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The Tightness of Country-specific Income Shifting Regulation and Multinationals' Transfer Pricing

An empirical study of European multinational corporations and their majority-owned affiliates worldwide

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Abstract

The main objective of this study is to analyze the profit shifting behavior of European multinational companies and their worldwide web of majority-owned affiliates. Consequently, we test the effect when income shifting not only depends on differences in statutory corporate income tax rates, but also considers differences in costs of shifting income from or to a specific country. The study focuses on transfer pricing through intangible goods such as royalty payments and intermediate goods. The model specification used is based on the working paper by Hopland, Lisowsky, Mardan and Schindler (2018) that presents an extension of the Huizinga and Laeven's (2008) C-measure. Predictions of the model forms the basis of our research question, which is tested on a sample of European multinational firms and their majority-owned affiliates all over the world, obtained from the firm-level Orbis database. When adjusting the weighted tax differential for the strictness of regulation in a country where a European multinational firm owns a productive affiliate; we find no significant relationship with the dependent variable EBITDA. Thus, implying that, in our model, the multinationals' profit shifting behavior is not incentivized by differences in tax regulation between the locations of which it owns affiliates.

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1. Introduction

Corporate income taxation of European multinationals continues to puzzle academics and policymakers as it tackles the underlying policy issues of tax efficiency and tax equity (Dyreng & Maydew, 2017). By using differences in tax rates in different countries, European multinational companies face incentives to reallocate accounting profits among their majority-owned affiliates worldwide to effectively reduce their global tax bill. The scope for international profit shifting for tax optimization is extensive in Europe, as the larger European multinationals usually operate subsidiaries all over the world. In recent years, the media has been flourishing with reports of large multinational companies paying little to no taxes as a result of prominent profit shifting schemes. As reported by Sullivan (2012), Apple Inc. reported a foreign effective tax rate of 4.7% for the fiscal year 2011.

In our study, we focus on transfer pricing in intangibles and intermediate goods to test the effect when income shifting not only depends on differences in statutory tax rates, but also considers differences in the costs of shifting income from or to a specific country. By constructing our own concealment cost measure, we model the opportunities and incentives faced by European multinational firms. These incentives are generated by differences in the cost of shifting income between the affiliates controlled by the multinational owner. The multinational firm can manipulate its transfer prices for intra-firm transactions between the multinationals' affiliates operating in locations with different tax regulation schemes. Accounting profits in high-tax countries, where the multinational owns affiliates, are effectively reduced by overstating the prices of imports into these countries, while understating the prices of exports from these countries, effectively lowering the tax rate of the corporate group.

Furthermore, the widespread use of tax arbitrage by multinational companies globally, has prompted debate among policymakers and is an evolving field in public finance. Policymakers view the tax base erosion, resulting from income shifting, as a growing concern for the efficiency and strength of the corporate income tax system. The Organization for Economic Co-operation and Development (OECD) views base erosion and profit shifting as a global issue and has called for coordinated solutions. Moreover, the organization has recognized that tax engineering activities, such as income shifting, represents a growing threat to the impartiality and integrity of tax systems all over the world.

The first to come up with a theory model and provide a seminal platform for further research on the profit shifting activities of multinational firms were Mintz and Smart (2004). The authors investigate corporate income competition between different jurisdictions in Canada, and evidence how the multinational optimally borrows in high-tax jurisdictions and declares its income from interest in the lowest-taxed jurisdiction. Since then, an increasing number of empirical studies have examined the income shifting behavior of multinational companies. Among these, Huizinga and Laeven (2008) model profit shifting arising from international tax differences between subsidiaries and parent companies, but also from tax differences between subsidiaries in different host countries. Furthermore, they investigate whether multinational companies' profit shifting in a country is determined by a weighted average of international tax rate differences between all countries where the multinational is operating. By using a dataset containing company-level information on the parent companies and affiliates of European multinationals, in addition to information about the international tax system, the authors empirically examine the extent of intra-European profit shifting by European multinationals and find that the international shifting of profits leads to a considerable redistribution of national corporate income tax revenues. This adds to the broad stream of research that uses subsidiary level information of multinationals and reports evidence for an adverse influence of host country taxes on reported profitability.

To date, there is hardly any empirical literature investigating the effect of income shifting targeted regulation on profit shifting. However, quite a few authors have investigated how changes in interest allocation rules or thin capitalization rules affect the financing decisions of multinational firms. Froot and Hines (1995) examines how the change in U.S. interest allocation rules in 1986 affected investment and financing choices of U.S. multinational corporations. Their results show that the tax deductibility of interest expenses decreased after the regulatory change in 1986, which led to a greater debt cost and reduced debt usage. Blouin, Huizinga, Laeven and Nicodeme (2014) study how thin capitalization rules influence the financial structures of foreign subsidiaries of U.S. multinational companies. Their analysis demonstrates that thin capitalization rules significantly affect the leverage choices of the subsidiaries. Similarly, Büttner, Overesch, Schreiber and Wamser (2012) study the effects of thin capitalization on the financial structures of affiliates in OECD countries in the sample period 1996-2004. Their results indicate that thin-capitalization rules reduce multinationals' incentives to use internal loans for tax scheming. The consequence is that companies utilize higher external debt.

Furthermore, Ruf and Weichenrieder (2012) studies the effect of controlled foreign corporation rules (CFC) on German multinationals' ability to shelter passive investment from taxation in Germany. They find that these rules are rather effective in hampering investments in low-tax jurisdictions. Lastly, Egger and Wamser (2015) also study the effect of CFC rules on foreign investments by German multinationals. Their results suggest that CFC legislation significantly affects the multinationals' investment activity abroad.

The evaluation of previous research on the topic forms the basis of our research question:

Are European multinationals' transfer pricing through intangibles and intermediate goods dependent on not only differences in statutory corporate tax rates, but also a weighted average of differences in tax regulation between all countries where the multinational is active?

Thus, the contribution of our study is twofold and takes up two of the points raised by Dyreng and Maydew (2017) on future JAR research.

Firstly, our study contributes to a better understanding of how the behavior of multinational companies are impacted by income shifting targeted regulation. By adding our own concealment cost indicator, constructed with the aim of capturing the differences in the real cost of shifting income, we extend the C-measure approach by Huizinga and Laeven (2008). Moreover, we examine whether such differences are significant determinants of the profit shifting behavior of European multinationals' and their worldwide web of affiliates available in the Orbis database.

Secondly, our study adds to the current empirical research on taxation of business activities that cover different countries. Due to large variations in the tax polices around the globe, companies are incentivized to strategically allocate income to low tax countries.

While researchers have made considerable progress on these topics, we hope to provide further insights into the behavior of multinational companies so that policy-makers can gain a better understanding of how to tax cross-border transactions.

2. Literature review

Multinational companies have used international profit shifting to optimize their tax bill for decades. In fact, it was Modigliani and Miller (1958) that demonstrated the opportunities brought forward by interest expenses being tax deductible, showing that companies could increase their value through leverage. Tax savings resulting from issuing more debt became a common method used to create additional value for the company. As corporate income is taxed at different rates in different countries around the world, multinational companies are induced to reorganize accounting profits to minimize the overall corporate tax burden. International profit shifting strategies have been exercised for decades, and both Grubert and Mutti (1991) and Hines and Rice (1994) were some of the first to write about profit shifting. Moreover, Collins and Shackelford (1997) documented the use of internal debt shifting, while in the accounting literature, Klassen, Land and Wolfson (1993) also discussed international income shifting.

