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- **Title: Business group complexity, regional tax autonomy and tax avoidance: evidence from Spain**☆

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Business group complexity, regional tax autonomy and tax avoidance: evidence from Spain

Abstract

This paper studies the relationships among business group complexity, regional tax autonomy and tax avoidance. We use a sample of 53,006 group-affiliated Spanish firms and 150,334 firm-year observations from 2007 to 2016. Our results confirm that firms affiliated with more complex business groups exhibit lower effective tax rates (ETRs). We further show a negative and significant relationship between a region's tax autonomy and the average ETR faced by firms located in that region, providing empirical evidence to the literature on tax competition. Moreover, we find that regional tax autonomy moderates the negative relationship between the complexity of the business group to which a firm belongs, and the tax burden borne, shedding light on the reasons for the lack of consensus on the relationship between tax burden and tax avoidance in corporate taxation. We apply several static and dynamic panel data model specifications and control for firm-specific and regional determinants of tax avoidance.

JEL classification: G30, H25, H26, M21, O52
Keywords: Corporate tax, effective tax rate, business group complexity, Spain, tax avoidance, tax autonomy, tax competition

1. Introduction

The avoidance of corporate income tax is a concern for most regulators globally. Several attempts have been made to put an end to tax avoidance and tax competition between countries. For instance, the OECD/G20 *Inclusive Framework on Base Erosion and Profit Shifting* (BEPS)[1] aims to reduce tax strategies that exploit gaps and mismatches in tax rules in 139 countries and jurisdictions. In June 2021, the Organisation for Economic Co-operation and Development (OECD) announced an agreement among 130 countries on a minimum global corporate tax of 15% to reduce corporate tax avoidance. A key factor in corporate tax avoidance is the complexity and opacity of business groups (Desai and Dharmapala, 2006; Manconi and Massa, 2009; Chen et al., 2010; Hsu and Liu, 2018; Minzak and Zeng, 2020). Overall, the literature shows that structural complexity leads to opacity, thus increasing the difficulty authorities face in detecting tax avoidance activities (Desai and Dharmapala, 2006; Manconi and Massa, 2009). Moreover, in complex business groups, ultimate controlling owners are more inclined to hide rent extraction activities and reap tax savings for their own benefit to the detriment of the interest of minority shareholders (Desai and Dharmapala, 2008; Hsu and Liu, 2018). In addition, they further suffer smaller reputation losses from their tax avoidance activities because it is difficult for outsiders to delimit their responsibilities (Chen et al., 2010).

Motivated by this growing concern of regulators and policy makers, this paper focuses on a large sample of business group-affiliated firms in Spain and studies the relationship between group complexity and corporate tax avoidance. Moreover, we further assess the relationship between regional tax autonomy and tax avoidance; and finally, we test for a moderation effect of regional tax autonomy between group complexity and corporate tax avoidance. Following Hanlon and Heitzman (2010), we measure corporate tax avoidance by the effective tax rate (ETR).

A limited body of literature has examined how the complexity of pyramid groups affects tax avoidance (Hsu and Liu, 2018; Minzak and Zeng, 2020), while other studies have focused on the relationship between the tax incentives for multinational groups to shift their profits among companies and the complexity of the structures adopted by these groups (Wagener and Watrin, 2014). Overall, the results show evidence that structural complexity can help companies achieve their goals of minimizing their tax payments. We measure the complexity of a business group by the maximum number of layers separating the apex from its most distant subsidiaries within the corporate structure (Desai and Dharmapala, 2006; Dyreng and Lidsey, 2009; Jung et al., 2009; Malan et al., 2012; and Minzak and Zeng, 2020). Likewise, we define a business group as the set of companies controlled directly or indirectly by a parent company through chains of ownership composed of shareholdings of more than 50% of voting rights. We design and implement our own group identification algorithm that allows us to apply different minimum ownership thresholds.

The scarce empirical literature on regional tax autonomy and competition shows that a horizontal externality may occur when different territories, in their efforts to attract production factors, might reduce their tax rates, causing a "race to the bottom" in the corporate tax burden (Bucovetsky, 1991; Wilson, 1991; Vandenbussche et al., 2005). To test the effect of regional tax autonomy on tax avoidance, we build a dummy variable that takes a value of one for tax autonomous regions and zero otherwise. We expect business groups located in tax autonomous regions to exhibit lower ETRs.

Finally, we test for a moderation effect of regional tax autonomy on the relationship between business group complexity and tax avoidance. We expect that firms located in tax autonomous regions that already enjoy a lower tax burden may be less prone to engaging in opaque tax planning activities to avoid taxes. Some studies provide empirical evidence that can support our hypothesis. For instance, Joulfaian and Rider (1998) and Wu and Teng (2005) showed a positive correlation between tax avoidance and tax rates, indicating that lower tax rates are related to better compliance with tax obligations.

Our results show a negative and significant relationship between both group complexity and regional tax autonomy and ETR. They further show that the impact of group complexity on the ETR is lower in regions with tax autonomy. Overall, after applying various multivariate analyses, including static and dynamic panel data models, these results are robust. We also provide additional robustness to our findings by proposing alternative models that censor the dependent variable, the ETR; use an alternative explanatory variable to measure group complexity; and modify the minimum ownership percentage required to identify business groups.

Our analysis is based on a sample of 150,334 firm-year observations of 53,006 Spanish non-financial firms affiliated with business groups over the period 2007–2016. Both listed and unlisted firms are included. It is important to emphasize that business groups account for more than two-thirds of the total assets of Spanish firms.

<Insert Figure 1 here.>

Panel A of Figure 1 shows the weight, in terms of total assets, of group-affiliated firms over the total number of firms in each Spanish province. The economic importance of the groups differs notably among provinces. However, as can be noted in the Figure, in several provinces (mostly in those located in the northern half of the country), group-affiliated firms account for more than half of the total assets of the province's business network. Therefore, firms integrated into business groups have a large weight in the Spanish economy.

Spain constitutes a suitable country for testing interregional tax competition due to the tax autonomy of some regions, such as the Basque Country and Navarre, and the existence of the Canary Islands Special Zone (ZEC), which is a tax haven recognized by the EU. These locations allow us to incorporate into our analysis the effect of the tax autonomy of regions within a country on the corporate tax burden. As shown in Panel B of Figure 1, the median ETR of Spanish firms belonging to groups reflects that the tax burden is lower in regions that have tax autonomy (Basque Country and Navarre) and regions that are integrated in the ZEC (Canary Islands) than in most of the remaining Spanish provinces.

This paper enriches the limited literature on the relationship between group complexity and tax avoidance by providing new empirical evidence on a country, Spain, in a geographical area, Europe, that has been scarcely studied in this regard. Our work further contributes to the existing literature on tax competition between geographic areas within a country by including regional variables that show that the tax autonomy of the region in which a firm is located is related to a lower tax burden. Moreover, to the best of our knowledge, this is the first work to analyse a moderation effect of regional tax autonomy between corporate group complexity and tax avoidance. Finally, unlike most of the literature, we focus our analysis on both listed and unlisted firms, which provides a more accurate picture of the Spanish business fabric (less than 1% of the firms in our sample are publicly traded).

Our work may be of interest to regulators, as it provides new empirical evidence on the determinants of corporate tax avoidance. Public revenue losses due to tax avoidance activities are estimated at $500 billion each year (Cobham and Janský, 2018). Our study could help regulators identify firms whose characteristics make them more prone to tax avoidance activities. In addition, the results reveal that a lower ETR could contribute to better tax compliance and be beneficial to public coffers.

The remainder of this paper proceeds in the following manner. Section 2 reviews the previous literature and develops our research hypotheses. Section 3 describes the data and variables. Section 4 shows the results of the analyses performed. Finally, section 5 presents the main conclusions, policy implications, limitations of the study and future research lines.

2. Related literature and research hypotheses

Although there is widespread interest in the literature in measuring the magnitude of tax avoidance by corporations and identifying its determinants, there are still no universally accepted definitions of this concept. Following Hanlon and Heitzman (2010), in this paper, we use the term "tax avoidance", which is broadly defined as an explicit reduction in taxes. Consequently, this definition encompasses all types of transactions that have some effect on a firm's explicit tax liability, including activities ranging from legal tax planning to illegal activities.

In the following subsections, we review the literature related to business group complexity, regional tax autonomy and tax avoidance, and we present our research hypotheses.

Tax avoidance and business group complexity

Business groups are criticized worldwide for their opaque ownership structures and tax avoidance activities (La Porta et al., 1999; Bertrand et al., 2002; Claessens et al., 2006; Hsu and Liu, 2018). As Graham et al. (2014) pointed out, among the main factors explaining why firms do not engage in tax avoidance activities are the risk of being scrutinized and detected by outsiders (i.e., tax agencies) and the potential harm to their reputation. Consequently, as Desai and Dharmapala (2006) argued, firms are more likely to avoid taxes by designing complicated and obscure transactions within the internal corporate group structure with the objective of making tax avoidance difficult to detect and trace by outsiders and minimizing reputational risk.

