Corporate Taxes as Determinants of Business Group Hierarchical Design Choice

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Abstract

This paper contributes to the theory of business group (BG) formation from two perspectives. This existing theory posits that BGs expand horizontally if the new affiliate's expected profitability is high and pyramidally (vertically) otherwise. We introduce taxes as a new determinant affecting the affiliates' position within the BG and the overall hierarchical design.

Using a sample of BGs in the OECD countries, our findings reveal that affiliates with higher effective tax rates (ETRs) are placed at more distant hierarchical layers from the controlling shareholder. This positioning prevents a substantial tax burden from impacting the economic rights that flow up from all affiliates, thus preserving the economic benefits of controlling shareholders. Additionally, while expanding pyramidally provides risk control benefits due to the limited liability of corporations, it incurs a fiscal cost. Taxes can diminish these pyramidal advantages because the income ascending through the pyramid is subject to taxation at each layer. Our analysis shows that as the average ETR paid by BG-affiliated firms increases, the BG hierarchy tends to become shallower.

1. Introduction

Business groups (BS) are a collection of legally independent companies operating under joint control and interconnected through a variety of persistent formal (e.g., ownership and interlocking directorates) or informal connections (e.g., family, kinship, friendship, religion, and language) (Aguilera et al., 2023). Given the global prevalence of BGs and their economic influence, comprehending their existence and formation is a pivotal research area for scholars. For example, two family-controlled business groups held a staggering 50% of the Swedish stock market in the XX century. BGs have been influential in the UK even though they are now rare, accounting for 2% of all listed firms. (Dau et al., 2021). The *keiretsu* and *zaibatsu* have been vital for corporate development in modern Japan (R. K. Morck & Nakamura, 2005). Internally, business groups are intricate structures. In India, for instance, BG-affiliated firms are also related through intra-group loans (Gopalan et al., 2007).

To the best of our knowledge, there is a limited understanding of the factors influencing the formation and evolution of BG structures. The primary theory we found is the theory of pyramidal ownership, which suggests that BGs expand horizontally when the expected profitability of a new affiliate is high and pyramidally otherwise (Almeida & Wolfenzon, 2006). This theory was tested and supported by analyzing Korean family business groups, or *chaebols* (Almeida et al., 2011). We extend this theory by replicating it with a broader multinational sample that includes different types of BG owners and by introducing a new determinant – taxes – that conditions both the affiliates' hierarchical position and the shape of BG structures.

Furthermore, drawing from institutional theory, BGs have been found to be substitutes for underperforming external markets in developing economies, such as underdeveloped financial markets (Belenzon & Berkovitz, 2010; Buchuk et al., 2014), but also arise in developed economies for risk control purposes. Risk control is achieved by combining the corporation's limited

liability with a pyramidal layout of affiliated firms. In countries with strongly limited liability (or weak enterprise liability), business groups compartmentalize risks by incorporating more affiliates (Belenzon et al., 2023). Limited liability is a legal invention that restricts passive investors' losses to only the amount invested in them, even if the corporation is found guilty of wrongdoing and its assets are insufficient to cover its liabilities (Belenzon et al., 2018). However, in some institutional contexts, enterprise liability applies (e.g., Germany), where shareholders can be held accountable for the actions of an affiliate (Belenzon et al., 2023). The more layers of firms between an affiliate and the controlling shareholder, the less likely it is that the affiliate's wrongdoing consequences reach the BG's controlling shareholder.

Nonetheless, adding layers comes at a cost, a fiscal cost, that remains unnoticed in previous literature. Each affiliate within every layer of the hierarchy gives up a proportion its earnings through taxes, even though its parent firm fully owns it. In this sense, the government metaphorically represents an unwanted minority shareholder from the perspective of the controlling shareholder. Consequently, adding more layers between the controlling shareholder and an affiliate can increase the overall tax burden paid by the BG, especially in high-taxing countries. For this reason, this paper aims to analyze whether BGs design their hierarchies to minimize the controlling shareholders' tax burden, contributing to the theory of pyramidal ownership (Almeida & Wolfenzon, 2006). We study how BGs balance the positive and negative effects of adding layers to their structure. Our findings provide evidence that affiliates with high effective tax rates (ETRs) are positioned hierarchically further away relative to the controlling shareholder compared to others with lower ETRs. The rationale behind this strategy is that placing the largest tax bite hierarchically distant protects the economic benefits that flow up toward the controlling shareholder from the tax bite. Additionally, we find that business groups that, on average, pay larger ETRs tend to present shallower structures, concentrating most of the affiliates at the upper layers of the hierarchy.

The subsequent sections of the paper are structured as follows: Section 2 reviews the existing literature and states the hypothesis. Section 3 explains our dataset and the key variables and provides descriptive statistics and econometric specifications. We provide robustness tests in Section 4, leading to the discussion and conclusions in Section 5.

2. Literature Review & Hypothesis Formation

Pyramidal structures allow controlling shareholders to exploit and exert control over all affiliates' resources without having to contribute a substantial capital investment (R. Morck et al., 2005). For example, suppose a shareholder (SH) invested $1 million in the past to finance its first affiliate. This investment provides SH with 51% of AFF's control rights. Now, suppose SH needs another $1 million to finance a new corporation (C). This is the amount that grants 51% control of firm C. The owner could directly invest $1 million and obtain the outstanding investment from minority shareholders. Nonetheless, SH could use AFF's retained earnings instead. By using AFF to finance C, only 51% of the $1 million needed ($510,000) comes from SH's investment, while AFF's minority shareholders provide the other 49%. Since the SH controls AFF by having 51% ownership and AFF controls the newly created or acquired C, SH controls C through AFF.

While the *raison d'être* of business groups has been widely explored, there remains a significant gap in understanding the intricacies of their structural design. These organizations can be structured horizontally (the largest shareholder is a person and controls several firms even though he or she might not fully own the affiliates), vertically, or pyramidally (various affiliate tiers separate one firm and the controlling shareholder), and in web form (where affiliates hold equity stakes in each other) (Dau et al., 2021). These hierarchies allow a

separation between control and economic rights, where the control rights of BGs' controlling shareholders typically exceed their economic rights.

Economic rights (ownership or cash flow rights) are the economic claims that controlling shareholders have in each affiliate. They dilute gradually when moving down the BG structure. Control is granted by ownership superiority. A parent firm can exert control by owning the total or just enough of the affiliate's ownership. Fastening control through BG structures benefits controlling shareholders with decision-making power over all affiliates, even though the separations between ownership and control or between the controlling shareholder and the affiliate's hierarchical position are significant (La Porta et al., 1999). Therefore, the design of the BG structure adds value for the controlling shareholders because they have access to a wide range of resources to be used either for tunneling or propping other affiliates (Cheung et al., 2006; Friedman et al., 2003).