The first to come up with a theory model and provide a seminal platform for further research on the profit shifting activities of multinational firms was Mintz and Smart (2004, pp. 1161). Their paper investigated corporate income competition between different jurisdictions to understand the financial scheming strategies of multinationals operating in multiple jurisdictions, facing different corporate tax rates. The central mechanism is the ability to shift income between affiliates operating in different jurisdictions, essentially allowing for tax optimization. The study is built around a model that shows that optimally, the multinational firm borrows in high-tax jurisdictions and reports its income from interest in the low-taxed jurisdiction. The multinational company maximizes the value of tax deductibility of interest paid, while at the same time minimizing the firm's taxes paid on interest income from interest. Furthermore, the model demonstrates that utilizing such a tax mechanism has the potential of leading to differences in statutory corporate tax methods around the world. Jurisdictions with low statutory corporate tax rates become tax havens to attract interest income, while other jurisdictions will face erosion of their tax base as companies navigate their income away from these high-tax areas. Furthermore, the authors find that when already high-tax jurisdictions face competition from tax havens, they often respond by increasing their corporate tax rates further. The paper identifies that profit shifting schemes have a significant effect on taxable income in Canada and reports that the elasticity of taxable income with respect to taxes is 4.9 for the companies that actively use profit shifting and 2.3 for comparable companies that do

not shift income. Klassen and Laplante (2012) demonstrate that cross-jurisdictions income shifting has become increasingly popular among U.S. multinationals as the regulatory costs of shifting profits have changed. Their empirical results, holding tax rate differences between the U.S. and overseas locations constant, suggest that the 380 companies studied, with low average effective foreign tax rates, together shifted about $10 billion worth of additional income out of the U.S. annually during the period 2005-2009, compared to the period 1998-2002. The authors argue that the increase is due to varying regulatory costs of shifting.

There are various techniques that the multinational firm can use to effectively shift profits from high-tax countries to low-tax countries. Firstly, the multinational can influence their transfer prices for intra-firm transactions between affiliates operating in different tax environments. Accounting profits in high-tax countries are effectively reduced by manipulating the prices of imports into this country, while understating the prices of exports from this country. Hines (1999) and Newlon (2000) surveyed several studies based on U.S. data and found evidence of profit shifting through the over and understating of transfer prices. Furthermore, Clausing (2003) finds direct evidence that intra-firm trade prices differ from the prices observed in third-party trade. These differences are found to be consistent with international tax minimization. Secondly, the multinational firm can optimize its international allocation of accounting profits through its financial organization. This is done by assigning debt, carrying high interest, to high-tax locations. By doing this, the multinational firm can minimize its worldwide tax bill. Another technique often used is the re-assigning of common expenses. An example of this is how R&D expenses are moved to high-tax countries to decrease total income in these countries. It is, however, important to emphasize how international profit shifting, regardless of its execution, enforces potentially significant costs to the firm. Grubert and Mutti (1991) analyze U.S. outward foreign direct investment and discover a negative relationship between the reported profitability of multinationals and total tax liabilities in foreign countries. Furthermore, Hines and Rice (1994) comparably examine the correlation between the profitability of U.S foreign direct investment overseas and foreign tax liabilities. Hines and Rice (1994) extend the model designed by Grubert and Mutti (1991) by controlling for labor and capital inputs in the examined countries. They find that the reported profits by U.S multinationals are sensitive to national tax burdens. This is explained by how U.S. multinationals are present in numerous tax havens that lack proper, or often any, application of anti-income shifting regulation. Haufler and Schjelderup (2000) use a model where countries can use the tax rate, in addition to the definition of the tax base as strategic variables to examine international tax competition. The authors find that the international

shifting of profits can explain comparatively low tax rates and a rather broad definition of the tax base as Nash equilibrium outcomes.

Demirgüc-Kunt and Huizinga (2001) present a negative correlation between the reported profitability of foreign-owned banks among 80 countries and the top national statutory tax rates. Bartelsman and Beetsma (2003), similarly, by using highly aggregated public account data, find that the reported value added at the sectorial level in OECD countries have a negative relationship with statutory tax rates. Büttner and Wamser (2013) studied profit shifting through internal debt only. Using a dataset consisting of German multinational companies, their results illustrated that tax differences between subsidiaries of a multinational company have a significant effect on that firm's internal debt. These results match those showcased by Mintz and Smart (2004). The study validates that a multinational that has subsidiaries operating in low-tax environments makes use of more internal debt. The tax effects found in the study are, however, small as German companies do not actively practice internal debt shifting strategies. The German CFC rules help explain part of this observation.

Recently, academic literature on the international profit shifting of multinationals has become more prevalent. This is possibly sparked by the ongoing public debate about multinationals utilizing legal tax avoidance to considerably lower their effective foreign tax rates. One area of research is directly focused on different profit shifting channels. Desai, Foley and Hines (2004) demonstrate that financial structures of multinational companies are utilized to take advantage of international tax differentials. Karkinsky and Riedel (2012), as well as Griffith, Miller and O'Connell (2014) present evidence for an optimization of the allocation of valuable patents that enable international profit shifting by relocating intra-firm royalties.

In spite of the evidence presented during the last 26 years of research on the topic, our understanding of the effects and mechanisms that drive profit-shifting behavior continues to have considerable shortcomings. This is particularly true when it comes to the scale of profit-shifting activity and how multinational companies balance international differences in regulation with the gains of shifting profits. Previous literature illustrates that multinational firms engage in activities such as using tax-efficient financial structures together with other non-financial profit shifting methods. However, how important these different shifting channels are remains undetermined as previous literature draw different conclusions. Grubert (2003) claims that the profit shifting volumes of U.S companies can nearly be equally credited to both shifting channels. Contrastingly, Dharmapala and Riedel (2013, pp. 99) reports that the profit-shifting effects are greatest from transfer pricing. Their theoretical model, however,

assume that the companies in their sample held a constant ownership structure over the sample period 1995-2005. The authors claim this is not a drawback of their paper, and argues that the inclusion of subsidiaries, which were connected with the parent company in the earlier years of the period of 11 years, creates a bias in their calculations.

Our paper is an extension of the study by Huizinga and Laeven (2008). The authors' use a model that consider not only profit shifting arising from international tax differences between subsidiaries and parent companies, but also from tax differences between subsidiaries in different host countries. Furthermore, they investigate whether multinational companies' profit shifting in a country is determined by a weighted average of international tax rate differences between all countries where the multinational is operating. By using a dataset containing company-level information on the parent companies and affiliates of European multinationals, in addition to information about the international tax system, the authors empirically examine the extent of intra-European profit shifting by European multinationals. This adds to the broad stream of research that uses subsidiary level information of multinationals and reports evidence for an adverse influence of host country taxes on profitability reported. The study finds a semi-elasticity of reported profits with respect to the top statutory rate of 1.3, while the costs of shifting income is estimated to be 0.6% of the tax base. The authors demonstrate that the international shifting of profits leads to a considerable redistribution of national corporate income tax revenues. Moreover, the study concludes that most European countries gain revenues from multinationals shifting income and that this is mostly at the expense of Germany.