However, studies exploring the relationship between the opacity and complexity of business groups and their tax avoidance activities remain limited (Minzak and Zeng, 2020). For this reason, our first research question focuses on gaining a better understanding of whether complex groups are more tax avoidant. With this objective, we define a business group as the collection of companies controlled by a parent company (or apex) through direct and indirect shareholdings. We understand that such control is exercised when the shareholdings that comprise the chain of ownership between an apex and its subsidiaries are greater than 50% of voting rights, providing a controlling interest and substantial power within the group.

The main works addressing our first issue focus on the relationship between the complexity of pyramidal business groups and tax avoidance (Hsu and Liu, 2018; Minzak and Zeng, 2020). A pyramid structure is defined by these authors as a business entity consisting of a group of firms whose ownership structure displays a top-down chain of control. In such a structure, the ultimate owners are located at the apex, with at least two successive layers of firms below.

While there may be several ways to empirically measure the complexity of groups, such as geographical and industrial diversification, the studies mentioned above capture this complexity through the number of layers that separate the parent company from the most distant subsidiaries within the group. These studies argue that corporate tax avoidance is positively associated with the number of layers in corporate pyramids and point out three main reasons why. First, a long pyramid structure makes a company less transparent, which makes it difficult for outside investors to assess the company's financial position and performance and for authorities to detect tax avoidance activities (Desai and Dharmapala, 2006; Manconi and Massa, 2009). Second, from the agency theory perspective, these long structures can be useful for the ultimate controlling owner to hide rent extraction activities and reap tax savings for their own benefit[2], to the detriment of the interest of minority shareholders (Desai and Dharmapala, 2008; Hsu and Liu, 2018). Third, in complex and opaque pyramid structures, the controlling shareholders suffer smaller reputation losses from their tax avoidance activities because it is difficult for outsiders to delimit their responsibilities (Chen et al., 2010). Consequently, complex pyramid structures make companies more prone to tax avoidance activities.

Recent empirical works also confirm the aforementioned relationship. Minzak and Zeng (2020) analysed Canadian listed firms from 2010 to 2013 and found that firms affiliated with pyramid structures engaged in more tax avoidance activities than did non-affiliated firms. Additionally, they revealed that firms affiliated with more complex pyramids engaged in greater tax avoidance practices and that firms located at the lower tiers of the pyramids avoided more taxes. Similarly, Hsu and Liu (2018) provided analogous results based on a sample of non-financial publicly traded firms in Taiwan from 2000 to 2011. These authors documented that the increase in the number of layers in corporate pyramids facilitates tax avoidance activities that reduce ETRs.

Given the existing empirical evidence on the relationship between group complexity and tax avoidance, we propose our first hypothesis:

H1: Firms affiliated with a more complex business group exhibit a lower ETR.

Tax avoidance, regional tax autonomy and tax competition

Following Blöchliger and Nettley (2015), we define tax autonomy as the extent of freedom that subcentral governments exert over tax policy. In recent decades, there has been a global trend towards fiscal decentralization that has increased the role of regional governments in taxation (Arzaghi and Henderson, 2005). The literature shows that this greater tax autonomy can lead to an increase in tax competition. Tax competition is defined as a fiscal adjustment strategy in a non-cooperative game between jurisdictions, in which each government adjusts its tax system taking into account the fiscal policy moves of other jurisdictions (Keen, 2008). The underlying idea behind this "tax competition" hypothesis is that production factors choose to locate in areas with a lower tax burden and, consequently, governments tend to reduce their tax rates to attract such production factors (Zodrow and Mieszkowski, 1986; Wilson, 1986).

Tax competition can take place between neighbouring countries (Hansson and Olofsdotter, 2005; Overesch and Rincke, 2011), between nearby regions (Hayashi and Boadway, 2001; Vandenbussche et al., 2005), and between administrations of different jurisdictions (e.g., between national and regional governments or between local and regional jurisdictions), giving rise to vertical or horizontal tax externalities (Brülhart and Jametti, 2006; Fox et al., 2015).

Vertical tax externalities occur when different administrations in a territory compete for the same tax base, resulting in a tax burden above the social optimum (Keen and Kotsogiannis, 2002; Brülhart and Jametti, 2006). However, empirical studies on this issue offer ambiguous results. On the one hand, empirical studies by Goodspeed (2000) and Hayashi and Boadway (2001) showed a significant negative correlation between subnational and federal tax rates. On the other hand, works from Besley and Rosen

(1998), Esteller-Moré and Solé-Ollé (2001) and Da Costa et al. (2015) revealed that regional jurisdictions increased their tax burdens in response to upward changes in federal taxes, causing an excessive tax burden.

Horizontal externalities take place when different territories, competing for mobile production factors and tax bases, reduce their tax rates to be more attractive, causing a "race to the bottom" in corporate tax burden (Hansson and Olofsdotter, 2005; Overesch and Rincke, 2011). Studies by Bucovetsky (1991), Wilson (1991) and Vandenbussche et al. (2005) provide empirical evidence on this matter. Bucovetsky (1991) and Wilson (1991) showed that smaller jurisdictions can impose lower taxes and are better positioned than larger regions to compete for capital inflows. Furthermore, Vandenbussche et al. (2005) analysed large Belgian firms in the period 1993–2002 and found evidence of horizontal tax competition, with peripheral regions having a lower tax burden on firms than central regions with the objective of attracting business investment.

In Spain, the central government designs and collects corporate income tax in all autonomous communities, except in the Basque Country and Navarre, which are regions that exercise complete tax autonomy in this matter. During the 2006–2017 period analysed, the overall corporate tax rate in Spain decreased from 32.5% to 25% (Spanish Tax Agency, 2020); in particular, between 2007 and 2015, small firms (i.e., turnover <€10 M) were granted reduced tax rates. During the same period, differences in tax rates and allowances applied in regions with tax autonomy may have resulted in a different tax burden for firms located in those regions.

Given that in Spain, regional governments with tax autonomy have the exclusive ability to levy the corporate tax base in their territory, and following the empirical evidence on horizontal tax competition, we expect group-affiliated firms located in tax autonomous regions to have a lower tax burden than those located in other Spanish territories. Moreover, following Bucovetsky (1991) and Wilson (1991), as these autonomous regions are smaller in size than the rest of the country, it is also reasonable to expect that they will be able to apply a lower tax burden on firms to attract mobile production factors and tax bases. Thus, our second hypothesis is as follows:

H2: Group-affiliated firms located in a tax autonomous region exhibit lower ETRs.

Tax avoidance, regional tax autonomy and business group complexity

There is a notion that regions and countries with a lower tax burden benefit from higher tax compliance and that higher taxes may lead to a larger underground economy (Gutmann, 1977). The empirical literature on the relationship between tax rates and tax avoidance focuses mainly on personal income tax, supporting the idea that high income tax rates partly explain the volume of unreported income (e.g., Clotfelter, 1983; Crane and Nourzad, 1987; Alm et al. 1990, among others). In this regard, studies that have focused on corporate income taxes are scarce and inconclusive. Studies from Joulfaian and Rider

(1998) and Wu and Teng (2005) provided evidence of a positive correlation between tax avoidance and tax rates. Wu and Teng (2005) estimated the determinants of tax compliance in 58 countries over the period 1996–2000 and found that tax burden negatively affects tax compliance. However, while they found a statistically significant negative correlation between the personal income tax rate and tax compliance, this relationship was not significant for corporate tax rates. Joulfaian and Rider (1998), focusing on small firms, discovered that tax evasion was positively correlated with tax rates.

Nevertheless, Kamdar (1997), Friedman et al. (2000) and Nur-tegin (2008) found no relationship between the degree of corporate tax compliance and tax burden. Friedman et al. (2000) analysed data from 69 countries but reported no evidence that higher tax rates are associated with higher unofficial activity, with the key factors being bureaucracy, corruption, and weak legal environments. Similarly, Nur-tegin (2008) analysed over 4,500 firms in transition economies and concluded that the degree of corporate tax evasion is not significantly affected by tax rates after controlling for tax corruption. Finally, using aggregate data from U.S. corporations over the period 1961–1987, Kamdar (1997) showed that audits are effective tools against corporate tax noncompliance, while ETRs do not seem to have a significant effect on the degree of compliance.

Given the scarcity of empirical studies analysing the effect of tax burden on corporate tax avoidance activities, the existing lack of consensus on the relationship between both issues and the high economic and social impact of corporate taxation (McCaffery and Slemrod, 2006), we consider it relevant to delve deeper into this question. To do so, we will analyse whether the tax autonomy of regions, which have a lower expected tax burden according to our second hypothesis, moderates the relationship between the complexity of business groups and the ETR of firms affiliated with these groups. If there is a negative relationship between corporate group complexity and ETR and regions with tax autonomy have a lower tax burden, we expect that tax autonomy may moderate this negative relationship between corporate complexity and ETR, so that in regions with tax autonomy, the impact of group complexity on ETR is lower. The rationale for this hypothesis is that firms located in regions with a lower corporate tax burden may have less incentive to engage in opaque tax planning activities that make use of complex corporate structures to avoid taxes. Taking into account the above evidence, our third hypothesis is as follows:

H3: The negative effect of the complexity of the business group the company is affiliated with on its ETR is lower in regions with tax autonomy.