This paper aims to expand our knowledge concerning the design choice of business group hierarchies. To the extent of our knowledge, only some scholars have analyzed this issue. From a transaction cost perspective, Almeida & Wolfenzon (2006) show that firm characteristics influence the position of the new entrant affiliate. *Chaebols* in Korea grow vertically if the new affiliate presents little potential cash flows or high investment requirements and horizontally otherwise. Therefore, controlling shareholders use BGs' internal resources to locate potential and higher-valued affiliates at the bottom of the hierarchy as long as the private benefits of control pay off (Almeida et al., 2011).

From an institutional perspective, younger and riskier firms tend to have more significant difficulties accessing external financial markets, leaving some projects underfinanced, especially where capital markets are weak. Masulis et al. (2011) show that BGs can use their organizational hierarchy to finance and prop up these affiliates, suggesting that for this reason,

younger and riskier affiliates can be found in lower tiers of the pyramid. Moreover, business groups grow vertically in environments with low investor protection since controlling shareholders can extract more private benefits at the expense of their minority shareholders (Masulis et al., 2011). However, in developed economies, adding layers to the BG hierarchy is beneficial, too. It limits the shareholders' risk to the investment provided in each affiliate, which dilutes down the pyramid (Belenzon et al., 2018). However, the economic rights the controlling shareholder receives from one affiliate come from its after-tax net income distribution. Hence, adding layers between one affiliate and the controlling shareholder implies surrendering a proportion of the affiliates' earnings through taxation. Therefore, every layer represents a tax burden that increases as per the business group's hierarchical depth, regardless of the controlling shareholder's total ownership.

As we will see below in the descriptive statistics (*Table 3*), affiliates within the same business group usually present different effective tax rates. This paper studies how the ETR firms pay in different countries, measured as income tax divided by earnings before taxes (EBT), influences the organizational position of BG affiliates. We expect that highly taxed affiliates will be placed at the bottom levels of the organizational structure to reduce the fiscal bite on other affiliates' income. Placing the affiliate with the highest ETR on top of the hierarchy would affect all affiliates' income, which would climb up towards the controlling shareholder. For this reason, we hypothesize that controlling shareholders have incentives to place highly taxed affiliates in a hierarchically distant position.

Hypothesis 1 (H1): The Effective Tax Rate is positively associated with hierarchical distance.

Furthermore, firms' limited liability can be used by controlling shareholders for risk control. Adding layers by using one affiliate's equity to finance a new acquisition or start-up typically prevents controlling shareholders from facing the financial responsibility of their affiliates (Belenzon et al., 2023). This strategy is worth it as long as the affiliates' income tax is low because the controlling shareholder gives up a proportion of the affiliates' income at every level. Therefore, we hypothesize that BGs that, on average, pay a low ETR will present deeper hierarchies because the liability protection and the private benefits of control offset the tax bite. Oppositely, if the *tax bite* is high and it exceeds the risk control advantage of growing pyramidally, we expect BGs to present a flatter structure.

Hypothesis 2. a (H2.a): BGs' maximum hierarchical depth measured in the number of layers of affiliated firms is inversely associated with the average Effective Tax Rate BGs pay.

Following the same idea, the fiscal cost should influence how the business group's structure grows when creating or acquiring new firms. Adding layers increases the BG's overall tax bite for highly taxed business groups. In this case, controlling shareholders may prefer adding affiliates horizontally instead of growing pyramidally when creating or acquiring new affiliates. This means that BGs will have a high proportion of affiliates at the first layers of the hierarchical structure over the total number of affiliated firms if the tax bite is high.

Hypothesis 2. b (H2.b): The Effective Tax Rate is positively associated with the proportion of affiliates BGs have in the first layer of the hierarchical structure.

3. Data and Methodology

This study uses accounting and ownership information from Bureau van Dijk's ORBIS database. We build a dataset consisting of panel data from 2017 to 2021. We restrict our sample so that we only work with OECD business groups. A business group is an OECD business group when its parent firm (APEX) is located in an OECD country, regardless of the location of the other affiliates. For example, if a business group has its headquarters in Spain and one affiliate in Andorra, this business group is still considered an OECD BG and included in our sample. Following these guidelines, we are left with a sample of 538,822 affiliated firms organized into 128,042 business groups, up to 17 hierarchical levels[1]. We use firms' ownership data and other fixed characteristics such as their geographic (country) and hierarchical (level) position. This data set will test *H1.b* since we do not need the firm's accounting information. After that, we trim this dataset further subject to the availability and quality of accounting information. For example, we select those business groups that present unconsolidated accounting information during the whole time window with no missing values. Therefore, we are left with 39,141 affiliated firms organized into 16,787 business groups up to 5 hierarchical levels to test *H1.a* and *H2*.

[Insert Table 1 over here]

[1] Our complete data comprises 1,061,425 affiliated firms organized into 262,860 business groups worldwide. When we apply the no-missing accounting data constraint, we are left with 48,376 affiliated firms organized into 20,646 business groups. Because this study draws from an institutional perspective, we restrict the data to OECD BGs to avoid significant differences in aspects such as economic development, political stability, or data transparency and availability, even though we always include country fixed effects in our models. While some countries outside the OECD present quite decent data, there are a few countries whose available observations are not numerous.

Appendix 1 shows the size and country distribution of our sample. First, roughly 2% of our sampled firms belong to state-owned business groups. Even though the proportion is relatively small, it represents 14,127 firms affiliated with a State BG, which we can use to conduct robustness tests. We argue that taxation should not affect the hierarchical structure of state-owned business groups. We assume governments have no preference for the source of their income, either through dividends or taxes. We already observe that the average level of state-owned business groups is greater than that for business groups of other owner types. This suggests that state-owned BGs allegedly have deeper hierarchies even though the difference between the average ETR is not so large.