Furthermore, our project is inspired by a working paper by Hopland et al. (2018) that presents an extension of the Huizinga and Laeven's (2008) C-measure to model income shifting with country-specific concealment cost by focusing on transfer pricing in intangibles and intermediate goods. This will be undertaken to further our understanding of the impact of regulation on firm behavior. To date, there is hardly empirical literature investigating the effect of income shifting targeted regulation on profit shifting. However, quite a few authors have investigated how changes in interest allocation rules or thin capitalization rules affect the financing decisions of multinational firms. An example being Froot and Hines (1995), who examined how the change in U.S. interest allocation rules in 1986 affected investment and financing choices of U.S. multinational corporations. Their results show that the tax deductibility of interest expenses decreased after the regulatory change in 1986, which led to a greater debt cost and reduced debt usage. Blouin et al. (2014) also study how thin capitalization rules influence the financial structures of foreign subsidiaries of U.S.

multinational companies. Their analysis demonstrates that thin capitalization rules significantly affect the leverage choices of the subsidiaries. Similarly, Büttner, Overesch, Schreiber and Wamser (2012) study the effects of thin capitalization on the financial structures of affiliates in OECD countries in the sample period 1996-2004. The authors' reports that their results indicate that thin-capitalization rules reduce multinationals' incentives to use internal loans for tax scheming. The consequence is that the companies utilize higher external debt.

Ruf and Weichenrieder (2012) studies the effect of CFC rules on German multinationals' ability to shelter passive investment from taxation in Germany. They find that these rules are rather effective in hampering investments in low-tax jurisdictions. Lastly, Egger and Wamser (2015) also studies the effect of CFC rules on foreign investments by German multinationals. Their results suggest that CFC legislation significantly affects the multinationals' investment activity abroad.

3. Methodology

3.1 Theoretical background

The methodology part of our paper follows the model specification proposed by a working paper by Hopland et al. (2018). We extend the model proposed by Huizinga and Laeven (2008), the C measure, for country-specific concealment costs and analyze the effect when income shifting not only depends on tax differentials but also considers differences in costs of shifting income from or to a country. By reproducing and extending the model, we examine whether predictions of the model are generally applicable to European multinational companies.

The model is tested on a data sample of European multinational companies and their respective subsidiaries all over the world. By doing this, we can test how country-specific concealment costs triggered by different tax environments affect how the multinational firm optimizes their profit shifting activities. For simplicity, we neglect the presence of both losses and internal debt. Furthermore, the model assumes that a multinational firm is a holding company operating in the parent country p, which has majority-owned subsidiaries located in i = 1, …, n countries that are owned directly by the parent, without any ownership chains.

A multinational company can manipulate its transfer prices for international intra-firm transactions to shift profits into country *i.* These concealment costs are the result of the multinational firm working its way around various tax regulation. Examples of this type of regulation include transfer pricing rules, which work as a common tool to ensure correct price setting in transactions between related parties. Similarly, CFC rules gives tax authorities, of the parent country, the ability to include non-repatriated income of companies in foreign countries in the domestic corporate tax base of the parent companies. Tax regulation like these examples cause increased administrative costs and should dampen international profit shifting. The multinational needs to modify its books, and possibly its real trade and investment pattern, to be able to justify the distorted transfer prices with the local tax authorities. Furthermore, tax regulation differs across countries. This leads to differences in the concealment cost. We will use a country-specific cost parameter (γ_i) to capture the strictness of regulation in country *i.*

The focus of our study is transfer pricing in intangibles and intermediate goods. Heckemeyer and Overesch (2017) documented that these are the most dominant profit-shifting

channels by synthesizing the findings from 27 empirical studies on the profit-shifting behavior of multinational companies.

It is well-known that income on intangibles is optimally shifted to the lowest-taxed subsidiary in the multinational company (Hopland et al., 2018). This is, in most cases, a tax haven or a jurisdiction with favorable tax regimes for which there exists no costs of shifting income. For the multinational, shifting income on intangible goods through royalties causes convex concealment costs:

$$C_i^X(P_i) = \frac{\gamma_i}{2}(P_i^X)^2$$

where $P_i^X = G_i^X \bar{X}$ is the shifted income by overestimating the use of the fixed factor $\bar{X}$, an example being a patent for company-developed software, and where γ_i is the country-specific concealment cost parameter that should capture the strictness of regulation in country *i*. The concealment cost measure is constructed to test the effect when income shifting not only depends on differences in corporate income tax rates, but also on differences in tax regulation across countries. The construction of the indicator and its components is discussed in Chapter 4.

Contrastingly, income shifting through intermediate goods causes quadratic concealment costs when one departs from the arm's-length price. The arm's-length price being the price of the transaction should it have been carried out between unrelated third parties (OECD, 2017). Concealment costs arise when income is shifted out of the subsidiary or when the subsidiary receives income from other subsidiaries. These costs are a result of income shifting targeted tax regulation such as thin capitalization rules, which aim at limiting the deductibility of interest expenses from taxable income. The level of tax regulation, often used to combat income shifting regulation directly, differs across countries and this is what our concealment cost measure should capture. Moreover, it is the variations in tax regulation between the countries for which the multinational company owns affiliates that we are interested in examining in relation to the differences in statutory corporate income tax rates. The resulting costs can be denoted as:

$$C_i^S(P_i) = \frac{\gamma_i}{2}\left(P_i^S\right)^2,$$

where $P_i^X = G_i^S S_i$ is the shifted income by mispricing the intermediate good S_i and where γ_i is the country-specific concealment-cost parameter as before.

Based on the presented assumptions, the economic profit of a productive affiliate $i > 1$ should be given by the revenue received from the sales of the output good minus the license cost for the intangible good, the input cost for the tangible intermediate good, the net position on income shifting in the intermediate good, which will be negative for relatively low-taxed subsidiaries, the concealment costs related to tangible and intangible goods due to deviations from arm's-length prices, and the user cost of capital (Hopland et al., 2018), and can be denoted

$$\pi_i^e = p_i y_i - (G_i^X + q_X)\bar{X} - \left(G_i^S + q_S\right)S_i - C^X(P_i^X) - C^S\left(P_i^S\right) - rK_i. \quad (1)$$

In most of the OECD countries, taxable income varies from economic profit as opportunity costs of equity are not tax-deductible. Moreover, to save notation and make the expression neater, we also assume that concealment costs are not tax deductible. The taxable income of subsidiary *i* can then be written as:

$$\pi_i^t = p_i y_i - (G_i^X + q_X)\bar{X} - \left(G_i^S + q_S\right)S_i = p_i y_i - q_X\bar{X} - q_S S_i - P_i^X - P_i^S. \quad (2)$$

The after-tax profit of the financial center in country 1 is equal to the receipt from each non-haven subsidiary of license fees minus the development cost of intangibles,

$$\pi_1 = (1 - t_1)\sum_i [(G_i^X + q_X)\bar{X} - q_X\bar{X}] = (1 - t_1)\sum_i G_i^X\,\bar{X}. \quad (3)$$

Furthermore, the parent company of the multinational maximizes its total after-tax income, denoted Π, by selecting the tax-efficient income-shifting activity, in principle by optimizing the transfer prices G_i^X and G_i^S. Moreover, we assume that the profits of the subsidiaries are only taxed in their home country, and that the parent company does not face a repatriation tax. By making use of equations 1 through 3, the maximization problem faced by the multinational can be expressed as the following

$$\max_{b_i, G_i^X, G_i^S} \Pi = \pi_1 + \sum_{i>1} (\pi_i^e - t_i \pi_i^t) \quad (4)$$

$$= (1 - t_1) \sum_i G_i^X \bar{X} + \sum_{i>1} \{(1 - t_i)[p_i F(K_i S_i) - (G_i^X + q_X)\bar{X} - (G_i^S + q_s) S_i] - \frac{\gamma_i}{2} (G_i^X \bar{X})^2 - \frac{\gamma_i}{2} \left(G_i^S S_i\right)^2 - r K_i\} \quad (5)$$

$$\text{s.t.} \sum_i G_i^S S_i = 0 \qquad , (\lambda)$$

where all shifted license fees are amassed in the financial center of the multinational without additional costs connected to concealing income. The sum of all shifted transfer payments for the intermediate factor must add up to zero across all productive subsidiaries $i > 1$. The final constraint is supplemented to the maximization problem with the Lagrange multiplier λ.