3. Data and variables

Sample description

Our sample consists of 150,334 observations from 53,006 group-affiliated Spanish non-financial companies from 2007 to 2016. We define a business group as the set of companies controlled by a parent company through chains of ownership composed of links that exceed 50% of ownership. Following

Garmendia-Lazcano and Baselga-Pascual (2021), we use the SABI database, and design an iterative algorithm to identify business groups that tracks the controlling shareholder of a company and builds the chain of ownership that links each company to its final owner or parent company. Regional information is obtained from the Spanish Senate website (2019).

Tables I and II report the sample description. In Table I, we provide observations per region. As can be noted from the table, Cataluña (26.4%) and Madrid (21.9%) account for almost half of the total observations, which is to be expected given that they are the core business locations in Spain. These regions, together with Comunidad Valenciana and Andalucía, represent approximately two-thirds of the observations.

<Insert Table I here.>

In Table II, we provide observations per year. As the table clearly depicts, there is a drastic drop in the number of observations since 2009, which may be explained by the financial crisis of 2008, which particularly hit the Spanish business network. Observations continue in a slight upward trend afterwards.

<Insert Table II here.>

Dependent variable

Following Landry et al. (2013), Sánchez-Marín et al. (2016), Stamatopoulos et al. (2019), and Garmendia-Lazcano and Baselga-Pascual (2021), among others, we use the ETR to proxy corporate tax avoidance. ETR is commonly used in the literature and has been shown to be a robust indicator of corporate tax burden (Graham, 2003; Plesko, 2003; Rego, 2003).

We operationalize this measure as follows:

$$ETR_{it} = \left(\frac{TITE_{it}}{PTBI_{it}}\right) \times 100$$

where ETR_{it}, $TITE_{it}$, and $PTBI_{it}$ are the effective corporate tax rate, total income tax expense, and pre-tax book income of company *i* in period *t*, respectively (Gupta and Newberry, 1997; Richardson and Lanis, 2007; Chen et al., 2010; Lanis and Richardson, 2012; Landry et al., 2013). In this ratio, both the numerator and the denominator can have positive and negative values. To avoid incorrect interpretations, we have adjusted the sign to ensure that a positive ETR indicates the payment of taxes by the company and that a negative ETR reflects the generation of a tax credit in favour of the firm (Garmendia-Lazcano and Baselga-Pascual, 2021). To confirm our results, we also replicate our analysis in the robustness subsection by censoring the ETR within the range of 0–100% (Gupta and Newberry, 1997; Higgins et al., 2015).

We expect a negative relationship between tax avoidance and ETR, as tax avoidance activities may result in a lower ETR. Tax avoidance activities tend to generate book-tax differences between book and taxable corporate income. For instance, investments in tax-exempt or tax-favoured assets, participation in tax shelters that result in losses for tax purposes but not for accounting purposes, and the use of foreign operations to reduce the company's tax bill, among other tax-motivated transactions, may result in a lower ETR (Rego, 2003; Chen et al., 2010). Given that the ETR captures the aforementioned strategies, it is considered an appropriate proxy for tax avoidance (Landry et al., 2013).

We must acknowledge, however, that there are some limitations in the ETR as a tax avoidance proxy. For instance, it might fail to detect deliberate tax avoidance activities as it covers all transactions that affect the tax liability of a firm; it further does not reflect tax deferring strategies; and finally, the ETR focuses on nonconforming tax activities and thus does not capture transactions that reduce both book and taxable income, the so-called book-tax-conforming tax avoidance activities (Hanlon and Heitzman, 2010; Badertscher et al., 2019).

Main explanatory variables: group complexity and tax autonomy

To proxy the complexity of a business group, we generate the variable MGL_{it}, which measures the natural logarithm of the maximum number of layers between the parent company and its most distant subsidiaries in the business group (Hsu and Liu, 2018; Minzak and Zeng, 2020). Our group identification algorithm allows us to measure the distance that separates each subsidiary from its apex. Consequently, we can calculate the maximum number of layers that separate the apex from its subsidiaries within each business group. Therefore, for this variable, all the firms that are affiliated with the same business group show the same value.

We build a dummy variable, TAD_{it}, which takes a value of 1 when firms are located in Navarra or the Basque Country, which are autonomous communities with corporate tax autonomy, and 0 otherwise.

Control variables

We include a commonly used set of firm-specific control variables in our multivariate analysis. Previous studies have documented that a firm's ownership concentration, size, profitability, age, leverage, public status, capital, inventory, and intangible asset intensity may affect corporate tax avoidance (Rego, 2003; Lanis and Richardson, 2012; Guenther et al., 2013; Landry et al., 2013; Sánchez-Marín et al., 2016; Stamatopoulos et al., 2019; Kovermann and Wendt, 2019).

The effect of ownership structure on tax avoidance remains unclear in the literature. Kovermann and Wendt (2019) show a positive and significant relationship between tax avoidance and the percentage of family ownership. Nevertheless, the results from Chen et al. (2010) and Sánchez-Marín et al. (2016) provide the opposite association. We proxy ownership concentration (OC_{it}) by the equity share of the main shareholder. We control for size in our study, as companies of different sizes may have different business strategies and media exposure. For instance, according to political cost theory, large corporations, due to their greater media visibility, are more exposed to greater wealth transfers; thus, larger firms might present a higher ETR (Zimmerman, 1983). Stamatopoulos et al. (2019) provide empirical support for this view. However, political power theory states that larger corporations, due to their superior economic and political power and access to economies of scale, are more likely to reduce their corporate tax burden (Siegfried, 1972; Porcano, 1986). Studies from Richardson and Lanis (2007) and Guenther et al. (2013) empirically show a negative correlation between the size of a firm and its corporate ETR. We proxy size ($SIZE_{it}$) by the natural logarithm of the total assets. Similar to larger firms, older firms might suffer from some inconvenience related to their greater public image awareness, but their longer experience also allows them to be more efficient in their tax planning, enjoying lower tax burdens (Kovermann and Wendt, 2019). Firm age (AGE_{it}) is measured by years in operation of each firm.

Profitability and leverage are also common ETR drivers. The literature mostly agrees on the notion that more profitable firms exhibit greater ETRs (Gupta and Newberry, 1997; Harris and Feeny, 2003; Richardson and Lanis, 2007; Chen et al., 2010). However, some authors highlight that the more profitable the firm is, the greater the incentives to engage in tax avoidance activities (Rego, 2003; Wilson, 2009). We control for firm profitability by the return on assets (ROA_{it}). Financial leverage is generally linked to lower ETRs since debt interest is a tax-deductible expense (Richardson and Lanis, 2007; Stamatopoulos, 2019). However, studies from Harris and Feeny (2003) and Janssen (2005) provide empirical support for the opposite relationship, finding financial leverage and the ETR to be positively correlated. They argue that firms with greater marginal tax rates might be more prone to taking on more debt. Financial leverage (LEV_{it}) is proxied by the winsorized ratio of total liabilities to the total assets of a company.

The intensity or capital, inventories and intangible assets are also linked to the ETR. The literature shows the intensity of both capital and intangible assets to be related to lower ETRs. Janssen (2005), Richardson and Lanis (2007) and Stamatopoulos (2019) show a negative relationship between capital intensity and the ETR, as firms may offset part of their asset cost by the application of accelerated amortization schemes. A similar effect is expected between intangible asset intensity and the ETR, as research and development (R&D) expenditure is tax deductible (Lanis and Richardson, 2012). On the other hand, the relationship between inventory intensity and the ETR remains inconclusive. Zimmerman (1983) and Gupta and Newberry (1997) argue that firms intensive in stocks may face higher ETRs, given that inventory intensity is a substitute for capital intensity as long as these firms use the same inventory method for both book and tax purposes. In contrast, Stamatopoulos et al. (2019) show the opposite relationship. Following the aforementioned authors, we proxy capital intensity ($CINT_{it}$), inventory intensity ($SINT_{it}$), and intangible asset intensity ($IINT_{it}$) by the ratio of fixed assets to total assets, inventory to total assets, and intangible assets to total assets, respectively. We further control for the public status of a firm (PD_{it}) by a dummy variable that equals 1 when a firm is publicly traded and 0 otherwise.

Finally, we include relevant regional control variables in our study. The political orientation of a governing party is a determinant factor in defining tax policy. One of the first announcements from the recently elected President Biden (US) in 2021 was changes to the corporate tax rate, which in turn had been changed by his predecessor four years previously. In general, left-wing governments are associated with a higher tax burden (Imbeau et al., 2001; Reed, 2006). As there are corporate tax autonomous regions in our study, we control for the political orientation of those regions (Navarre and Basque Country) and the rest of the country, where the central government designs and collects corporate taxes. To that end, we build a dummy variable, LRW_{it}, which equals 1 for right-wing-oriented parties and 0 for left-wing parties. A final factor that must be controlled for in our study is the location of a firm in the ZEC. This territory in the Canary Islands is classified as an official tax haven recognized by the EU because of its marginal geographic location; thus, the corporate tax rate in the ZEC is 4%. We use a dummy variable, ZEC_{it}, that takes a value of 1 if a firm is located in this area.

Table III presents the definitions of all the variables.