3.1. Business Group Empirical Identification

We follow the same BG empirical identification methodology as (Aguilera et al., 2020; Belenzon et al., 2019; Masulis et al., 2011), which is depicted in *Figure 1*. To identify business groups, we employ specific variables for each firm, each shareholder's identifier, and the ownership structure of 9,683,174 firms (we consider all active firms in the ORBIS database). In the first stage, (1) we look at a firm and identify its largest shareholder. We must distinguish whether it is a person or another firm, too. (2) We recognize this shareholder as the controlling shareholder of the affiliated firm if at least one of the two following criteria are met: A) the firm is privately held, and the largest shareholder's stake in the firm is greater than 50%; B) the firm is publicly traded, and the largest shareholder's stake in the firm is at least 20%. If we identify a controlling shareholder and it is a corporation, we repeat the process for this other

corporation. Numerous studies investigating ownership structures have assumed that control can be attained through an ownership stake larger than 20% in public companies (La Porta et al., 1999; Masulis et al., 2011), although in the case of private companies, the ownership threshold is 50% (Belenzon et al., 2019). We consider the company a widely held firm if its largest shareholder does not meet one of these two ownership thresholds. (3) We stop escalating if the identified controlling shareholder is an individual or an institution not included in our database (e.g., a governmental institution). The last controlling shareholder found following this process is the BG controlling shareholder. If the controlling shareholder is a corporation and does not meet one of the mentioned criteria, we consider the parent firm as the BG controlling shareholder, which happens to be a widely held corporation.

[Insert *Figure 1* around here]

In this stage, we are able to depict the business groups and the location of each member firm in the organizational structure by levels. The *Level* measures the distance between one affiliated firm and the BG's controlling shareholder in terms of the number of affiliates between them. Right below the controlling shareholder, we have all firms that inject cash flows to the controlling shareholder. For example, below a level-1 firm, we identify the level-2 firms that provide cash flows to level-1 firms, simultaneously escalating the cash flows upwards to the parent firm and ultimately to the controlling shareholder.

3.2. Variables and Models

3.2.1. Dependent Variables

We aim to analyze whether and how effective tax rates influence the hierarchical position of affiliates and the hierarchical structure of business groups. To do this, we first use the variable *Level*, which represents an affiliate's hierarchical distance relative to the BG's controlling shareholder. The *Level* is our dependent variable for testing *Hypothesis 1*.

Our second dependent variable is the *Max Level*, which indicates the maximum depth of a BG's hierarchy. The *Max Level* is used to test *Hypothesis 2. a.* We then use the proportion of *Level*-1 firms in the business group (*L1 prop*) as a dependent variable to test *Hypothesis 12. b*.

3.2.2. Key Explanatory Variables

This study contributes to the theory of pyramidal ownership developed by Almeida & Wolfenzon, (2006), which posits that BG structures expand horizontally when high profitability is expected from a new affiliate and expand pyramidally (vertically) otherwise. We first test this theory by replicating the model presented by Almeida et al., (2011), hoping to achieve similar results. In their model, *Profitability* (measured as EBIT divided by assets) is estimated by regressing it against several variables: *Firm Age,* natural log of assets (*Ln assets*), *Public* (whether the affiliate is publicly traded), *Leverage*, and *Ultimate Ownership* (*Economic Rights*). The estimated profitability then serves as the key explanatory variable to determine the *Position* (*Level*) of the affiliate within the BG, along with the previous control variables. We also include the affiliates' *Tangibility* (measured as tangible assets divided by assets), following Almeida et al., (2011).

Secondly, we examine not only the *Level* of each affiliate within the hierarchy but also the hierarchical structure itself, addressing *Hypothesis H2.a*. The key explanatory variable used to analyze *Max Level* (the maximum depth of the BG) is the business group's mean effective tax rate (BG ETR). We calculate it as the average ETR of all affiliates within each group. To test *Hypothesis H2.b*, we regress the *L1 prop* against *ETR*.

Table 1 describes all the variables used in our models. *Table 2* and *Table 3* provide descriptive statistics for affiliate-level and BG-level variables, respectively, after constraining the sample

subject to the quality and availability of accounting data. *Appendix 1* details the variables and their calculations.

[Insert Table 1 over here]

[Insert Table 2 over here]

[Insert Table 3 over here]

Tax-related variables (*ETR* and *BG* ETR) have a mean of 22%. They are tightly clustered around their median values, suggesting relative consistency in *ETR* across observations. However, there is significant variation, as shown by the wide range between the maximum and minimum values. The standard deviation of the BG ETR averages 0.11, suggesting differences in ETRs among affiliates within the same group. Business groups have an average *Level* of 1.41, indicating relatively flat structures but with considerable variability, as evidenced by the standard deviation being close to the mean. Similarly, the average depth of BGs (*Max Level*) is 2.42, with a standard deviation of 2.

Economic Rights average 82%, with a median of 100%, indicating minimal separation between ownership and control. *EBIT on Assets* averages 8% and only 5% at the aggregated BG level. *Total Assets*, expressed in thousands of euros, average 46,551.12€, suggesting that the sample mainly consists of large affiliates, though it also includes smaller and medium-sized enterprises, given the wide range in asset values. *Table 3* shows that, on average, business groups have 28 affiliates diversified across eight sectors and four countries. Additionally, the average proportion of *Level*-1 and *Level*-2 affiliates are 43% and 23%, respectively, indicating that controlling shareholders maintain a significant proportion of affiliates hierarchically close to them.

Furthermore, we provide a correlation matrix for each variable level. *Table 4* shows that the effective tax rate (*ETR*) positively correlates with *Level*, which, at first glance, supports

Hypothesis H1. *Table 5* presents the correlation matrix of BG-level variables, revealing that *BG ETR* is negatively correlated with the hierarchical depth of the business group (*Max Level*), also favorable with *Hypothesis 2.a*. Moreover, large BGs, in terms of the number of affiliated firms, correlate negatively with the average ETR they pay. Additionally, we find that the proportion of *Level*-1 firms in a business group positively correlates with *BG ETR*, while the proportion of *Level*-2 firms does not. These findings suggest that if a BG pays a high average ETR, its structure tends to be flatter or, in other words, the *Max Level* tends to be smaller. These results support our *Hypothesis 2. b*.