The accompanying first-order conditions for transfer pricing (G_i^X and G_i^S) can be written

$$t_i - t_1 - \gamma_i P_i^X = 0 \;\rightarrow\; G_i^X \bar{X} = \frac{t_i - t_1}{\gamma_i}, \quad (6a)$$

$$-(1 - t_i) - \lambda - \gamma_i P_i^S = 0 \;\rightarrow\; G_i^S S_i = -\frac{(1 - t_i) + \lambda}{\gamma_i}. \quad (6b)$$

As we can read from the first-order condition (6a), income shifting in royalties, for example through a patent, increases in the tax rate differential $t_i - t_1$ to the financial center of the multinational. Contrastingly, stricter regulation in country i, meaning higher concealment costs captured by γ_i, will have a mitigating effect on the amount of shifting income compared to a country with the identical tax rate, but weaker/more lenient income shifting regulation, implying a lower γ_i and therefore a lower weighted tax difference. If we solve the first-order condition (6b) for shifted income $G_i^S S_i$ and insert the term into the income-shifting constraint $\sum_{i>1} G_i^S S_i = 0$, we can derive the opportunity costs of the shifted transfer payments for the intermediate factor, as done by Hopland et al. (2018, pp. 2), denoted as

$$\lambda = \left(\sum_{i>1} -\frac{(1 - t_i)}{\gamma_i}\right) \frac{1}{\sum_{i>1} \frac{1}{\gamma_i}} \quad (7)$$

Reinserting this expression into the first-order condition (7), gives us

$$\gamma_i \left(\sum_{i>1} \frac{1}{\gamma_i}\right) G_i^S S_i = -\left(\sum_{i>1} \frac{1}{\gamma_i}\right)(1-t_i) + \sum_{i>1} \frac{1-t_i}{\gamma_i}$$
$$= -\frac{1-t_i}{\gamma_i} - \sum_{j>1, j\neq i} \frac{1-t_i}{y_j} + \frac{1-t_i}{\gamma_i} + \sum_{j>1, j\neq i} \frac{1-t_j}{\gamma_j}$$
$$= \sum_{j>1, j\neq i} \frac{t_j - t_i}{\gamma_j}$$

and further readjustments lead to

$$\gamma_i G_i^S S_i = \left(\sum_{j>1, j\neq i} \frac{t_j - t_i}{\gamma_j}\right)\left(\sum_{i>1} \frac{1}{\gamma_i}\right)^{-1} = \sum_{j>1, j\neq i} \left(\frac{t_j - t_i}{\gamma_j} \frac{1}{\sum_{i>1} \frac{1}{\gamma_i}}\right) = \sum_{j>1, j\neq i} \frac{t_j - t_i}{\sum_{i>1} \frac{\gamma_j}{\gamma_i}}$$

before we arrive at our final expression

$$P_i^S = G_i^S S_i = \sum_{j>1, j\neq i} \frac{t_j - t_i}{\gamma_i \sum_{i>1} \frac{\gamma_j}{\gamma_i}} = \sum_{j>1, j\neq i} \frac{t_j - t_i}{\gamma_j (1 + \sum_{k>1, k\neq i} \frac{\gamma_i}{\gamma_k})}. \qquad (8)$$

The last denominator captures the strength of regulation in country *j*, to which income shall be shifted, and of country *i,* from which income will be shifted relative to the concealment cost parameter (γ_i). The constructed concealment cost measure is based on the inverse of the Tax Attractiveness Index developed by Schanz, Keller, Dinkel, Fritz and Grosselfinger (2017).[1] This all being relative to some average concealment cost parameter. If concealment costs are the same for all countries, thus implying, $\gamma_i = \gamma \; \forall \; i$, the term breaks down into:

$$G_i^S S_i = \frac{1}{\gamma} \sum_{j>1, j\neq i} \frac{t_j - t_i}{(n-1)}$$

[1] A detailed description of how we arrived at our concealment cost measure is found in Chapter 4.

which we can see corresponds to the 'C-measure' from Huizinga and Laeven (2008). The model conveys the baseline idea that income shifting across subsidiaries are dependent on both the tax-rate differentials and the strictness of tax regulation. Stricter tax regulation in either the shifting or the receiving country, implying a high γ_i or γ_j increases the costs of shifting income. This reduces the regulation-adjusted tax differential and slows down income shifting as higher costs imply less net tax savings. Given these verdicts, EBITDA in affiliate *i* can be derived as dependent variable as:

$$EBITDA_i = p_i y_i - q_X \bar{X} - q_s S_i - P_i^X - P_i^S - C_i^X(P_i^X) - C_i^S(P_i^S). \quad (9)$$

This should be able to instrument income shifting via royalties by the tax rate of the lowest taxed affiliate (i.e., t_1) and transfer pricing by intermediate goods with the regulation-adjusted weighted tax differential $\sum_{j>1, j\neq i} \frac{t_j - t_i}{\gamma_j(1+\sum_{k>1,k\neq i}\frac{\gamma_i}{\gamma_k})}$.

3.2 Theoretical predictions of the model

There are three main theoretical predictions of the specification presented in subsection 3.1. This section presents these expectations separately.

The first prediction is that the dependent variable, EBITDA decreases as the total amount of profit shifted increases. This is evident from equation (9) where, all else equal, a higher P^S and higher P^X imply a lower left side of the equation; EBITDA. We can show this by partially deriving the dependent variable EBITDA in regards to P^S and P^X.

$$\frac{\partial EBITDA_i}{\partial P_i^S} = -1 - C_i^S < 0$$

$$\frac{\partial EBITDA_i}{\partial P_i^X} = -1 - C_i^X < 0$$

The second prediction of the model is that the amount of shifted profit via intangible goods such as royalties will decrease as the statutory tax rate increases in the country where the profit center, some affiliate *i*=1, of the multinational company is located. Formally, the tax differential from equation (6a) shrinks as t_1 increases.

For our model, this implies that a higher weighted tax differential will mean a larger amount of profit shifted by the multinational company. Furthermore, intuitively this implies the tax savings from income shifting of the multinational, will be higher in the rate of the weighted tax differential.

The third theoretical prediction of the model is that the effect of shifting income through both intangible and tangible goods will increase in the domestic tax rate. A higher statutory tax rate implies a larger differential and higher tax savings all else equal. Thus, both types of profiting shifting will increase. In addition, the statutory corporate income tax rate in a country is likely to also capture other effects relevant to a company's EBITDA, where examples include the level of investment in the country and the access to productive infrastructure.

In sum, based on these theoretical predictions of our model, the impact of profit shifting through intangibles is captured by the statutory tax rate of the country for which the profit center is located (country $i = 1$). That tax rate will have negative impact on profit shifting by intangibles. Moreover, the weighted tax differential should capture profit shifting via tangibles and have a positive impact on the shifting.