<Insert Table III here.>

4. Empirical analysis

Descriptive statistics

Table IV reports the summary statistics for the variables used in the empirical analysis. As can be noted from the table, the average ETR is 9.34%, although the median, which is more relevant in our study, reaches 22.48%. On average, there are 1.62 layers between the apex and its most distant subsidiaries in the chain of ownership. The average size in terms of total assets is €60.4 million. Firms in our sample are almost 20 years old on average, and the mean ROA is 2.65%. Ownership is very concentrated in the main shareholders (91.72%), and most firms are unlisted (0.44% of observations), while 8% of the observations in our sample are located in tax autonomous regions.

<Insert Table IV here.>

Pairwise correlations

Pairwise correlations between tax avoidance and our explanatory variables are reported in Table V. As seen from the table, our dependent variable, ETR_{it}, is significantly correlated with both variables of interest, group complexity (MGL_{it}) and tax autonomy (TAD_{it}). The correlation coefficients show that ETR is negatively associated with the complexity of business groups and the tax autonomy of the regions where the firms are located; thus, the pairwise correlations provide support for hypotheses H1 and H2.

ETR further shows a significant negative correlation with firms' main shareholder concentration (OC_{it}); public status (PD_{it}); intangible asset ($IINT_{it}$), capital ($CINT_{it}$), and inventory ($SINT_{it}$) intensity; debt ratio

(LEV_{it}); and location in the ZEC. These coefficients show that firms whose ownership is concentrated in the main shareholder; are publicly listed; and are intensive in capital, intangible assets and stocks present a lower ETR. In contrast, the correlation coefficients between ETR_{it} and $SIZE_{it}$, AGE_{it}, and ROA_{it} are positive and significant, indicating that larger, older and more profitable firms tend to have higher ETRs.

Regarding the explanatory variables, the coefficients from $SIZE_{it}$ and MGL_{it} are significantly and positively correlated, suggesting that larger companies are associated with greater complexity within groups (MGL_{it}). Given the statistically significant correlations between some of our explanatory variables, we perform dynamic panel data regressions to ensure that the results of our multivariate analysis are not affected by multicollinearity.

<Insert Table V here.>

Multivariate analysis

To test our hypotheses, we run alternative multivariate settings and use different model specifications, including static (fixed and random effects) and dynamic (system generalized method of moments (system GMM)) models, to control for endogeneity and check the robustness of our results.

We estimate several alternative versions of the following panel regression specification:

$$ETR_{it} = \propto_0 + \propto_1 MGL_{it} + \propto_2 TAD_{it} + \propto_3 (MGL_{it} \times TAD_{it}) + \phi X_{it} + \eta_i + d_t + v_{it} \qquad (1)$$

where the dependent variable is the ETR of firm i in year t. We include two explanatory variables of interest. MGL_{it} is the natural logarithm of the maximum number of layers between the apex and its subsidiaries in the business group to which company i belongs in year t. TAD_{it} is a dummy variable that equals 1 when the firm is located in a region with corporate tax autonomy and 0 otherwise. To test for moderation effects, we further include the interaction of our main explanatory variables ($MGL_{it} \times TAD_{it}$). X_{it} is a matrix of time-variant determinants of the ETR taken from the literature, including company features (ownership concentration, size, ROA, age, stock exchange listing, intangible asset intensity, capital intensity, inventory intensity, and leverage) and regional indicator variables (the ZEC special zone and the left- or right-wing politics of the governing political party). η_i and d_t denote firm-specific time-invariant unobservable characteristics and time-specific fixed effects, respectively. v_{it} is the disturbance term. Our second specification is a dynamic model that includes the one-year lagged dependent variable $ETR_{i,t-1}$ as an explanatory variable in Equation (1).

We estimate the static and dynamic specifications of Equation (1) using three different estimators. Table VI reports the estimates of the panel regressions. In models (1) and (2), we run fixed-effects regressions following the overidentifying restrictions test (Arellano, 1993; Wooldridge, 2010). Fixed-effects regression allows us to control for time-invariant unobservable firm characteristics (Treiman, 2009).

Nevertheless, as some of our variables show little or no time variation (e.g., PD_{it}, TAD_{it} and ZEC_{it}), the estimated coefficients of these variables might be biased (Longhi and Nandi, 2014), and their standard errors could be larger than those obtained with other estimators (Allison, 2009). In models (3) and (4), we use a random effects estimator since it allows us to obtain less biased estimates of these variables with little within-firm variation over time (Wooldridge, 2010). Finally, to address the potential endogeneity issues in our baseline equation[3], in models (5) and (6), we estimate a dynamic specification of Equation (1) using the system GMM estimator developed for dynamic panel models by Arellano and Bover (1995) and Blundell and Bond (1998). The system GMM estimator addresses endogeneity by means of suitable instruments. It further allows us to control for a firm's individual heterogeneity. We employ the two-step estimation procedure with finite-sample-corrected standard errors, which provides less biased coefficient estimates and more accurate standard errors (Windmeijer, 2005). We treat all variables as endogenous covariates by employing the lagged first differences of the explanatory variables as instruments for the equation in levels and the lagged values of the explanatory variables in levels as instruments for the equation in differences (Arellano and Bover, 1995; Blundell and Bond, 1998). We further use robust standard errors to control for heteroscedasticity and serial correlation.

<Insert Table VI here.>

As can be noted from Table VI, we verify hypotheses H1, H2 and H3. The coefficients of MGL_{it} are negative and statistically significant in all model specifications, thus supporting hypothesis H1, which posits that firms affiliated with a more complex business group present a lower ETR. This result is consistent with the findings of Hsu and Liu (2018) and Minzak and Zeng (2020). Regarding H2, the TAD_{it} coefficient is negative and statistically significant in models (3)-(6), showing that group-affiliated firms located in regions with tax autonomy seem to face a lower tax burden. However, the TAD_{it} coefficients lose their significance in models (1) and (2). This effect may be caused by the fact that, in general, the location of a firm presents little variation; hence, the coefficients of the fixed-effects regressions may be biased due to the scarce within-firm variation that exists in this variable. H3 is tested in models (2), (4) and (6), where we study a moderation effect of TAD_{it} in the relationship between MGL_{it} and ETR_{it}. The coefficient of the interaction between MGL_{it} and TAD_{it}, which captures the incremental effect for group-affiliated firms located in regions with tax autonomy, becomes positive and statistically significant in models (4) and (6), providing support for our third hypothesis. These results suggest that the negative impact of business group complexity on ETR in tax autonomous regions is lower than that in regions without tax autonomy. In contrast, in model (2), the interaction coefficient becomes statistically nonsignificant. Note that the coefficient of the interaction term in model (2) may be biased; therefore, in this case, we discard the results of this model.

To facilitate the interpretation of the moderation effects, we plot in Figure 2 the interactions of models (4) and (6) in Panels A and B, respectively. As can be noted from the figure, the differences between regions with and without tax autonomy in the ETR are manifest for non-complex groups; however, they tend to disappear as complexity arises.

In Panel A of Figure 2, the interaction between group complexity, measured by the natural logarithm of the maximum number of layers between the matrix and its subsidiaries, and tax autonomy shows that in regions without tax autonomy, the tax burden on firms decreases as the complexity of the group increases. The slope of the line associated with regions without tax autonomy is negative (b=-3.56, p<0.01) and statistically significant. Therefore, as the complexity of the groups increases, so do their tax avoidance activities. In contrast, in regions with tax autonomy, the ETR does not depend on the complexity of the business group. The slope of the line for regions with tax autonomy is slightly negative but statistically nonsignificant. Moreover, the differences in the ETR between regions with and without tax autonomy become blurred when the complexity of the group exceeds 4 layers.

In Panel B of Figure 2, the slope of the line associated with regions without tax autonomy is also negative (b=-1.086, p<00.1) and statistically significant. In contrast, the slope corresponding to firms located in regions with tax autonomy is positive but statistically nonsignificant, showing that in these regions, group complexity does not seem to influence the intensity of tax avoidance activities. Both results are in line with those obtained in Panel A of Figure 2 and further confirm hypothesis H3.

<Insert Figure 2 here.>

Control variables in Table VI show, in general, expected results. The coefficients of $CINT_{it}$, $SINT_{it}$, LRW_{it} and $SIZE_{it}$ are negative and statistically significant in most models. In particular, the coefficients of $CINT_{it}$ and $SINT_{it}$ are significant in all model specifications, providing robustness to our results, which show that both the intensity of capital and stocks are related to a lower ETR (Janssen, 2005; Richardson and Lanis, 2007; and Stamatopoulos et al., 2019). Similarly, the coefficients of LRW_{it} and $SIZE_{it}$ are highly significant in all models except for the random-effect regressions, suggesting that larger firms and those located in right-wing-governed areas exhibit lower ETRs (Imbeau et al., 2001; Reed, 2006; Richardson and Lanis, 2007; and Guenther et al., 2013). ZEC_{it} and PD_{it} exhibit negative and highly significant coefficients in several regressions (ZEC_{it} in models (3) and (4) and PD_{it} in model (6)). Nevertheless, these results should be interpreted with caution, as they lack robustness and might be driven by endogeneity.