[Insert Table 4 around here]

[Insert Table 5 around here]

3.3. Econometric Specifications

3.3.1. Pretests

The business group formation theory suggests that BGs expand horizontally if the new affiliate's expected profitability is high and pyramidally otherwise (Almeida et al., 2011). This theory was originally tested only with Korean family business groups. Our study aims to provide broader evidence for the BG formation theory by replicating these tests with a more diverse sample. To do this, *Profitability* is estimated and then regressed against *Level* as shown in equations 2 and 3.

$$
\begin{aligned}
Profitability_i \\
&= \alpha + \beta_1\, Firm\ Age_{i,t} + \beta_2 \ln (Assets)_{i,t} \\
&+ \beta_3\, Public_{i,t} + \beta_4\, Leverage_{i,t} \\
&+ \beta_5\, Economic\ Rights_{i,t} + Industry\ FE_i \\
&+ Country\ FE_i + Year\ FE_i + \varepsilon_{i,t}
\end{aligned} \tag{2}
$$

$$
\begin{aligned}
Level_i = \alpha + \beta_1\, \widehat{Prof}_{i,t} + \beta\ Controls + Industry\ FE_i \\
+ Country\ FE_i + Year\ FE_i + \varepsilon_{i,t}
\end{aligned} \tag{3}
$$

We are particularly interested in the coefficient of *Profitability* from Equation (3), which is previously estimated using Equation (2). The variables in Equation (2) include *Firm Age,* size (measured as *ln(Assets)*), the public status of the affiliate (*Public*), its *Leverage*, and *Economic Rights*. In both equations, *t* represents the time identifier (year), and *i* denotes the affiliate identifier. Industry-, country-, and year-fixed effects are also included in the models. To conduct these tests, our sample is further restricted to observations without missing values for any of the variables used in the original study by Almeida et al., (2011). However, the control variables in Equation (3) exclude the economic rights.

3.3.2. Hypothesis testing

We aim to enhance the business group formation theory by examining how taxes influence the hierarchical design of BGs. First, we predict an affiliate's hierarchical distance (*Level*) using

Equation (4) with a broader sample that includes all OECD business groups with available accounting data on income tax from 2017 to 2021.

$$Level_i = \alpha + \beta_1 ETR_{i,t} + \beta_2 EBIT\ on\ Assets_{i,t} + \beta_3 Economic\ Rights_i + \beta_4 Tangibility_{i,t} + \beta_5 Controls_{i,t} + FE + \varepsilon_{i,t} \quad (4)$$

In this model, we reintroduce *Economic Rights* as they reveal the controlling shareholders' economic claim from the affiliates. We replace the estimated profitability with *EBIT on Assets* to increase the number of observations. *Tangibility* is included because the nature of an affiliate's assets can affect its *Level* within the group; firms with more tangible assets often find it easier to secure external funding, as these assets can be used as debt collateral (Almeida et al., 2011). Finally, the controls used in Equation (4) are the same ones used in Equation (3).

Second, we examine the hierarchical depth of BGs (*Max Level*) using Equation (5), which employs the same controls as in Equation (4) but aggregates them at the BG level. For example, aggregated *EBIT on Assets* results from adding up the EBIT and the assets of all affiliates within one business group and dividing the total EBIT by the total assets. We hypothesize that business group diversification – measured by the number of firms, countries, and sectors – positively associates with *Max Level*, indicating deeper pyramidal structures. In Equation (5), *j* represents the business group identifier, and *N Affiliates, N Sectors,* and *N countries* are fixed distinctive characteristics of BGs. We expect the coefficient $\beta_1$to be negative, confirming *Hypothesis H1.a*.

$$Max\ Level_j = \alpha + \beta_1\ BG\ ETR_{j,t} + \beta_2\ N\ Affiliates_j + \beta_3\ N\ Sectors_j + \beta_4\ N\ Countries_j + \beta_5\ Aggregated\ Controls_{j,t} + FE + \varepsilon_{j,t} \quad (5)$$

Last, we explore the relationship between the proportion of *Level*-1 affiliates in a BG and the *BG ETR*. Since we focus on BG structure, additional accounting information is unnecessary beyond the *BG ETR*.

$$Prop\ L1_j = \alpha + \beta_1\ BG\ ETR_{j,t} + \beta_2\ Max\ Level_j + \beta_3\ Economic\ Rights_i + FE + \varepsilon_{j,t} \quad (6.1)$$

$$Agg\ Prop\ L2_j = \alpha + \beta_1\ BG\ ETR_{j,t} + \beta_2\ Max\ Level_j + \beta_3\ Economic\ Rights_i + \beta_4\ Prop\ L1_j + FE + \varepsilon_{j,t} \quad (6.2)$$

Our primary interest is in the coefficient β_1, which we expect to be positive, indicating that BGs with a higher average ETR tend to concentrate affiliates at the upper layers of the pyramid. When we use *Agg Prop L2* – the sum of *Prop L1* and *Prop L2* – as the dependent variable, we anticipate that β_1 will be negative or smaller than when *Prop L1* is the dependent variable. *Prop L1* is also included as a control variable in this second model.

4. Results

In *Table 6*, we replicate the model from Almeida et al., (2011) to predict the *Profitability* of affiliates, referred to here as the reference model. The results present eight specifications to test the robustness of their findings by varying some variables in each specification. The Firm Age and Public coefficients are negative but not statistically significant across all specifications. The coefficient for *Ln Assets* is positive and significant, indicating a small but positive effect on *Profitability*. In contrast, *Leverage* has a strong, negative, and significant impact on *Profitability*. *Economic Rights* show a positive and significant relationship with *Profitability* in all specifications where the variable is included (four in total). Specification (1) in *Table 6* provides the *Profitability* estimation using our sample, and the results are consistent with those of the reference model: *Firm Age* and *Public* are negative but statistically insignificant, *Ln Assets* positively affects *Profitability* slightly, and *Leverage* has a strong, negative, and significant effect. Similarly, the coefficient for *Economic Rights* remains positive and significant, reinforcing the findings of the reference model.

[Insert Table 6 around here]

In the reference model, *Economic Rights* are removed as a control variable, and the estimated profitability (referred to as *Profitability hat*) is introduced as an explanatory variable to predict an affiliate's position within the BG hierarchy. The coefficient for *Profitability hat* is negative and statistically significant, as shown in Specification (2), meeting the findings of the reference model. This coefficient remains negative and highly significant ($p < 0.01$) in Specification (3), when we add the *ETR* as the key explanatory variable. These findings suggest that higher

estimated profitability is associated with a lower hierarchical level (or greater hierarchical distance) within the BG, supporting the BG formation theory (Almeida & Wolfenzon, 2006). However, the positive and significant coefficient for *ETR* (0.139, $p < 0.05$) suggests that affiliates with higher tax burdens are positioned at lower layers within the BG, which aligns with our *Hypothesis (H1)*. We further test *Hypothesis (H1)* using Equation (4), where *Profitability hat* is replaced with *EBIT on Assets*. The results presented in *Table* 7 confirm the consistency with the previous findings. Specification (1) only tests the key explanatory variable (*ETR*) without controls or fixed effects. Then, we add the controls and the fixed effects in Specification (2) and Specification (3), respectively.