3.3 Emperical strategy

The theoretical equation (9) can be expressed as the following regression specification:

$$EBITDA_i = \beta_0 + \beta_1 t_i + \beta_2 \gamma_i + \beta_3 t_1 + \beta_4 \sum_{j>1, j\neq i} \frac{t_j - t_i}{\gamma_j (1 + \sum_{k>1, k\neq i} \frac{\gamma_i}{\gamma_k})} + (\text{controls and fixed effects}) + \epsilon_i. \quad (10)$$

The dependent variable $EBITDA_i$ is the pre-tax earnings of affiliate *i*. On the right-hand side of the equation we have β_0, which is the constant term, whereas β_1 the statutory tax rate in the country where affiliate *i* is located. This coefficient captures the effect from profit shifting in intangibles. Based on our theoretical predictions, a higher tax rate in the profit center reduces profit shifting and increases EBITDA. Based on this, we expect $\beta_1$to be positive.

Furthermore, β_2 is the concealment cost parameter that captures the strictness of tax regulation for the country for which affiliate *i* is located. The coefficient captures the impact

of the concealment cost parameter. In general, tighter regulation will decrease profit shifting and increase EBITDA. Thus, β_2 is expected to be positive.

Moreover, β_3 is the maximum tax difference in the multinational firm that is the ultimate global owner of affiliate *i,* while β_4 is the extended C-measure from Huizinga and Laeven (2008) that captures the sum of maximum tax difference across all affiliates over the weighted differences in the concealment cost parameter. Lastly, the control variables are turnover, inflation, corruption index, growth opportunities and real GDP growth. These controls are discussed in Chapter 5.

For countries where EBITDA data was not available, an example is Russia, we use EBIT as the dependent variable to run the identical regressions.

$$EBIT_i = \beta_0 + \beta_1 t_i + \beta_2 \gamma_i + \beta_3 t_1 + \beta_4 \sum_{j>1, j\neq i} \frac{t_j - t_i}{\gamma_j (1 + \sum_{k>1, k\neq i} \frac{\gamma_i}{\gamma_k})} + (\text{controls and fixed effects}) + \epsilon_i. \quad (11)$$

4. Creating a Concealment Cost Indicator

4.1 Aim and basis of indicator

Multinational firms try to balance their potential tax savings from income shifting with the cost of concealing this income (Huizinga & Laeven, 2008). We are interested in concealment costs, but more specifically how country-specific concealment costs triggered by different tax environments affect how the multinational firm optimizes their income shifting activities. To test the effect when income shifting also depends on differences in tax regulation across countries, we constructed a concealment cost indicator with the aim to capture the tightness of tax regulation and this acts as a measure of the costs of international profit shifting.

The indicator is based on the Tax Attractiveness Index (TAX) developed by Schanz et al. (2017). The TAX measures the relative attractiveness of the tax environment for firms in a total of 100 countries worldwide. The index is composed of 20 components that are all restricted to values between zero and one, where a value of one indicates optimum. The components that make up the TAX are listed in Table 1.

Table 1: Overview of all TAX components and those included in our study

This table shows the components of the Tax Attractive Index and the components we have included in the concealment cost indicator. The information on the variables of the Tax Attractiveness Index has been obtained from Schanz et al. (2017). The combination of the core components and weak components in concealment cost indicator have been used in section 7, by running regressions and performing robustness tests. Description of the variables are presented in 4.2, 4.3 and 4.4.

Tax Attractive Index components	Concealment Cost Indicator	
	Core Component	Weak Component
Anti-Avoidance Rules	Yes	
CFC Rules	Yes	
Corporate Income Tax Rate		
Depreciations		
EU Member State	Yes	
Group Taxation Regime		Yes

Table 1 (continued)

Tax Attractive Index components	Concealment Cost Indicator	
	Core Component	Weak Component
Holding Tax Climate		Yes
Loss Carryback		
Loss Carryforward		
Patent Box Regime		Yes
Personal Income Tax Rate		
R&D Tax Incentives		
Taxation of Capital Gains	Yes	
Taxation of Dividends Received	Yes	
Thin Capitalization Rules	Yes	
Transfer Pricing Rules	Yes	
Treaty Network	Yes	
Withholding Tax Rate Dividends		
Withholding Tax Rate Interests	Yes	Yes
Withholding Tax Rate Royalties	Yes	

An optimal tax environment is characterized by a corporate income tax of 0%; the option of cross-border group relief and no thin capitalization rules. A value of zero indicates the least favorable tax conditions and are characterized by the highest corporate income tax rate in the sample; no group relief and codified thin capitalization rules.

4.2 Concealment cost parameter

To obtain a parameter γ_i that can act as a measure of the tightness of tax regulation in the sample countries, we captured in the inverse of the TAX. In the resulting concealment cost indicator, we have excluded a total of six of the 20 components in the original TAX. The result is a measure of the tightness of tax regulation in 100 countries. All the included components affect the international profit-shifting environment for the sample firms. Moreover, the elements in our indicator affect profit shifting in different ways; some items affect concealment costs directly, while others make it harder for firms to strip out profits untaxed, especially those related to interest and royalties. In the following sections, we will discuss the components included in our indicator, in addition to presenting the excluded items.

4.3 Core components of index

In this subchapter, we will present and evaluate each of the 10 core components of our indicator. We distinguish between core and weak components in the concealment cost index as a robustness test are used to analyze whether leaving out the four items deemed weak significantly affects our regression results.

4.3.1 Anti-Avoidance rules

Through anti-avoidance rules tax authorities try to fight tax avoidance and challenge artificial or fictitious transactions. Therefore, firms located in countries with strict anti-avoidance rules are left with less tax planning opportunities and such an environment is less attractive for cross-border profit shifting. This item is, therefore, a good measure for concealment costs as it captures profit shifting regulation directly.

4.3.2 CFC rules

Most high tax countries have implemented CFC rules to protect their tax base from profit shifting to non-operational subsidiaries in low tax countries that only generate passive income such as interest and royalties. If these profits are kept in the non-operational subsidiaries and not distributed, they are effectively hidden from the home country of the parent company. This enables multinational companies to reduce their total tax burden substantially if there are no CFC rules in place. With effective CFC rules in place, however, tax authorities of the parent country can include non-repatriated income of corporations in foreign countries in the domestic corporate tax base of the parent companies. Companies in countries with CFC rules in place therefore have less flexibility in their tax planning activities and this way faces higher costs of concealing profits. This is an important component in our indicator that, just like the anti-avoidance rules item, captures profit shifting regulation directly.

4.3.3 Thin-Capitalization rules

By means of internal financing strategies, multinational companies can optimize their debt allocation. Debt financing is often preferred over equity financing as interest is deductible for tax purposes. This advantage is the most valuable in high tax countries, and affiliates in

low tax countries may therefore be equipped with equity. To curb the extensive use of debt financing, tax authorities especially in high tax countries have implemented thin capitalization rules. These rules aim at limiting the deductibility of interest expenses from taxable income and are therefore disadvantageous for companies. This is another item in the indicator that directly affects the costs of concealing profits and are therefore highly relevant for our analysis.

4.3.4 Transfer Pricing rules

Related companies that carry out internal transactions need to set prices for their products and services at a level that ensures comparability to a transaction between non-related corporations. Transfer pricing rules are a common tool to ensure correct pricing. Such rules cause increased administrative costs and provide less leeway for international profit shifting. Including this element in the concealment cost indicator gives us another component that affects income shifting regulation and should act as a good measure for concealment costs.

4.3.5 Withholding Tax Rate on Interest Payments

Withholding taxes on interest payments have the potential to dampen or even shut down debt shifting. The withholding tax reduces or nullifies the tax savings from the deduction of interest expenses. This leads to debt shifting becoming less or not at all attractive, illustrating the effectiveness of this type of regulation. This makes this item a core component of our indicator.