In contrast, positive and significant correlations are found in the coefficients of ROA_{it}, LEV_{it}, and AGE_{it}. The coefficient of ROA_{it} is highly significant in all model specifications, suggesting a positive correlation between the profitability of a firm and its ETR (Gupta and Newberry, 1997; Harris and Feeny, 2003; Richardson and Lanis, 2007; Chen et al., 2010). Likewise, unexpectedly, the coefficient of LEV_{it} is positive and highly significant, except for models (3) and (4), suggesting that leveraged companies present greater average ETRs, providing support to studies from Harris and Feeny (2003) and Janssen (2005). Finally, the coefficient of AGE_{it} becomes positive and highly significant in all models except for the fixed-effects regressions (columns 1 and 2), indicating that older firms present higher ETRs (Kovermann and Wendt, 2019). The coefficient of the lagged dependent variable in models (5) and (6) is also positive and statistically significant, suggesting the strong persistence of ETR over time.

Robustness checks

We conduct several tests to ascertain the robustness of our empirical findings in addition to the alternative regression specifications provided in the previous table.

First, we build an alternative censored dependent variable with a minimum ETR of 0% for firms enjoying tax refunds that provide a negative numerator and a maximum ETR of 100% for firms with positive taxes and negative or zero pre-tax income or presenting a very small denominator (Gupta and Newberry, 1997; and Higgins et al., 2015). We run Tobit regressions, which provide better estimates for censored dependent variables. As can be noted from Table VII, model (1) shows the estimates of Equation (1), where MGL_{it} and TAD_{it} are the main effects and $MGL_{it} \times TAD_{it}$ is the interaction term. As expected, the coefficients of the main variables are negative and statistically significant, and the one corresponding to the interaction between group complexity and tax autonomy is positive and significant. The results from the Tobit regression resemble those from the previous table, thus enhancing the robustness of our original results and providing support for H1, H2 and H3.

<Insert Table VII here.>

Second, we build an alternative proxy of group complexity (GLY_{it}). This variable measures the natural logarithm of the number of layers that separate a company from the apex in the chain of ownership that links the two (Minzak and Zeng, 2020). We understand that complexity increases as this distance becomes greater. We re-estimate Equation (1) by replacing the variable MGL_{it} with this alternative proxy and applying the same three estimators used in Table VII. The results are presented in columns (2), (3) and (4) of Table VII, which includes the same control variables from our baseline models and controls for time fixed effects.

Table VII further shows the coefficients of the alternative variable, GLY_{it}, in models (2)-(4), which are negative and highly significant. Consistent with Minzak and Zeng (2020), this result reveals that the more distant a subsidiary is from the apex in the ownership structure of the group, the lower the ETR of the subsidiary. Therefore, hypothesis H1 is once again supported by this alternative measure of group complexity. The coefficient of TAD_{it} is negative and highly significant in models (3) and (4), thus supporting H2. Nevertheless, the coefficient of TAD_{it} loses its significance in the fixed-effects regression. However, as noted previously, TAD_{it} presents very little time variation, and fixed-effects regressions might provide biased coefficients. Likewise, in models (3) and (4), the interaction term

$GLY_{it} \times TAD_{it}$ shows the expected positive and statistically significant coefficient, confirming hypothesis H3.

Regarding the control variables, they provide similar results to those obtained in Table VI: 1) the most profitable companies present a greater average ETR; 2) firms that are intensive in capital and inventories tend to have lower ETRs; and 3) right-wing-oriented governments seem to favour a reduction in ETRs. When interpreting these results, it is worth remembering that in model (2), the coefficients of the PD_{it}, TAD_{it} and ZEC_{it} variables and the interaction term $GLY_{it} \times TAD_{it}$ are unreliable because they may be biased due to the reasons explained above.

Table VIII provides the results of the third robustness test. In this test, we increase our business group sample by softening the criteria to be considered a business group. More specifically, we redefine a business group as a collection of firms in which the shareholdings that comprise the chain of ownership between the apex and its subsidiaries are greater than 20% of voting rights (instead of the majority criteria stated in the original model). We apply our group identification algorithm with this new threshold for the 2007–2016 period and replicate all the multivariate analyses presented thus far. We exclude from these analyses firms that, when applying the algorithm, are found to belong to more than one business group. Based on this new group identification algorithm, we run alternative regression specifications. Model (1) shows the estimates for the fixed-effects (within) regression estimator; model (2) shows the estimates for random effects; and model (3) shows the estimates for the system GMM dynamic panel estimator. As can be noted from the table, we confirm H1, H2 and H3 and provide robustness to our original results by using an alternative business group definition that allows us to increase our sample.

<Insert Table VIII here.>

5. Conclusions, discussion, and future research

In this paper, we study the association between business group complexity, regional tax autonomy and tax avoidance using a sample of 53,006 group-affiliated Spanish firms and 150,334 firm-year observations from 2007 to 2016. The motivation for this analysis stems from the recurrent public debate on tax avoidance. Global regulators are concerned about corporate tax avoidance by business groups that use their complex corporate structures to globally shift profits to lower tax jurisdictions (Torslov et al., 2018). An example of this global concern is the ongoing debate among OECD world leaders on the possibility of a 15% minimum corporate tax rate. Analysing the factors that lead to tax avoidance seems to be highly relevant for regulators and policy makers.

In particular, we test three hypotheses: 1) firms affiliated with complex business groups avoid more taxes; 2) group-affiliated firms located in regions with tax autonomy bear a lower tax burden than those located in regions without such autonomy; and 3) the tax autonomy of a region moderates the negative relationship between the complexity of the business group and its ETR so that this negative effect is diluted in regions with tax autonomy.

Our results confirm the three proposed hypotheses. First, in line with Hsu and Liu (2018) and Minzak and Zeng (2020), we find that firms affiliated with complex business groups present lower ETRs. This result confirms that complex and opaque corporate groups may increase their tax avoidance activities. Complex groups' tax avoidance can be explained by the fact that it is more difficult to trace transactions between their affiliates (Desai and Dharmapala, 2006). Moreover, the ultimate owners of complex business structures suffer lower reputational risk when these activities are disclosed (Minzak and Zeng, 2020), and they tend to be more likely to engage in internal transactions that allow them to shift income between affiliates to reduce the overall tax burden (Dyreng and Lindsey, 2009).

Second, we find a negative and significant relationship between firms located in tax autonomous regions and their ETR. This result provides empirical support for tax competition theory, which states that tax autonomy gives rise to tax competition between regions that generates a horizontal externality by causing a "race to the bottom" in their tax burden (Hansson and Olofsdotter, 2005; Overesch and Rincke, 2011). Moreover, as Spanish regions with tax autonomy are smaller in relative size than the rest of Spain and are on the periphery of the country, our results are also in line with Bucovetsky (1991), Wilson (1991) and Vandenbussche et al. (2005).

Third, we find that regional tax autonomy moderates the negative relationship between the complexity of the business group to which the firm belongs, and the tax burden borne. While in regions without tax autonomy, we find that more complex corporate structures lead to higher tax avoidance activity, in regions with tax autonomy, this phenomenon disappears, and group complexity no longer influences the ETR. This result suggests that regions with tax autonomy have a lower tax burden than other regions, and as a result, the incentives for companies to engage in tax engineering activities that take advantage of the complexity and opacity of corporate structures to reduce tax payments are diminished. This result sheds some light on the lack of consensus in the literature on the relationship between tax burden and tax avoidance in corporate taxation. This conclusion seems to be in line with Joulfaian and Rider (1998), who argue that lowering the tax burden reduces the intensity of tax avoidance.

Overall, the findings reported in this paper contribute to the existing literature by providing empirical evidence that an increase in the tax burden may increase incentives for tax avoidance. Moreover, this paper is the first empirical study to test for a moderation effect of regional tax autonomy between group complexity and tax avoidance. In addition, we extend the literature on group complexity by providing the empirical case of Spain, which allows us to contrast the differences between autonomous regions in corporate taxation and centralized regions, which has not been a focus of previous works. Finally, we analyse the universe of group-affiliated firms in Spain, whereas most studies focus only on listed companies. In doing so, we provide a more accurate picture of the Spanish business network.

Our results may be of interest to regulators and tax agencies in charge of monitoring tax compliance, as they provide evidence that higher group complexity is associated with lower taxation, especially in regions without tax autonomy. Our findings invite an assessment of the adequacy of the corporate tax burden, as they suggest that an increased tax burden increases incentives for tax avoidance. Furthermore, an appropriate tax treatment of intragroup transactions may contribute to improving the efficiency of tax collection. Similarly, these results may benefit both investors in finding tax-efficient business groups and firms in improving their tax policies by taking better account of aspects such as the location of the firm in tax-friendly regions or the design of complex corporate structures. Moreover, our results are valuable for policy makers when defining a country's territorial financing model, as they indicate that regional tax autonomy may lead to internal tax competition between regions to attract business investment, which might generate a horizontal externality by triggering a "race to the bottom" in the tax burden.

Naturally, our study also has limitations. For instance, due to data unavailability or the difficulty of proxying some firm characteristics, we omit from our analysis some firm-specific and time-variant variables with potential explanatory power, such as the firm's corporate culture, the characteristics of its board of directors or remuneration policies, leading to unobserved heterogeneity. Moreover, we should recognize that some variables might suffer from reverse causality. For example, a corporate group might alter the complexity of its corporate structure or move to a tax autonomous region in search of more favourable corporate taxation. To address these concerns, we use the system GMM estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998), which addresses endogeneity using appropriate instruments and allows us to control for unobserved heterogeneity.