[Insert Table 7 around here]

Hypothesis H2.a and *Hypothesis H2.b* posit that taxation affects not only the affiliates' position but also the business group's overall hierarchical design. *Table 8* shows the determinants of a BG's hierarchical depth, as Equation (5) measures. The coefficient for *BG ETR* is negative and significant (-0.097, $p < 0.01$), indicating that higher tax burdens are associated with a shallower hierarchical structure. Additionally, BG diversification and *Leverage* are positively related to hierarchical depth. The results also show that deeper business groups tend to have more extensive assets but lower tangibility. This finding supports the idea that BGs use internal equity to finance affiliates that may struggle to secure external funding (Masulis et al., 2011). Overall, these findings confirm *Hypothesis H2.a*.

Table 9 shows the relationship between the average ETR paid by a business group and the proportion of *Level*-1 firms it has. The positive and significant coefficient for *BG ETR* (0.095, $p < 0.01$) supports *Hypothesis 2. b*, keeping up with the idea that BGs with a higher tax burden

tend to have shallower hierarchical structures. In Specifications (2) and (3), where the dependent variable is *Agg Prop L2* (the sum of *Prop L1* and *Prop L2*), both coefficients are positive and statistically significant, reinforcing our earlier conclusions. In Specification (3), however, we include *Prop L1* as a control variable to isolate the effect on the proportion of affiliates in the second layer of the hierarchy. The coefficient for *BG ETR* in this model is significantly lower than in Specification (1), indicating that the impact of *BG ETR* on the proportion of *Level*-1 affiliates is more pronounced than on the proportion of *Level*-2 affiliates.

We apply the same methodology in Specification (4) and Specification (5), using *Agg Prop L3* as the dependent variable. The results show that the coefficients for *BG ETR* continue to decrease, further demonstrating that the tax burden has a diminishing impact on the business group hierarchical design.

[Insert Table 9 around here]

5. Robustness Tests

We conduct various tests to ensure the selected sample does not influence our analysis. *Table 10* shows the regression from Equation (4) with specific nuances in each specification. If a BG consists only of one APEX (parent) firm and one affiliate, our identification strategy identifies a link and determines that these belong to one BG. A BG with only two affiliates will not entail much variability. For this reason, Specification (1) shows the results of running Equation (4) with BGs with more than two affiliates. We expect that state-owned business groups do not care so much about taxation when designing BG hierarchical structures. The government will eventually harvest its income either through taxes or through dividends. We run the model only

with state-owned BGs and show the results in Specification (2). As expected, ETR does not affect the affiliates' position within the hierarchy. Specification (3) and Specification (4) show the results for non-state BGs and our whole sample regardless of the owner type and country (non-OECD business groups are also included), respectively, and the coefficients agree with those from the original model. However, in Specification (5), we run our regression only with non-OECD BGs, and the coefficient is not statistically significant. The various institutional contexts outside the OECD countries allegedly explain this, but further research is required.

[Insert Table 10 around here]

6. Conclusions & Discussion

This study extends the existing theory of pyramidal ownership (Almeida & Wolfenzon, 2006) by exploring the impact of taxation on the hierarchical structure of business groups. Building upon the theory of pyramidal ownership, which posits that BGs expand horizontally when the expected profitability of a new affiliate is high and expand vertically otherwise, we offer new insights by incorporating the role of taxes into this framework. Our findings reveal several critical patterns in the organizational design of BGs. First, this paper demonstrates that effective tax rates play a significant role in determining affiliates' hierarchical position (Level) within BGs. Affiliates with higher ETRs are more likely to be positioned further down the hierarchy, distancing them from the controlling shareholder. This strategic positioning is likely employed to mitigate the overall tax burden on the controlling shareholders, preserving the economic benefits flowing up the corporate structure.

Our results also suggest that BGs adopt flatter hierarchical structures in high-tax environments. Our analysis shows that BGs with higher average ETRs have fewer hierarchical layers, concentrating their affiliates closer to the top. This structural choice appears to be a strategy to reduce the cumulative tax impact, as governments function similarly to minority shareholders, absorbing a portion of the earnings that could otherwise accrue to the controlling shareholders.

Our replication of (Almeida & Wolfenzon, 2006) model with a broader, multinational sample supports the original theory of pyramidal ownership. Higher estimated profitability is associated with shorter hierarchical distance within the BG, confirming the theory's applicability across different contexts and ownership types. Furthermore, introducing taxation as an additional factor demonstrates how BGs might adjust their structures in response to tax considerations, further enhancing the theory's explanatory power.

The findings suggest that BGs strategically use their hierarchical design to optimize tax liabilities, particularly in high-tax countries. This behavior has important implications for policymakers aiming to understand corporate tax strategies and their impact on organizational design. Future regulatory frameworks could consider these strategic responses to taxes to ensure fair and effective tax policies.

While this study broadens the understanding of BG formation and evolution by incorporating tax considerations, future research could explore other determinants, such as regulatory environments. Additionally, further studies could provide deeper insights into how BGs dynamically adjust their structures in response to changing tax regimes and economic conditions. For this reason, being able to explain and predict the ETR of a new entrant affiliate is vital when deciding its positioning within the BG structure and its acquisition or creation methodology.