4.3.6 Withholding Tax Rate on Royalty Payments

With constant technological advances and digitalization of business models, royalty payments are becoming larger proportions of companies' revenues. Tax authorities can try to hinder firms from distributing royalty payment internationally by means of withholding taxes. As with withholding taxes on interest payments, this component affects companies' ability to strip out profits untaxed, and is therefore another core item for our indicator.

4.3.7 EU Member State

Companies operating within the European Union (EU) are under the Parent-Subsidiary Directive as well as the Interest and Royalties Directive. The Parent-Subsidiary Directive implies that profits distributed by an affiliate in one member state to its parent company located in another member state will be relieved from withholding taxes. This is conditional on the parent company holding at least 10% of the affiliate (World.Tax, 2012). Similarly, the Interest and Royalties Directive states that interest and royalty payments are free of any taxes in the member state given that the owner that ultimately receives the payment also is based in another member state (European Commission, 2003). Furthermore, the non-application of CFC rules follows from the Cadbury-Schweppes ruling of the European Court of Justice (ECJ). The ECJ concluded that a company which sought to profit from tax advantages in a Member State other than the state of residence should not be robbed of the right to rely on the provisions of the Treaty and establishing a firm in another Member State for the purposes of profiting from more favorable legislation did not constitute an abuse of the freedom of establishment (ETUI, 2006).

The result is a tax environment where CFC rules do not apply and where withholding taxes are banned. This is done to reduce instances of double taxation. This makes it more attractive for companies to operate within the EU, and in turn, these firms should face decreased concealment costs.

4.3.8 Treaty Network

Many tax treaties help to avoid the double taxation of profits from foreign sourced income. Furthermore, double tax treaties serve the purpose of reducing or even eliminating withholding taxes imposed on distributed profits as well as on interest and royalty payments. Therefore, companies located in countries that have signed double tax treaties with many countries internationally have an advantage over companies with a more limited treaty network. In a few cases, these tax treaties shelter companies from the full application of profit-shifting regulation and are therefore highly relevant for our concealment cost indicator.

4.3.9 Taxation of capital gains

As capital gains include the after-tax retained earnings of the divested company, the taxation of capital gains often cause double taxation. To solve this issue, many countries introduce partial tax exemptions for capital gains. Like above, we believe this component to be relevant for both affiliates that serve as the multinationals' bank and profit center, and for affiliates that shift income to the profit center. Furthermore, partial tax exemptions could serve as a sign of an ineffective tax environment, but this is not clear.

4.3.10 Taxation of Dividends Received

In a multinational group, subsidiaries may distribute their profits to the parent company through dividends. As the dividends have already been taxed as profits by the subsidiary, many countries balance this through a participation exemption. This means that dividends received from both domestic and foreign affiliates are omitted when defining total taxable income. Similarly, as discussed in subsection 4.3.9; partial tax exemptions could serve as a sign of an ineffective tax environment, but whether it affects concealment costs is rather unclear.

4.4 Weak components of index

The following subchapter discusses the last four components making up our concealment cost indicator. Whether these items capture tax regulation across countries directly is not as clear as with the core components. In Chapter 6, we evaluate whether leaving out these weak components gives us a better measure of regulation.

4.4.1 Withholding Tax Rate on Dividends

To secure its share in tax revenue, the source country uses withholding taxes. From a corporation's perspective, withholding taxes can increase their total tax burden. Profits that have already been subject to corporate taxation are taxed again when distributed as dividends, in contrast to dividends that are not distributed across borders. Therefore, companies in countries with low withholding taxes can distribute dividends with a lower tax burden. This is an element in our indicator that makes it more difficult for companies to repatriate profits from their profit centers. Hence, it may have an indirect effect on concealment costs.

4.4.2 Group Taxation Regime

Companies that are operating under group taxation regimes, and belong to the same corporate group, can file a consolidated tax return. Aggregating profits and losses across the corporate group can lead to a lower overall tax burden. While this component does not affect profit shifting regulation directly, it is still included in our indicator as group taxation has played an important role in some prominent international income shifting devices. Weichenrieder and Windischbauer (1998) study the effect of German thin-capitalization rules on corporate policy. The researchers find that the strengthening of regulations in 2001 had a restrictive effect on leverage. Their paper illustrated how foreign subsidiaries reacted to the tightening of regulation by reducing internal loans, while increasing equity. Furthermore, they find no significant evidence of reduced real investment. The limited impact of these thin-capitalization rules might be explained by the fact that the multinational companies had the ability to work around the regulation by utilizing various holding company structures.

4.4.3 Holding Tax Climate

Holdings or companies that own shares in other companies are an essential tool in corporate tax planning strategies. Holdings can be under special rules which include exemption from current taxation, as experienced in Luxembourg until 2010 and exemptions from local corporate income tax as seen in Switzerland. Just like the group taxation regime item, the holding tax climate component is included in the concealment cost indicator. The justification of its inclusion is not about its role in operating loss offset, but rather its importance in well-known international profiting shifting schemes.

4.4.4 Patent Box Regime

Patent Box Regime is about how royalty income is taxed. In some countries, royalty income is taxed lower than ordinary business income. This is done through either a reduced tax rate on royalty income or a tax exemption of a certain percentage of royalties. While it is challenging to say that such a regime affects concealment costs directly, it may emphasize a tax climate that is lenient towards income shifting. This makes it an indicator for weak regulation in general and the item is included in our indicator.

4.5 Not-included components

In this section, we will briefly discuss the components in the TAX that were not found relevant for the constructed concealment cost indicator. The corporate income tax rate component is instrumental for profit shifting, but as it measures tax savings it should not be incorporated into a concealment cost indicator. Moreover, depreciations are an important component of most companies' tax base. The item is, however, not relevant for concealment costs and it has therefore been left out of the constructed indicator. Both loss carryback and loss carryforward allow companies to use current losses or profits to be offset against profits and losses in the past. Neither of these components play a role in international profit shifting strategies, and they are therefore left out of the indicator. The personal income tax rate simply determines the tax burden for employees and is not related to profit shifting devices. Lastly, the final component from the TAX that is not included in the constructed indicator is R&D incentives. Potential R&D incentives covered by this component include tax credits and tax deductions. Nevertheless, this aspect is not related to concealment costs and it has therefore been out of the indicator (Schanz et al., 2017).

5. Data and descriptive statistics

5.1 Data sources and sample restrictions

We use the firm-level database Orbis, offered by Bureau van Dijk, to obtain historical ownership information and financial data on European multinational corporations and their worldwide web of majority-owned affiliates. Orbis, one of the most sophisticated comparable data resources on private companies, offers data on a total of 65 million companies all over the world, in addition to information on full and partial ownership structures. The archived data is available from January 2009. We have restricted our main data sample from 2009 to 2017, as the TAX, that forms the basis of our concealment cost indicator are restricted to these years[2]. Hence, we have obtained ownership information and financial data on European multinational companies and all their subsidiaries over a period of nine years. The data available in Orbis is organized and presented in a standardized format. The accounting practices of the companies in our sample, however, differ. Consequently, cross-country research, which aims to compare and evaluate the behavior of unrelated companies by using standardized financial records, which is based on different accounting practices should, according to Klapper, Laeven and Rajan (2004), be handled with caution. Any biases characterizing the data should, however, have decreased greatly after applying the inclusion criteria and having carried out the data trimming process. No currency conversions are necessary, as all the financial data gathered from the Orbis database is registered in US dollars[3].