Finally, a reasonable extension of our work could focus on other countries that, as in the Spanish case, have regions or jurisdictions with tax autonomy to design and manage corporate taxation. In particular, it would be of interest to test the moderation effect of the tax autonomy of these regions on the relationship between the complexity of corporate groups and their tax avoidance activities. This would allow us to confirm whether the results of our study can be extended to other geographical areas. It would also be relevant for both regulators and academia to deepen the understanding of the mechanisms that make the complexity of business groups in regions with tax autonomy cease to influence the ETR.

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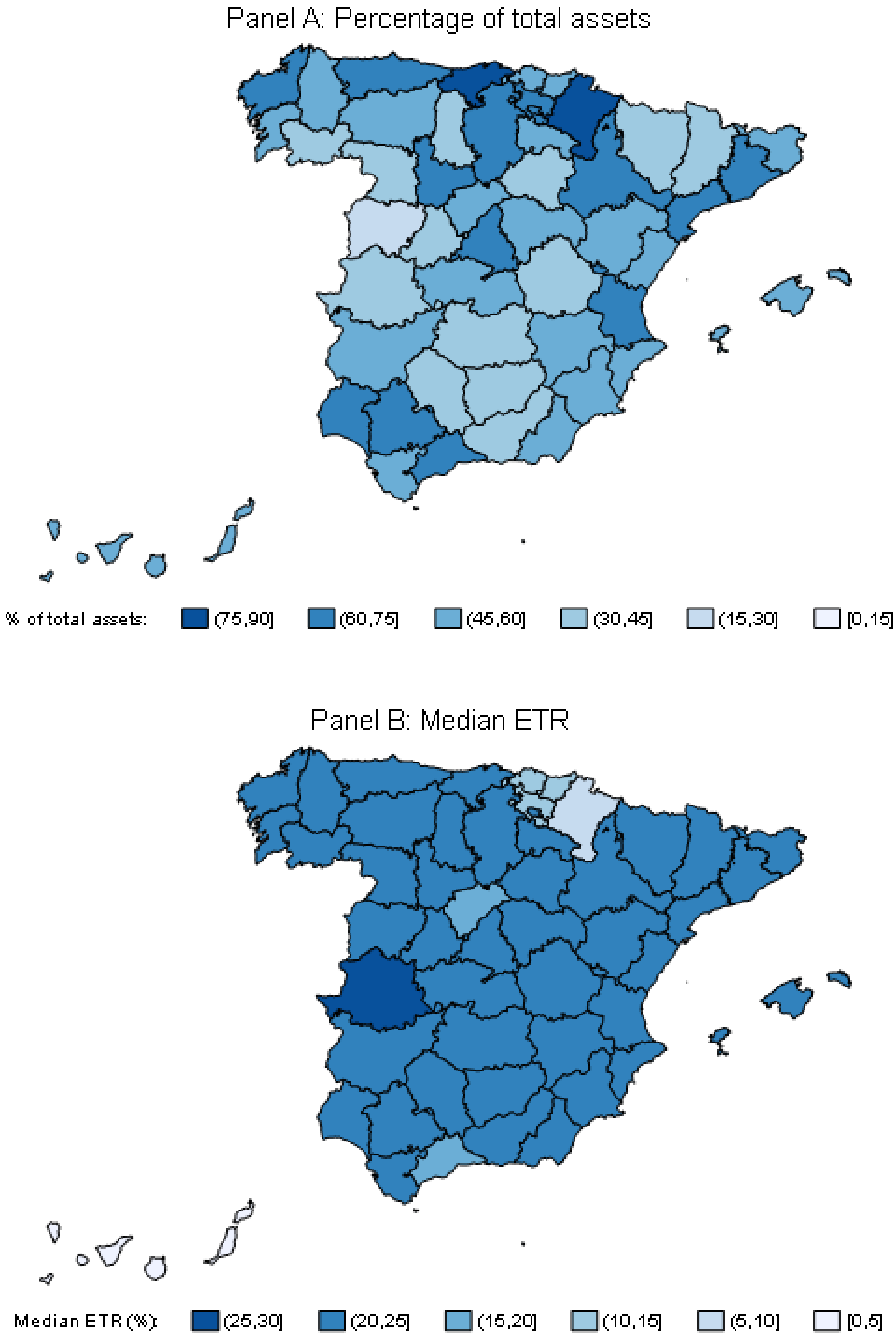
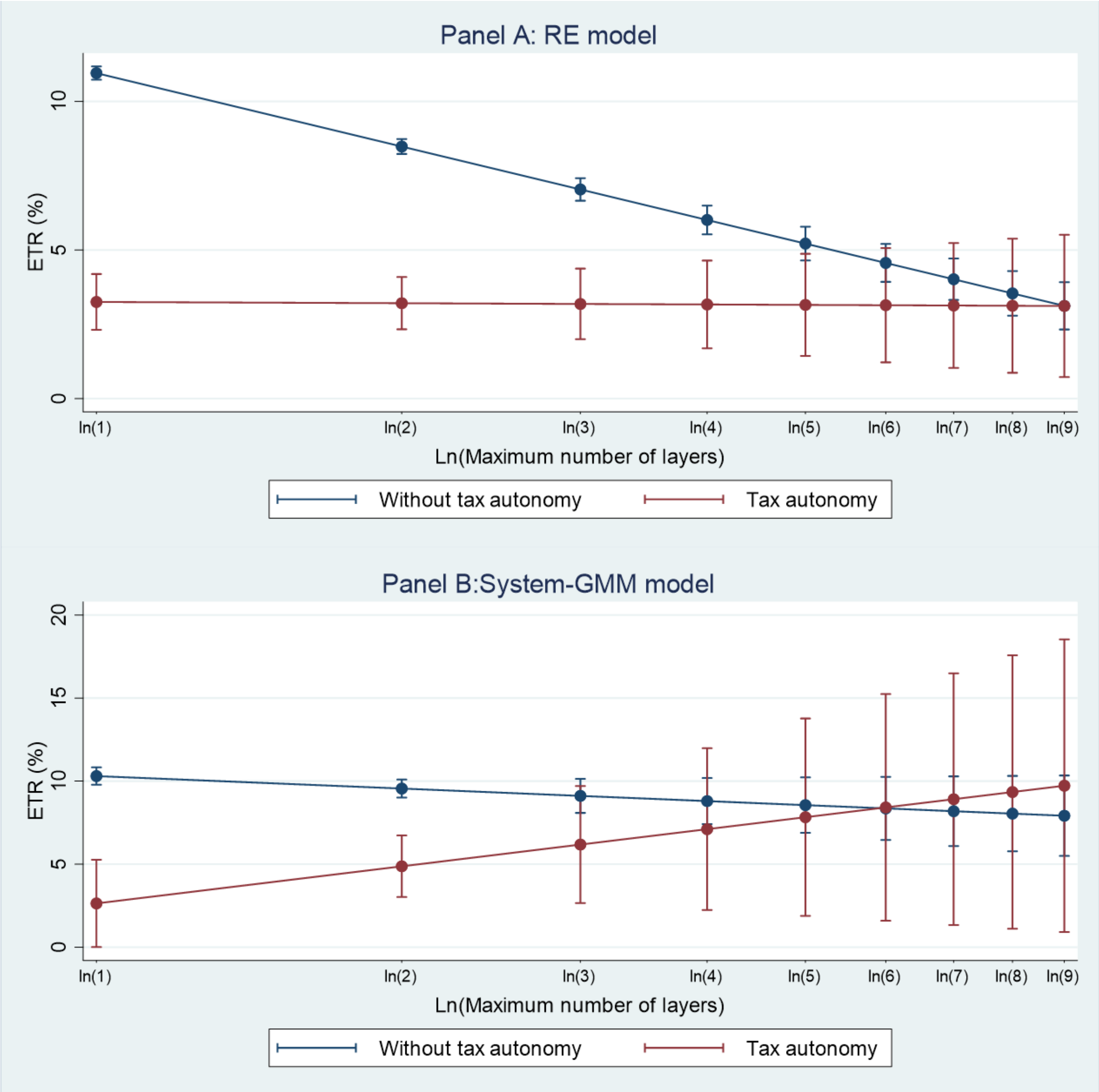
Figure 1: Percentage of total assets and median ETR of group-affiliated firms by Spanish provinces during the period 2007–2016



Note: This figure shows two choropleth maps for Spanish group-affiliated firms in each province in the period 2007–2016. Panel A shows the weight of group-affiliated firms over the province's business fabric according to their total assets. Panel B shows the median ETR of group-affiliated firms in each province. In both panels, darker colours correspond to higher values, while lighter colours represent lower values. Source: own elaboration based on SABI data.

Figure 2: Interaction plot of group complexity and tax autonomy



Note: This figure plots the interaction between group complexity and regional corporate tax autonomy. Group complexity is measured by the natural logarithm of the maximum number of layers in a business group. Panels A and B illustrate the interaction effects provided by the random-effects and system GMM regression models, respectively.