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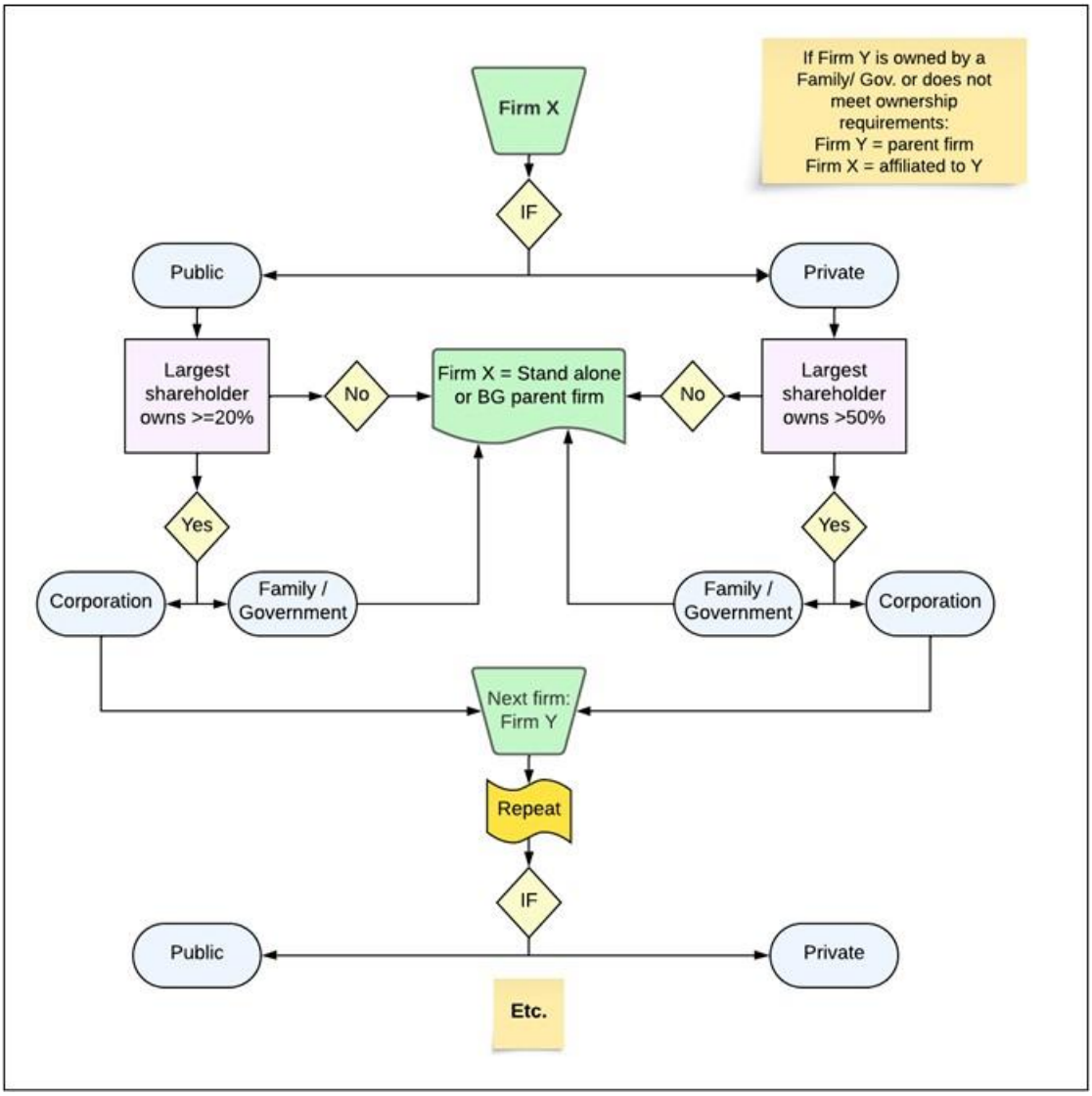
Figure 1. Business Group Identification Strategy



In the first step (1), we look at one firm (*Firm X*) and determine whether it is a publicly listed or privately held company. We identify the largest ownership stake in the second step (2). Private firms' largest shareholder needs more than 50% of the equity to exert full control. In public firms, the largest shareholder must own at least 20% of the equity. If the ownership stake is large enough to grant the largest shareholder absolute control of the firm, we move to the third step. Conversely, we deem *Firm X* a widely held stand-alone or BG's parent firm. In the third step (3), we identify the largest and controlling shareholder's nature: corporation, family member, or government. If the controlling shareholder is a family member or a government, then we stop. Otherwise, if the controlling shareholder is another firm, we begin the whole process again: (1) determining whether it is public or private, (2) identifying the largest ownership stake, etc.

Table 1. Variable Names and Descriptions.

ETR	Effective tax rate calculated as the income tax divided by earnings before taxes.
BG ETR	The average of the ETR of all affiliates within one business group.
BG ETR sd	The standard deviation of the ETR of all affiliates within one business group.
Level	The hierarchical position of each affiliate within the business group structure.
Level (μ)	A business group average level, averaging the level of all its affiliates.
Max Level	A business group's maximum distance between the controlling shareholder and the hierarchically furthest affiliate in terms of number of affiliates between them.
Economic Rights	The controlling shareholder's economic claim from each affiliate resulting from multiplying a chain of ownership percentages.
N Affiliates	The total number of affiliates a business group has got including the APEX.
N Sectors	The total number of sector a business group has presence in. We classify industries by the first digit of the Nomenclature of Economic Activities (NACE).
N Countries	The total number of countries a business group has presence in.
Total Assets	Book value of an affiliates total assets.
EBIT on Assets	A profitability proxy resulting from dividing earnings before interests and taxes by total assets.
Tangibility	A proxy of business strategy resulting from dividing the book value of tangible assets by the total asset value.
Prop L1	The proportion of affiliates at Level 1 in each business group.
Prop L2	The proportion of affiliates at Level 2 in each business group.

Table 2. Descriptive Statistics of Affiliate-Level Variables.

Variable	Mean	p50	SD	Min	Max
ETR	0.22	0.22	0.15	0.00	1.00
Level	1.55	1.00	1.41	0.00	17.00
Economic Rights	0.82	1.00	0.24	0.01	1.00
EBIT on Assets	0.08	0.05	0.14	-0.55	0.60
Total Assets	46,551.12	7,738.30	158,080.18	23.17	1,335,085.86
Tangibility	0.21	0.08	0.28	0.00	0.99
Leverage	0.18	0.06	0.25	0.00	1.25

Table 3. Descriptive Statistics of BG-Level Variables.

Variable	Mean	p50	SD	Min	Max
BG ETR	0.22	0.21	0.11	-0.02	0.49
BG ETR sd	0.11	0.11	0.09	0.00	0.36
Level (μ)	1.41	1.00	1.15	0.00	10.82
Max Level	2.42	2.00	2.01	1.00	17.00
N Affiliates	27.79	6.00	71.12	2.00	860.00
N Sectors	8.09	4.00	12.85	1.00	122.00
N Countries	3.84	1.00	6.47	0.00	57.00
BG EBIT on Assets	0.05	0.03	0.07	-0.16	0.36
BG Total Assets	5,951,417.96	68,602.62	27797989.11	0.00	201794912.00
BG Tangibility	0.16	0.08	0.19	0.00	0.91
BG Leverage	0.18	0.12	0.19	0.00	0.98
Prop. L1 Affiliates	0.43	0.42	0.30	0.00	1.00
Prop. L2 Affiliates	0.23	0.18	0.23	0.00	1.00

