (4.i). Thus, the hypothesis H1e was not supported.

The coefficient between profitability and ETR2 was positive and statistically significant ($\beta=1.4468$, $z=6.6825$), contrary to the sign obtained in equation (4.i) for the same relationship. In this case, the results validate what is the most obvious and common relationship in the literature, that is, firms with higher profitability have to pay a higher

amount of taxes and, therefore, have higher ETRs. The results are in line with Gupta and Newberry (1997), Richardson and Lanis (2007), Minnick and Noga (2010), Armstrong et al. (2012), Moreno et al. (2017), Salaudeen and Eze (2018) and Stamatopoulos et al. (2019). Therefore, we were able to validate the hypothesis H1f.

5.3.2. Corporate Governance

Regarding the model (4.iv), we recorded a positive and statistically significant association ($\beta=0.0676$, $z=2.3611$) between size (SIZE) and ETR2. These results are better than those of equation (4.ii), since they were statistically significant and validate the political cost theory (Zimmerman et al., 1983). Therefore, we corroborated the hypothesis H1a. The coefficient of the relationship between leverage (LEV) and ETR2 was positive and statistically significant ($\beta=0.2635$, $z=1.6751$). However, we still do not validate the hypothesis H1b.

Capital Intensity (CAP_INT) showed a positive and statistically significant relationship ($\beta=0.4828$, $z=5.3599$) with ETR2, as in equation (4.ii). The difference is in the value of the coefficient, as the coefficient in equation (4.iv) is almost half the value of the coefficient in equation (4.ii). Therefore, the hypothesis H1c was not validated. Inventory Intensity (INV_INT) had a negative and statistically significant relationship ($\beta=-0.3692$, $z=-2.5652$) with ETR2. This result is still in line with what has been said so far, the difference being that in equation (4.iv) we had a statistically significant coefficient at 5% level and in equation (4.ii) a significance of 1%. Still, we did not support the hypothesis H1d. Research & Development intensity (RD_INT) continued to have a positive and insignificant coefficient with ETR2 ($\beta=0.1074$, $z=0.5936$). Therefore, we did not validate the hypothesis H1e.

Finally, contrary to the results of equation (4.ii), we obtained a positive and statistically significant coefficient between profitability (PROF) and ETR2 ($\beta=1.3607$, $z=6.2585$). What we found is that changing the measure of the dependent variable possibly shifted the sign of the relationship between the variables. Despite the changes, we continued to validate the hypothesis H1f, because we obtained a statistically significant relationship.

Within the board structure, we concluded that there is a statistically significant coefficient with a negative sign ($\beta=-0.0165$, $z=-3.0660$) between board size (BOARD) and ETR2. This confirms that larger boards benefit firms through lower effective tax rates. Thus, we validated the hypothesis H2a. The association between board independence (NON_EXEC) and ETR2 has a negative and statistically significant sign ($\beta=-0.2061$, $z=-$

1.8569), as in equation (4.ii). The results confirm, once again, that the presence of non-executive directors favors the reduction of effective tax rates. Therefore, the hypothesis H2b was validated. Regarding board gender diversity (B_DIV), we found a positive and non-significant relationship with ETR2 ($\beta=0.0933$, $z=0.7896$). Although the sign obtained is in line with our predictions, the association was not statistically significant, which may have to do with the low presence of female directors on boards of directors (Osebe et al., 2019). Therefore, the hypothesis H2c was not corroborated.

CEO duality (D_CEO) showed a negative and insignificant relationship ($\beta=-0.0139$, $z=-0.3876$) with ETR2, which means that this mechanism causes the reduction of ETRs. Even using a different measure for the dependent variable (ETR2), the results were in the same direction, not corroborating the hypothesis H2d.

Finally, we found a positive and non-statistically significant relationship between Insider ownership (INS_OWN) and ETR2 ($\beta=0.1067$, $z=1.5289$). This association suggests that greater ownership by managers makes them entrench themselves at the expense of shareholders, which results in higher ETRs. However, it should be noted that if we perform the unilateral test, we conclude that the relationship becomes statistically significant at the 10% significance level ($p\text{-value}=0.1263/2=0.06315$). Thus, with due reservations, we validated the hypothesis H2e.

Both regressions are globally significant ($p\text{-value}=0.000$, corresponding to the F test of global significance). Therefore, the regressions show the importance of firms' operational and financial specific characteristics and corporate governance mechanisms as determinants of ETRs.

In general, the results obtained do not differ much between ETR1 and ETR2. Observing the results of the more complete models (4.ii) and (4.iv), we concluded that the model that uses ETR1 as the dependent variable allows us to validate the hypotheses H1f, H2a, H2b, H2c and H2e. In turn, the model that uses ETR2 as the dependent variable allows us to corroborate the hypotheses H1a, H1f, H2a, H2b and H2e. Although we did not validate all the research hypotheses, we concluded that operational and financial characteristics can be seen as determinants of ETRs, as well as the analyzed corporate governance mechanisms. Therefore, we demonstrate the relevance of both operational and financial characteristics and corporate governance mechanisms.