Table I: Observations by autonomous community

Autonomous community	Freq.	Percentage	Cum.
Andalucía	11,514	7.66	7.66
Aragón	5,301	3.53	11.19
Asturias	2,347	1.56	12.75
Canarias	4,652	3.09	15.84
Cantabria	1,277	0.85	16.69
Castilla y León	5,369	3.57	20.26
Castilla-La Mancha	3,163	2.10	22.37
Cataluña	39,695	26.40	48.77
Ceuta	55	0.04	48.81
Comunidad Valenciana	13,915	9.26	58.06
Comunidad de Madrid	32,952	21.92	79.98
Extremadura	1,300	0.86	80.85
Galicia	8,269	5.50	86.35
Islas Baleares	3,571	2.38	88.72
La Rioja	1,336	0.89	89.61
Melilla	68	0.05	89.66
Navarra	2,682	1.78	91.44
País Vasco	9,735	6.48	97.92
Región de Murcia	3,133	2.08	100.00
Total	150,334	100.00	

Note: This table shows the distribution of our sample of group-affiliated firms by Spanish regions.

Table II: Observations by year

Year	Freq.	Percentage	Cum.
2007	21,740	14.46	14.46
2008	33,566	22.33	36.79
2009	11,406	7.59	44.38
2010	11,605	7.72	52.10
2011	11,805	7.85	59.95
2012	11,225	7.47	67.41
2013	11,435	7.61	75.02
2014	12,218	8.13	83.15
2015	12,536	8.34	91.49
2016	12,798	8.51	100.00
Total	150,334	100.00	

Note: This table shows the distribution of our sample of group-affiliated firms by year.

Table III: Variable definitions

Variable	Symbol	Definition
Effective tax rate	ETR_{it}	This rate is defined as the total income tax expense divided by the pre-tax book income (Lanis and Richardson, 2012; Landry et al., 2013); winsorized p (0.01).
Maximum group layers	MGL_{it}	This variable is measured as the natural logarithm of the maximum number of layers between the apex and its subsidiaries in the business group to which a company belongs.
Number of layers	GLY_{it}	This variable is the natural logarithm of the number of layers that separate a company from its apex in the chain of ownership that links them together.
Tax autonomy dummy	TAD_{it}	This dummy variable equals 0 when the autonomous community of the firm applies the general Spanish corporate tax rules and 1 for regions with corporate tax autonomy (the Basque Country and Navarre) that may have different tax rules.
Ownership concentration	OC_{it}	This variable is the main shareholder's percentage of direct ownership in a company.
Size	$SIZE_{it}$	This variable is measured as the log of the total assets of a company.
ROA	ROA_{it}	This variable is the return on assets of a company; winsorized p (0.01).
Age	AGE_{it}	This variable is the age of a company based on when it was incorporated.
Public dummy	PD_{it}	This dummy variable equals 1 when a company is listed on the stock exchange and 0 otherwise.
Intangible asset intensity	$IINT_{it}$	This variable is the ratio of intangible assets to the total assets of a company.
Capital intensity	$CINT_{it}$	This variable is the ratio of fixed assets to the total assets of a company.
Inventory intensity	$SINT_{it}$	This variable is the ratio of inventory to the total assets of a company.
Leverage	LEV_{it}	This variable is the ratio of total liabilities to the total assets of a company; winsorized p (0.01).
Governing political party: left-wing or right-wing	LRW_{it}	This variable is a proxy for the political orientation of the governing political party (left-wing or right-wing) in regions with tax autonomy (the Basque Country and Navarre) and the rest of Spain. It equals 0 when the governing political party is considered left-wing and 1 when the governing political party is considered right-wing.
Canary Islands Special Zone	ZEC_{it}	This dummy variable equals 1 if a firm is located in the Canary Islands Special Zone and 0 otherwise.

Note: This table reports the variables used in the paper and their definitions.

Table IV: Descriptive statistics

	Mean	Median	Std. Dev.	Max	Min
ETR_{it}	9.34	22.48	30.94	89.46	-100.00
MGL_{it}	1.62	1.00	1.02	9.00	1.00
TAD_{it}	0.08	0.00	0.28	1.00	0.00
OC_{it}	91.72	100.00	15.54	100.00	0.01
$SIZE_{it}$	15.60	15.58	1.94	24.78	8.01
ROA_{it}	2.65	2.95	14.33	40.62	-62.39
AGE_{it}	19.48	16.00	14.82	161.00	1.00
PD_{it}	0.00	0.00	0.07	1.00	0.00
$IINT_{it}$	3.92	0.23	10.35	90.00	0.00
$CINT_{it}$	37.69	33.12	27.98	95.00	0.00
$SINT_{it}$	15.10	7.66	18.73	90.00	0.00
LEV_{it}	63.40	63.40	35.16	215.58	1.11
LRW_{it}	0.45	0.00	0.50	1.00	0.00
ZEC_{it}	0.03	0.00	0.17	1.00	0.00

Note: This table reports the descriptive statistics for the sample of group-affiliated firms. The MGL_{it} variable shows the descriptive statistics of the number of levels without applying the natural logarithm, and $SIZE_{it}$ is log transformed. See Table III for a description of the variables.

Table V: Pearson correlation results

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) ETR_{it}	1.00													
(2) MGL_{it}	-0.06*	1.00												
	(0.00)													
(3) TAD_{it}	-0.05*	0.05*	1.00											
	(0.00)	(0.00)												
(4) OC_{it}	-0.02*	0.00	-0.01*	1.00										
	(0.00)	(0.47)	(0.00)											
(5) $SIZE_{it}$	0.01*	0.27*	0.04*	0.00	1.00									
	(0.00)	(0.00)	(0.00)	(0.30)										
(6) ROA_{it}	0.39*	-0.01*	0.01*	-0.02*	0.12*	1.00								
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)									
(7) AGE_{it}	0.04*	0.07*	0.03*	-0.03*	0.31*	0.06*	1.00							
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)								
(8) PD_{it}	-0.02*	0.01*	-0.01*	-0.04*	0.04*	-0.01*	-0.01*	1.00						
	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)							
(9) $IINT_{it}$	-0.04*	0.06*	-0.02*	0.00	0.04*	-0.04*	-0.07*	-0.01*	1.00					
	(0.00)	(0.00)	(0.00)	(0.14)	(0.00)	(0.00)	(0.00)	(0.00)						
(10) $CINT_{it}$	-0.16*	0.10*	0.00	-0.03*	0.17*	-0.13*	0.03*	-0.05*	0.25*	1.00				
	(0.00)	(0.00)	(0.13)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)					
(11) $SINT_{it}$	-0.02*	-0.14*	0.00	-0.01*	0.02*	-0.04*	0.01*	-0.04*	-0.12*	-0.35*	1.00			
	(0.00)	(0.00)	(0.35)	(0.05)	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)				
(12) LEV_{it}	-0.14*	0.03*	-0.03*	0.04*	-0.09*	-0.35*	-0.17*	-0.09*	0.06*	-0.02*	0.10*	1.00		
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)			
(13) LRW_{it}	0.01*	-0.01*	0.20*	0.03*	0.11*	0.04*	0.14*	-0.04*	0.04*	0.06*	0.01*	-0.07*	1.00	
	(0.02)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		
(14) ZEC_{it}	-0.04*	0.02*	-0.05*	-0.02*	0.01*	-0.01*	-0.02*	-0.01*	-0.02*	0.07*	-0.02*	-0.04*	0.20*	1.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	

Note: This table reports pairwise correlations and their significance level (in parentheses) among the dependent, independent and control variables. MGL_{it} and $SIZE_{it}$ variables are log transformed. See Table III for a description of these variables.
* All correlation coefficients are significant at the 10% level or better.