Table 4. Correlation Matrix of Variables at the Affiliate Level

Variables	ETR	Level	Economic Rights	EBIT on Assets	Total Assets	Tangibility	Leverage
ETR	1.000						
Level	0.101***	1.000					
Economic Rights	-0.062***	-0.065***	1.000				
EBIT on Assets	0.113***	0.147***	-0.010***	1.000			
Total Assets	-0.040***	-0.060***	0.043***	-0.037***	1.000		
Tangibility	0.058***	0.166***	0.026***	-0.065***	-0.059***	1.000	
Leverage	-0.011***	0.050***	0.028***	-0.187***	0.000	0.369***	1.000

*** p<0.01, ** p<0.05, * p<0.1*

Table 5. Correlation Matrix of Variables at the BG Level

Variables	BG ETR	BG ETR SD	Max Level	N Affiliates	N Sectors	N countries	BG EBIT on Assets	BG Total Assets	BG Tangibility	BG Leverage	Prop L1	Prop L2
BG ETR	1.000											
BG ETR SD	0.081***	1.000										
Max Level	-0.044***	0.063***	1.000									
N Affiliates	-0.026***	0.050***	0.457***	1.000								
N Sectors	0.001	0.130***	0.347***	0.476***	1.000							
N Countries	0.010***	0.013***	0.048***	0.076***	0.142***	1.000						
BG EBIT on Assets	0.125***	-0.052***	-0.058***	-0.055***	-0.051***	0.112***	1.000					
BG Total Assets	0.031***	0.019***	0.015***	0.018***	0.000	-0.058***	-0.025***	1.000				
BG Tangibility	0.006**	-0.008***	-0.031***	-0.027***	-0.032***	0.003	-0.085***	-0.037***	1.000			
BG Leverage	-0.051***	-0.005**	0.051***	0.074***	-0.039***	-0.022***	-0.196***	-0.031***	0.414***	1.000		
Prop L1	0.009***	0.029***	-0.439***	0.254***	0.255***	0.035***	-0.011***	0.067***	0.003	-0.009***	1.000	
Prop L2	-0.037***	0.057***	0.869***	0.519***	0.302***	0.038***	-0.054***	0.019***	-0.029***	0.064***	-0.505***	1.000

*** p<0.01, ** p<0.05, * p<0.1*

Table 6. Replication of the Reference Model, adding ETR

	(1) EBIT on Assets	(2) Level	(3) Level
ETR			0.144**
			(0.060)
Profitability hat		-29.705***	-29.780***
		(1.687)	(1.687)
Firm Age	-0.000	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)
Ln Assets	-0.009***	-0.268***	-0.267***
	(0.001)	(0.017)	(0.017)
Public	-0.015***	-0.498***	-0.499***
	(0.004)	(0.057)	(0.057)
Leverage	-0.123***	-3.770***	-3.778***
	(0.006)	(0.217)	(0.217)
Economic Rights	0.025***		
	(0.004)		
cons	0.199***	9.831***	9.809***
	(0.019)	(0.419)	(0.419)
Observations	11322	11322	11322
R-squared	0.086	0.139	0.139
Adj R^2	0.082	0.135	0.136
Industry FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

Table 7. Determinants of an Affiliate's Hierarchical Position within the Business Group

	(1) Level	(2) Level	(3) Level
ETR	0.134***	0.107***	0.099***
	(0.005)	(0.005)	(0.005)
Economic Rights		-0.162***	-0.175***
		(0.007)	(0.007)
EBIT on Assets		0.495***	0.419***
		(0.011)	(0.011)
Ln Assets		-0.051***	-0.060***
		(0.001)	(0.001)
Leverage		0.055***	0.145***
		(0.006)	(0.006)
Tangibility		0.267***	0.299***
		(0.005)	(0.005)
cons	0.769***	1.234***	0.900***
	(0.002)	(0.010)	(0.034)
Observations	144337	144337	142697
R-squared	0.004	0.063	0.134
Adj R^2	0.004	0.063	0.133
Industry FE	No	No	Yes
Country FE	No	No	Yes
Year FE	No	No	Yes
Sample	Tax Full	Tax Full	Tax Full

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

Table 8. Determinants of a Business Group Hierarchical Depth

	(1) Max Level	(2) Max Level	(3) Max Level
BG ETR	-0.133***	-0.109***	-0.097***
	(0.007)	(0.006)	(0.006)
N Countries		0.005***	0.012***
		(0.002)	(0.002)
N Sectors		0.065***	0.069***
		(0.001)	(0.001)
N Affiliates		0.074***	0.071***
		(0.001)	(0.001)
Ln BG Assets		0.021***	0.023***
		(0.001)	(0.001)
BG EBIT on Assets		-0.015	-0.012
		(0.010)	(0.010)
BG Leverage		0.069***	0.038***
		(0.004)	(0.004)
BG Tangibility		-0.043***	-0.045***
		(0.004)	(0.004)
_cons	1.124***	0.577***	0.452***
	(0.002)	(0.006)	(0.019)
Observations	186263	186226	184068
R-squared	0.002	0.240	0.248
Adj R^2	0.002	0.240	0.247
Fixed Effects	No	No	Yes
Sample	Tax Full	Tax Full	Tax Full

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

Table 9. Determinants of the Proportion of Level-1 Firms within a BG

	(1) Prop L1	(2) Agg Prop L2	(3) Agg Prop L2	(4) Agg Prop L3	(5) Agg Prop L3
BG ETR	0.095***	0.088***	0.061***	0.079***	0.032***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.001)
Max Level	-0.081***	-0.074***	-0.051***	-0.054***	-0.015***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Economic Rights	0.037***	0.031***	0.021***	0.014***	-0.002***
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Prop L1			0.289***		0.551***
			(0.001)		(0.001)
Prop L2					0.799***
					(0.001)
_cons	0.668***	0.864***	0.671***	0.920***	0.395***
	(0.006)	(0.005)	(0.004)	(0.005)	(0.003)
Observations	281723	281723	281723	281723	281723
R-squared	0.554	0.593	0.644	0.439	0.761
Adj R^2	0.553	0.593	0.644	0.439	0.761
Fixed Effects	Yes	Yes	Yes	Yes	Yes
Sample	OECD	OECD	OECD	OECD	OECD
Structure	Affi>2	Affi>2	Affi>2	Affi>2	Affi>2

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

Table 10. Robstness Test of the Hypothesis 1 on the Relationship between ETR and Level