We have used the inverse values from the TAX developed by Schanz et al. (2017). This gives us a concealment cost measure that can be used to quantify the strictness of tax regulation in the sample countries. This parameter is used to derive the regulation-adjusted weighted tax differential. Before retrieving the financial and ownership structure data from the Orbis database, we apply various search criteria. These include shareholder location, which needs to be in Europe as we only consider European multinational companies. Contrastingly, as we consider the multinationals' worldwide web of affiliates, we alter our Orbis search to include all affiliates, regardless of geographical location. Additionally, we are only interested

[2] The Tax Attractiveness Index (TAX) and how we used it as the basis for our concealment cost indicator is discussed in Chapter 4.
[3] A detailed description of how to obtain ownership and financial data in the Orbis database is provided in Appendix B.

in majority owned affiliates so the shareholder needs a minimum company share of 50%. Lastly, we restrict our sample to firms with assets of at least $10 million. This limits our sample to companies of a considerable size (OECD, 2005).

The main data sample consists of 869,454 worldwide affiliate-year observations operating in 87 countries, where the multinational companies have their headquarters located in one of 38 countries, all in Europe. Moreover, the number of worldwide affiliate-year observations do not reflect all the majority-owned affiliates of all European multinationals, as we only include those for which there exists Bureau van Dijk ID codes. These identification numbers were used to obtain ownership information. The data trimming procedures and selection criteria used to obtain the main data sample are illustrated in Table 2. Firstly, we dropped affiliate-year observations with no majority owner located in Europe. This as we are only interested in affiliates that are part of a European multinationals' global network of subsidiaries. Next, a total of 797,378 additional observations were dropped as they were observations related to purely domestic firms. For companies with no activity abroad, both the weighted tax differential and the maximum tax differential variables will be equal to zero. We are interested in the behavior of European multinational firms exclusively. Lastly, we dropped affiliate-year observations that were missing the necessary firm-level or country-level control variables needed to run the modelled regressions[4].

[4] The regression equations can be found in subsection 3.3.

Table 2: Data trimming procedures

Table 2 shows data selection criteria and trimming procedures used to construct the main sample. The main sample consists of majority-owned subsidiaries of European multinational companies, whose historical ownership information and financial data has been acquired from the Orbis database.

	Number of observations	Percentage
(1) All affiliate-year historical ownership observations from Orbis (2009-2017)	3,318,629	100%
(2) Dropped affiliate-year observations with no ultimate global owner	2,556,847	77%
(3) Dropped purely domestic firms	1,759,469	53%
(4) Dropped affiliate-year observations with missing firm-level or country-level control variables	869,454	26%
Final sample	869,454	26%

5.2 Dependent variable

The dependent variable used in the regression is the EBITDA margin of affiliate *i*, defined as the firm's operating profitability as a percentage of its total revenue. It is determined by dividing EBITDA by total revenue. This variable can provide insight into a company's operating profitability and cash flow. The variable is derived from financial data obtained from Orbis. Lastly, EBIT margins will be used as a replacement for EBITDA margins as the dependent variable for multinational companies located in certain countries, which have no available EBITDA margin values, such as Russia.

5.3 Tax mechanisms

Our regression equations use a total of three tax mechanisms. The first mechanism is simply the statutory corporate tax rate of the country for which affiliate *i* is located. These data were acquired from KPMG's corporate tax rates table survey (KPMG, 2017). The impact of the tax rates in our model is unclear per se, as it distorts capital investment.

The second tax mechanism used represents the maximum tax difference in the multinational firm that controls affiliate *i*. The model predicts that a higher minimum tax rate should increase the dependent variable EBITDA in subsidiary *i*.

Finally, our third tax mechanism signifies the sum of the maximum tax difference across all affiliates of the multinational, divided by the weighted differences in the concealment cost parameter. Contrastingly to the maximum tax difference mechanism, the model predicts that the weighted-tax differential should decrease EBITDA given a higher minimum tax rate in the multinational company.

5.4 Concealment cost parameter

As a measure of the strictness of tax regulation in the sample countries, we captured the inverse of the TAX index as a parameter γ_i[5].

5.5 Control variables

Our analysis focuses on how the tax mechanisms affect the pre-tax earnings of affiliates that are ultimately owned by a European multinational company. We have included one firm-level and four country-level control variables to reduce the potential omitted variable bias in relation to the dependent variable EBITDA. In addition to the firm- and country-level variables, the regressions include time dummy variables and fixed effects. The fixed effects control for unobserved heterogeneity among the EBITDA observations from the sample period. Lastly, the effect of time-invariant factors will be removed by using fixed effects.

As our study is solely based on firm-level data from the Orbis database, our sample lacks information on the firms' fixed assets and financial leverage, as used by Huizinga and Laeven (2008). This is the justification for including only one firm-level control variable in our model specification.

[5] The construction of the concealment cost parameter from the Tax Attractiveness Index are discussed in chapter 4.

5.5.1 Firm-level control variable – Firm size

To control for firm size, we used the logarithm of sales of the affiliates in the sample period. The effect of company size on our dependent variable EBITDA suggests that larger firms have greater EBITDA than smaller firms. Doğan (2013) find that there is a positive relation between size indicators and the profitability of companies in Turkey. In addition, smaller firms are often operating in more unpredictable and emerging industries. The firm size variable is an important determinant for several reasons. Firstly, larger firms tend to have greater bargaining power with customers, they run more efficient production facilities and possess broader product offerings. Furthermore, small firms do not have the same access to capital as larger firms. Lastly, it is harder to liquidate larger firms and the risk of bankruptcy tends to be lower, which again leads to lower capital expenditures (Aivazian et al., 2001, pp. 105).

5.5.2 Country-level

Inflation

The inflation variable states the annual percentage change in the consumer price index, as reported from the World Economic Outlook Database of the International Monetary Fund (2017) and the World Development Indicators of the World Bank.

EBITDA and EBIT values are in nominal terms, while changes in inflation have real effects. When the inflation rate increases, companies may experience rising costs, such as wages, cost of goods sold and additional services. If the company is unable to increase their prices as result of the increasing costs, then EBITDA will decrease. Hence, the future direction of the inflation rate is a source of uncertainty for companies, especially which engage in cross-border activities.

Small variations in the rate of inflation can lead to greater profitability for firms who are able to increase their prices greater than the cost associated with making a product or service. Inflation is also beneficial in terms of decreasing the real value of interest payments if they depend on historical values and the rates are fixed.

Corruption

The corruption variable states the logarithm of the annual corruption index in each country, obtained through the Worldwide Governance Indicator of the World Bank (n.d.). The index reports a range of scores from -2.5 to 2.5 for each country. The higher the index value, the less corrupt, indicating that a country with a score of 2.5 has the lowest level of corruption. Furthermore, the corruption variable illustrates the amount of public power used to acquire private benefits. Thus, it captures the risk of investors' expropriation by firm's management, or by public officials and politicians.

Growth opportunities

The growth opportunity variable is expressed as the median annual growth in sales per country. The impact of growth opportunities on firm's EBITDA and EBIT values is uncertain.

It is reasonable to assume that a country which are experiencing growth will have a positive impact on the EBITDA and EBIT values of a firm residing in the country. According to Hanneman (2005), value is a function of future performance. Hence, multinational companies with good growth prospects receive premium sales prices in comparison to prices paid for steady business with limited growth. The sum of all future cash flows to investors determines value, hence as the future cash flow stream grows, it is more valuable than a similar company that does not show the same growth. If a multinational firm decides to pursue investment that carry higher risk through increased leverage as a result of strong growth, investors will require higher returns for the equity. Moreover, this indicates that growth opportunities should have a positive impact on EBITDA and EBIT values.