Table VI: The ETR, business group complexity and regional tax autonomy

	(1) F.E.	(2) F.E.	(3) R.E.	(4) R.E.	(5) System GMM	(6) System GMM
Dep var	ETR_{it}	ETR_{it}	ETR_{it}	ETR_{it}	ETR_{it}	ETR_{it}
ETR_{it-1}					0.141***	0.142***
					(0.008)	(0.008)
MGL_{it}	-1.677***	-1.786***	-3.219***	-3.565***	-0.622*	-1.087*
	(0.408)	(0.422)	(0.198)	(0.207)	(0.363)	(0.659)
TAD_{it}	-5.155	-5.724	-6.319***	-7.700***	-6.073***	-7.667***
	(4.313)	(4.366)	(0.428)	(0.496)	(0.785)	(1.388)
MGL_{it*} TAD_{it}		1.069		3.503***		4.312*
		(1.508)		(0.668)		(2.615)
OC_{it}	-0.005	-0.005	-0.037***	-0.036***	0.018	0.012
	(0.015)	(0.015)	(0.006)	(0.006)	(0.039)	(0.038)
$SIZE_{it}$	-1.651***	-1.653***	-0.007	-0.009	-2.967***	-2.862***
	(0.318)	(0.318)	(0.054)	(0.054)	(0.418)	(0.413)
ROA_{it}	0.797***	0.797***	0.747***	0.748***	0.844***	0.843***
	(0.012)	(0.012)	(0.006)	(0.006)	(0.018)	(0.018)
AGE_{it}	-0.070	-0.069	0.056***	0.057***	0.370***	0.354***
	(0.105)	(0.105)	(0.007)	(0.007)	(0.072)	(0.067)
PD_{it}	7.870	7.858	-12.772***	-12.809***	-10.452	-11.535**
	(6.595)	(6.592)	(0.788)	(0.778)	(15.232)	(5.623)
$IINT_{it}$	0.014	0.014	-0.015	-0.014	-0.004	-0.004
	(0.022)	(0.022)	(0.011)	(0.011)	(0.063)	(0.063)
$CINT_{it}$	-0.154***	-0.154***	-0.135***	-0.135***	-0.253***	-0.252***
	(0.010)	(0.010)	(0.004)	(0.004)	(0.017)	(0.017)
$SINT_{it}$	-0.049***	-0.049***	-0.096***	-0.096***	-0.071***	-0.076***
	(0.014)	(0.014)	(0.005)	(0.005)	(0.023)	(0.023)
LEV_{it}	0.085***	0.085***	-0.002	-0.002	0.107***	0.107***
	(0.007)	(0.007)	(0.003)	(0.003)	(0.011)	(0.011)
LRW_{it}	-1.974***	-1.977***	0.038	-0.002	-1.918**	-1.781**
	(0.580)	(0.580)	(0.454)	(0.454)	(0.852)	(0.859)
ZEC_{it}	-13.806	-13.785	-5.943***	-5.896***	-0.511	-0.874
	(10.532)	(10.545)	(0.659)	(0.659)	(2.719)	(2.690)
Intercept	39.716***	39.790***	21.201***	21.301***	50.050***	49.463***
	(5.409)	(5.408)	(0.940)	(0.940)	(7.048)	(7.031)
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	150,334	150,334	150,334	150,334	102,523	102,523
R-squared	0.142	0.142	0.175	0.176	-	-

Note: This table reports the coefficients and robust standard errors (in parentheses) for six panel data models. The dependent variable in all regressions is the ETR. Columns (1) and (2) show the estimates for the fixed-effects (within) regression estimator; columns (3) and (4) show the estimates for random effects; and columns (5) and (6) show the estimates for the system GMM dynamic panel estimator using the two-step estimation procedure with finite-sample correction for the variance. All estimations control for year fixed effects. In columns (5) and (6), the number of observations drops when using the system GMM regression, as it requires information on all the variables of each firm for at least five consecutive years to test for the absence of second-order serial correlation. See Table III for a description of the variables.

***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.

Table VII: Robustness. Alternative dependent variable and group complexity measures

	Alternative dependent variable	Alternative group complexity measure		
	(1) Tobit	(2) F.E.	(3) R.E.	(4) System GMM
Dep var	Cens.ETR_{it}	ETR_{it}	ETR_{it}	ETR_{it}
ETR_{it-1}				0.142***
				(0.008)
MGL_{it}	-2.488***			
	(0.231)			
TAD_{it}	-6.303***	-6.001	-7.749***	-7.329***
	(0.523)	(4.439)	(0.479)	(1.183)
MGL_{it}*TAD_{it}	3.055***			
	(0.706)			
GLY_{it}		-2.157***	-2.991***	-2.414***
		(0.540)	(0.255)	(0.862)
GLY_{it}*TAD_{it}		2.293	5.310***	5.809*
		(1.964)	(0.818)	(3.164)
OC_{it}	-0.035***	-0.005	-0.036***	0.031
	(0.007)	(0.015)	(0.006)	(0.039)
$SIZE_{it}$	1.453***	-1.686***	-0.179***	-2.990***
	(0.063)	(0.318)	(0.053)	(0.429)
ROA_{it}	0.767***	0.797***	0.750***	0.846***
	(0.008)	(0.012)	(0.006)	(0.018)
AGE_{it}	0.056***	-0.061	0.055***	0.375***
	(0.008)	(0.105)	(0.007)	(0.072)
PD_{it}	-18.626***	7.540	-12.636***	-10.923
	(1.403)	(6.602)	(0.769)	(11.853)
$IINT_{it}$	0.033***	0.015	-0.016	0.007
	(0.010)	(0.022)	(0.011)	(0.063)
$CINT_{it}$	-0.121***	-0.155***	-0.136***	-0.256***
	(0.004)	(0.010)	(0.004)	(0.018)
$SINT_{it}$	-0.089***	-0.049***	-0.090***	-0.075***
	(0.006)	(0.014)	(0.005)	(0.023)
LEV_{it}	-0.002	0.085***	-0.002	0.107***
	(0.003)	(0.007)	(0.003)	(0.012)
LRW_{it}	-1.206***	-1.938***	0.098	-1.792**
	(0.448)	(0.581)	(0.454)	(0.870)
ZEC_{it}	-4.876***	-14.000	-6.055***	-1.006
	(0.699)	(10.515)	(0.661)	(2.683)
Intercept	-3.881***	39.945***	23.227***	49.429***
	(1.123)	(5.415)	(0.940)	(7.217)
Year F.E.	Yes	Yes	Yes	Yes
Observations	150,334	150,334	150,334	102,523
R-squared	-	0.142	0.174	-

Note: This table reports the coefficients and robust standard errors (in parentheses) for four panel data models. In column (1), we show the estimates for the Tobit model when the dependent variable is the ETR censored at a lower limit of 0 and an upper limit of 100%. The dependent variable in columns (2)-(4) is the ETR. Column (2) shows the estimates for the fixed-effects (within) regression estimator; column (3) shows the estimates for random effects; and column (4) shows the estimates for the system GMM dynamic panel estimator using the two-step estimation procedure with finite-sample correction for the variance. All estimations control for year fixed effects. In column (4), the number of observations drops when using the system GMM regression, as it requires information on all the variables of each firm for at least five consecutive years to test for the absence of second-order serial correlation. See Table III for a description of the variables.

***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.

Table VIII: Robustness. Business groups identified with the threshold of >20%

	(1) F.E.	(2) R.E.	(3) System GMM
Dep var	ETR_{it}	ETR_{it}	ETR_{it}
ETR_{it-1}			0.144***
			(0.007)
MGL_{it}	-0.816**	-2.673***	-0.822*
	(0.330)	(0.159)	(0.498)
TAD_{it}	-3.476	-7.747***	-7.758***
	(4.193)	(0.473)	(1.420)
$MGL_{it}*TAD_{it}$	0.944	2.534***	3.804*
	(1.291)	(0.560)	(2.281)
OC_{it}	-0.005	-0.022***	0.023
	(0.011)	(0.003)	(0.029)
$SIZE_{it}$	-1.792***	-0.032	-2.984***
	(0.295)	(0.050)	(0.398)
ROA_{it}	0.801***	0.749***	0.849***
	(0.011)	(0.005)	(0.017)
AGE_{it}	-0.020	0.062***	0.414***
	(0.081)	(0.007)	(0.094)
PD_{it}	3.894	-12.682***	-4.591
	(5.094)	(0.767)	(10.550)
$IINT_{it}$	0.016	-0.025**	0.027
	(0.019)	(0.010)	(0.060)
$CINT_{it}$	-0.153***	-0.133***	-0.247***
	(0.010)	(0.003)	(0.016)
$SINT_{it}$	-0.041***	-0.097***	-0.075***
	(0.013)	(0.004)	(0.022)
LEV_{it}	0.089***	0.001	0.108***
	(0.007)	(0.003)	(0.011)
LRW_{it}	-1.924***	-0.073	-1.431*
	(0.536)	(0.418)	(0.795)
ZEC_{it}	-10.284	-5.587***	-0.067
	(8.806)	(0.586)	(2.388)
Intercept	40.298***	20.127***	48.245***
	(4.863)	(0.755)	(6.139)
Year F.E.	Yes	Yes	Yes
Observations	178,647	178,647	118,779
R-squared	0.142	0.173	-

Note: This table reports the coefficients and robust standard errors (in parentheses) for three panel data models. The dependent variable in all regressions is the ETR. Column (1) shows the estimates for the fixed-effects (within) regression estimator; column (2) shows the estimates for random effects; and column (3) shows the estimates for the system GMM dynamic panel estimator using the two-step estimation procedure with finite-sample correction for the variance. All estimations control for year fixed effects. In column (3), the number of observations drops when using the system GMM regression, as it requires information on all the variables of each firm for at least five consecutive years to test for the absence of second-order serial correlation. See Table III for a description of the variables.

***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.

Notes

[1] http://www.oecd.org/tax/beps/

[2] The ultimate owners in complex group structures may be more inclined to engage in tax avoidance practices as their control rights and cash flow rights diverge. They may engage in unethical practices, such as tunnelling, to capture an entire amount of cash tax savings (Shleifer and Vishny, 1997; Bebchuk et al., 2000; Desai and Dharmapala, 2006; Malan et al., 2012). Tunnelling consists of shifting revenues, resources, and profits from the subsidiaries where the ultimate owner of the business group has less cash flow rights to the subsidiaries where the ultimate owner has more cash flow rights via commercial transactions between these subsidiaries (Johnson et al., 2000; Bertrand et al., 2002).

[3] For example, the existence of omitted variables with explanatory power, such as board characteristics, could lead to nonorthogonal errors and biased estimates.