	(1) Level	(2) Level	(3) Level	(4) Level	(5) Level
ETR	0.094***	-0.036	0.100***	0.089***	0.016
	(0.009)	(0.046)	(0.005)	(0.005)	(0.012)
Economic Rights	-0.351***	-0.611***	-0.174***	-0.213***	-0.424***
	(0.012)	(0.080)	(0.007)	(0.006)	(0.016)
EBIT on Assets	0.305***	0.221**	0.420***	0.302***	-0.021
	(0.019)	(0.112)	(0.011)	(0.009)	(0.017)
Ln Total Assets	-0.058***	-0.168***	-0.059***	-0.068***	-0.083***
	(0.002)	(0.009)	(0.001)	(0.001)	(0.002)
Leverage	0.094***	0.183***	0.146***	0.121***	0.025**
	(0.010)	(0.053)	(0.006)	(0.005)	(0.011)
Tangibility	0.308***	0.197***	0.300***	0.283***	0.182***
	(0.008)	(0.046)	(0.005)	(0.004)	(0.011)
_cons	1.092***	2.673***	0.888***	1.315***	1.862***
	(0.088)	(0.276)	(0.034)	(0.160)	(0.167)
Observations	50951	1041	141656	173437	30740
R-squared	0.125	0.418	0.133	0.124	0.132
Adj R^2	0.124	0.397	0.132	0.123	0.131
Fixed Effects	Yes	Yes	Yes	Yes	Yes
Sample	Tax Full	Tax Full	Tax Full	Tax Full	Tax Full
Condition	N Affi>2	State BG	NonState BG	All	Non OECD

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

Appendix 1. Variable Names and Descriptions.

OECD Business Groups						
	Non-State BG			State BG		
	N	Level (μ)	ETR (μ)	*N*	Level (μ)	ETR (μ)
Andorra	1	1.000				
United Arab Emirates	4	2.250				
Albania	27	1.481		2	3.500	
Armenia	2	1.500				
Austria	17,591	1.163	0.269	734	1.891	0.309
Australia	10,035	1.261	0.091	90	2.556	0.218
Azerbaijan	3	1.667				
Bosnia and Herzegovina	233	2.365	0.202	8	2.000	0.322
Bangladesh	5	2.400		1	3.000	
Belgium	11,921	1.300	0.251	185	2.303	0.214
Bulgaria	1,245	2.088	0.201	31	2.742	0.320
Bahrain	1	5.000				
Belarus	1	2.000				
Switzerland	422	0.775	0.434	45	0.600	0.199
China	8,027	1.968	0.271	66	2.818	0.320
Cyprus	199	1.915	0.312	4	3.000	0.322
Czech Republic	9,058	1.311	0.216	177	1.921	0.297
Germany	65,281	1.207	0.278	3,178	1.175	0.368
Denmark	15,070	1.200	0.163	458	1.321	0.195
Estonia	2,802	1.197	0.103	43	1.419	0.486
Spain	42,353	1.328	0.237	387	2.235	0.241
Finland	9,316	1.317	0.160	530	1.153	0.227
Fiji	2	2.000				
France	68,918	1.397	0.179	1,228	2.652	0.313
United Kingdom	107,440	1.467	0.293	669	2.466	0.318
Georgia	18	1.611		2	3.000	0.320
Greece	2,054	1.181	0.219	48	2.292	0.320
Croatia	618	2.228	0.257	11	2.273	0.321
Hungary	3,572	1.250	0.148	133	1.180	0.094
Indonesia	110	1.709	0.259	2	1.500	.
Ireland	12,342	1.289	0.300	110	2.100	0.320
Israel	337	0.656	0.249	1	0.000	.
India	2,532	1.984	0.310	49	2.878	0.320
Iraq	1	3.000	.			
Iceland	1,217	0.993	0.205			
Italy	61,186	1.071	0.257	962	1.664	0.287
Jordan	1	4.000				
Japan	11,665	0.911	0.258	229	1.659	
Kyrgyzstan	1	1.000				
Cambodia	7	1.714				
South Korea	7,320	0.914	0.289	45	1.311	0.223

OECD Business Groups (continued)						
	Non-State BG			State BG		
	N	Level (μ)	ETR (μ)	*N*	Level (μ)	ETR (μ)
Kuwait	1	8.000				
Kazakhstan	32	1.719		4	3.750	
Laos	1	1.000	0.000			
Lebanon	5	1.800	0.251			
Liechtenstein	9	2.778				
Sri Lanka	6	2.167				
Lithuania	1,513	1.321	0.187	41	1.024	0.197
Luxembourg	18,788	1.361	0.325	122	1.721	0.329
Latvia	1,791	1.250	0.178	57	1.333	0.289
Monaco	9	1.778				
Moldova	84	1.810	0.339	2	3.000	
Montenegro	52	2.269	0.120	5	2.000	0.280
Marshall Islands	2	1.000				
North Macedonia	105	2.200	0.192	10	3.500	0.321
Malta	561	2.535	0.215	1	2.000	
Malaysia	1,508	2.114	0.231	30	3.267	0.320
Netherlands	51,106	1.329	0.270	433	1.861	0.413
Norway	31,159	1.313	0.161	1,085	1.265	0.189
Nepal	1	2.000	0.486			
New Zealand	1,235	1.738	0.163	13	1.000	
Oman	2	3.500				
Papua New Guinea	5	1.000	0.000			
Philippines	462	1.567	0.295	12	2.750	0.320
Pakistan	32	2.250	0.399			
Poland	15,790	1.499	0.214	835	1.250	0.187
Portugal	10,663	1.373	0.213	106	1.689	0.354
Romania	3,337	1.977	0.205	58	2.828	0.206
Serbia	1,049	2.088	0.196	16	2.250	0.322
Russia	1,177	2.059	0.230	25	2.640	0.176
Saudi Arabia	5	1.800				
Sweden	21,551	2.033	0.140	1,552	1.547	0.280
Singapore	5,012	2.076	0.242	62	2.839	0.320
Slovenia	1,587	1.249	0.181	88	1.216	0.318
Slovakia	2,704	1.461	0.232	58	1.483	0.320
Thailand	1,685	1.729	0.231	22	3.591	0.320
Turkey	2,298	1.147	0.217	36	1.667	0.320
Ukraine	655	2.169	0.303	20	2.800	0.239
Uzbekistan	3	1.000	0.486			
Vietnam	899	1.690	0.239	6	3.500	0.320
Total	649,822	1.357	0.222	14,127	1.657	0.268