Table 8: Estimation results for ETR2

VARIABLE	ETR2 (1)	ETR2 (2)
C	0.1310 (0.7964)	0.0290 (0.1641)
SIZE	0.0052 (0.2286)	0.0676** (2.3611)
LEV	0.2685* (1.8590)	0.2635* (1.6751)
CAP_INT	0.4875*** (5.5551)	0.4828*** (5.3599)
INV_INT	-0.3585** (-2.4584)	-0.3692** (-2.5652)
RD_INT	0.0959 (0.5309)	0.1074 (0.5936)
PROF	1.4468*** (6.6825)	1.3607*** (6.2585)
MB	0.0008 (0.9718)	0.0009 (1.0714)
D_EARN	-0.1555*** (-3.0137)	-0.1601*** (-3.1244)
BOARD	-	-0.0165*** (-3.0660)
NON_EXEC	-	-0.2061* (-1.8569)
B_DIV	-	0.0933 (0.7896)
D_CEO	-	-0.0139 (-0.3876)
INS_OWN	-	0.1067 (1.5289)
COEFFICIENT	0.4962	0.4921
STD.ERROR	0.0139	0.0138
Z-ESTATISTIC	35.5895	35.6097
PROB	0.0000	0.0000

This table presents the estimation results for equations (4.iii) and (4.iv). The dependent variable is ETR2 for both equations. The independent variables for equation (4.iii) are firms' operational and financial characteristics. For equation (4.iv), in addition to the variables mentioned above, we added the corporate governance mechanisms. ETR2 is the ratio between total tax expense and operational cash flow. SIZE is the logarithm of total assets, LEV is the ratio between long-term debt and total assets, CAP_INT is net property, plant and equipment divided by total assets, INV_INT is inventories divided by total assets, RD_INT is R&D expenses divided by sales, PROF is pre-tax income divided by total assets, MB is market capitalization divided by the book value of equity, D_EARN is a dummy variable equal to 1 when pre-tax income is positive and 0 otherwise, BOARD is the current total number of directors on the board, NON_EXEC is the number of non-executive directors divided by the total number of directors, B_DIV is the number of female directors divided by the total number of directors, D_CEO is a dummy variable equal to 1 when there is CEO duality and 0 otherwise and INS_OWN is the number of closely held shares divided by the number of common shares outstanding. The equations were estimated using the Tobit method. * means 10% individual significance, ** means 5% individual significance and *** means 1% individual significance. In parenthesis are observed z-statistic values.

6. Conclusions

Effective tax rates are an increasingly important factor for companies as they affect their decision-making in terms of financing and investment. Thus, it is important to analyze which factors can affect and how they can affect effective tax rates. Therefore, this paper adds value to the literature on the determinants of effective tax rates, as we analyze how corporate governance mechanisms and firms' operational and financial specific characteristics influence effective tax rates.

In order to examine the determinants of effective tax rates, we used a panel data sample of 130 non-financial companies, listed on European stock exchanges, belonging to 14 countries of the European Union, for the period between 2009 and 2018. To study what affects ETRs, we estimated several regressions using Tobit as the estimation method. Regarding the dependent variable, we used two different measures in order to increase the robustness of our results.

In order to investigate whether firms' operational and financial characteristics influence ETRs, we created several regressions following the models of Richardson and Lanis (2007), Kraft (2014) and Barbera et al. (2020). Our results show that larger firms have higher ETRs, which is in line with the political cost theory (Zimmerman et al., 1983). Contrary to our expectations, more leveraged and more capital-intensive firms have higher ETRs. Although there is a substitution effect between capital intensity and inventory intensity, we concluded that firms that are more intensive in inventories have lower ETRs. Finally, although we have found a significant association between profitability and ETRs, the sign of the relationship varied depending on the measure used for ETRs.

Later, we developed a more complete model, including corporate governance mechanisms as independent variables of our regressions, such as Minnick and Noga (2010), Osebe et al. (2019) and Chythis et al. (2020). These models include operational and financial characteristics and corporate governance variables. In this investigation, we estimated the impact of board structure, CEO duality, and ownership structure on ETRs. Corporate governance mechanisms are important, as they can help to control managers' opportunism and to align the interests of managers and shareholders. Thus, the presence of these mechanisms can contribute to the creation of value, which can be done through greater tax savings, that is, lower ETRs. The results show that firms with larger boards of directors have lower ETRs, which can be explained by the fact that they benefit from a greater variety of skills and experiences and because they more easily control tax planning (Pearce and Zahra,

1991; Abdul Wahab and Holland, 2012; Khaoula and Moez, 2019). Boards with a higher proportion of non-executive directors also have lower ETRs, proving that board independence is a factor that contributes to the reduction of ETRs. On the other hand, we found that boards of directors with a greater presence of female directors and greater ownership by managers are associated with higher ETRs. Regarding CEO duality, it was not possible to find a statistically significant relationship with the dependent variable.

Our investigation contributes to the literature on the determinants of effective tax rates, adding value to how the factors under study influence ETRs. The first contribution is the inclusion of corporate governance mechanisms as determinants of effective tax rates, creating a more complete model on the factors that impact ETRs and considering the separation between ownership and management of firms. Secondly, we used a sample of firms that belong to 14 countries of the European Union, and the use of European companies is quite scarce in the literature. We also selected a 10-year time period that covers more recent years (2009-2018). Additionally, our corporate governance variables present annual data, rather than being assumed to be constant for the selected time periods, which produces more accurate results.

Our results may be useful for other researchers that study the determinants of effective tax rates. In addition, policymakers and regulators will also benefit from this research, as it is important for them to take into account the factors that affect effective tax rates, when establishing countries' tax systems. Likewise, managers and shareholders are interested in this investigation, as the factors analyzed may have an impact on ETRs, which could lead to greater tax savings, influencing the wealth and the creation of value in firms.

Although our sample focuses on firms from different European countries, its size is not very significant, due to the fact that this is an investigation that focuses on many variables, some being quite difficult to find in databases. Furthermore, our sample is mostly composed of large firms, which mean that our results may not be valid for firms with other dimensions. Finally, our study focused more on annual ETRs and, therefore, we did not address long-term ETRs. Thus, in the future, it would be interesting to understand how operational and financial characteristics and corporate governance mechanisms affect long-term ETRs. It could also be interesting to use another measure for the dependent variable, such as the cash effective rate, which helps to capture tax evasion activities.

7. References

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