Real GDP growth

In addition to growth opportunities, we have included an additional variable for growth. The real GDP growth variable is expressed as the annual percentage change in a country's GDP, as reported from the World Bank (n.d.a). The EBITDA values are in nominal terms, while a change in GDP have real effects. However, the direction on EBITDA and EBIT is uncertain.

This variable is related to the previous, growth opportunities, in terms of an increase in real GDP growth indicates a positive impact on EBITDA and EBIT values.

5.6 Descriptive statistics

5.6.1 Multinationals and affiliates by country

Information on multinational firms and their respective affiliates by country is presented in Table 3. The Orbis database provides ownership information and financial data on privately owned companies all over the world. The number of affiliate-year observations are 869,454 over the sample period of nine years. The total number of affiliates are 96,606 over the sample period. Table 3 shows information on the number of affiliates per country in the sample.

We do not have financial information on the corporate group, but the number of affiliate-year observations changes with the number of affiliates per multinational firm. Moreover, the number of subsidiaries varies as well, the smallest corporate groups own two subsidiaries, while the largest group European multinational in the sample owns 7,830 affiliates worldwide.

Table 3: Number and location of the affiliates

Table 3 illustrates the number of affiliates located worldwide, with a total of 96,606 subsidiaries in the sample period of 2009-2017.

Country	Number of affiliates
Algeria	159
Angola	127
Argentina	1,041
Austria	1,483
Bahrain	48
Bangladesh	6
Belarus	40
Belgium	4,168
Bolivia	110
Botswana	3
Brazil	3,281
Bulgaria	1,046
Canada	315
China	2,038
Colombia	765
Costa Rica	200

Table 3 (continued)

Country	Number of affiliates
Croatia	794
Cyprus	143
Czech Republic	2,912
Denmark	864
Dominican Republic	231
Ecuador	190
Egypt	78
El Salvador	44
Estonia	678
Finland	1,740
France	7,677
French Guiana	5
Germany	4,296
Greece	676
Guatemala	84
Hong Kong	100
Hungary	1,326
Iceland	78
India	1,403
Indonesia	39
Ireland	1,335
Israel	18
Italy	5,426
Japan	591
Jersey	123
Kazakhstan	36
Kenya	114
Latvia	718
Lebanon	9
Lithuania	563
Macedonia (Fyrom)	122
Malaysia	760
Malta	450
Martinique	6
Mauritius	18
Montenegro	102
Morocco	643

Table 3 (continued)

Country	Number of affiliates
Namibia	3
Netherlands	1,523
New Zealand	423
Nicaragua	1
Nigeria	62
Norway	3,035
Pakistan	19
Panama	474
Paraguay	52
Peru	316
Philippines	179
Poland	4,222
Portugal	2,122
Puerto Rico	66
Republic of Korea	497
Romania	256
Russian Federation	3,534
Saudi Arabia	55
Serbia	1,041
Singapore	2,133
Slovakia	1,834
Slovenia	565
South Africa	314
Spain	5,449
Sweden	3,827
Switzerland	18
Thailand	522
Tunisia	261
Turkey	512
Ukraine	761
United Arab Emirates	112
United Kingdom	6,270
United States of America	3,487
Uruguay	174
Venezuela	101
Vietnam	110
Venezuela	5

Table 4 displays the summary statistics for parents and affiliates. The main variables of interest are the statutory corporate tax rate, the weighted tax difference, the maximum tax difference and the concealment cost indicator. From the data, we can observe the difference between the concealment cost measure from the main regression, and the more concentrated indicator from the robustness test. There is a slight difference in the mean and the standard deviation values.

Table 4: Summary statistics for parents and affiliates

Table 4 shows the summary statistics for the dependent and independent variables for the main sample. The dependent variables are EBITDA and EBIT margins. The statutory corporate tax rates of the countries, where the affiliates are located, from KPMG's corporate tax rate tables. Weighted tax difference, illustrated as the weighted sum of differences between the corporate tax rate faced by an affiliate and all other tax rates faced by all other affiliates that belong to the multinational firm. The maximum tax difference, illustrated as the difference between the tax rates of the country where an affiliate is located and the lowest-taxed affiliate of the multinational firm.

	Mean	Standard deviation
EBITDA	11.683	23.871
EBIT	7.115	21.571
Statutory corporate tax rate	0.262	0.071
Weighted tax difference	-2.446	14.885
Maximum tax difference	0.115	0.102
Concealment cost indicator (14 components)	2.925	3.123
Concealment cost indicator (10 components)	2.990	3.542
Log(Sales)	9.249	2.217
Inflation	2.592	12.517
Corruption index	0.907	0.965
Growth opportunities	0.311	12.397
Real GDP growth	1.654	3.317

6. Emperical results

6.1 Main variables of interest

In the following section, we examine whether the theoretical predictions of our model hold for European multinational firms and their majority-owned affiliates worldwide over the sample period of 2009 through 2017[6]. We start by analyzing how our dependent variable, EBITDA (EBIT for countries in which EBITDA data is not available) is affected by the different tax mechanisms. Then we discuss the potential omitted variable biases associated with omitting any of the tax mechanisms from the model. Furthermore, we discuss the economic significance of our result, before we review how the dependent variable is affected by the control variables.

Table 5 and 6 reports our main regression results. Here, the maximum tax differential, the weighted tax differential and the concealment cost indicator, by itself, have been computed for each observation in our study. All regressions illustrated in the table control for fixed effects.

For regression (1) in Table 5, we include the three tax mechanisms and the concealment cost indicator. From the results, we see that the coefficients of the statutory corporate tax rate and concealment cost indicator are negative, while the coefficients of the weighted and maximum tax difference are positive. For these regressions, the statutory tax rate coefficient is significant at the 5% level, while the maximum tax difference and concealment cost coefficient is significant at the 10% level. The coefficient for the weighted tax differential in regression (1), which includes our constructed concealment cost indicator, is not statistically significant.

Focusing on the implications of our results, when adjusting the weighted tax differential for the strictness of regulation in a country where a European multinational firm owns a productive affiliate; we find no significant relationship with the dependent variables EBITDA or EBIT. Thus, implying that, in our model, the multinationals' profit shifting behavior is not incentivized by differences in tax regulation between the locations of which it owns affiliates.

This non-finding of significant relationships is contrary to the theoretical predictions of our model. From our specification, a higher weighted tax differential increases the amount of

[6] The theoretical predictions of our model are presented and discussed in subsection 3.2.

shifted profit and thus reduce EBITDA (or EBIT). This implies that the costs of concealing income are convex so that tax savings from profit shifting decreases as the total amount shifted increases.

By also including the concealment cost indicator as an independent variable, we observe that this cost measure is correlated with our dependent variable and significant at the 10% level in regression (1). The coefficient of -0.182 implies that a one percent increase in the concealment cost measure leads to a fall in EBITDA of 18.2%. In terms of economic significance, such a finding would suggest that the strictness of income shifting regulation in country *i* has huge consequences for the pre-tax earnings of firms operating in this country, as the controlling European multinational will shift its income to other locations. Unfortunately, the relationship is not significant at any level when including the control variables. This might imply that there exists a relationship between the dependent variable EBITDA and the strictness of tax regulation in a country where the multinational company owns affiliates, but the cost measure used in our model is not effective enough in capturing this level of regulation.

In the construction of the indicator, we included a total of 14 components, and what our findings might imply is that some of these components does not capture income shifting regulation directly and therefore distorts our ability to evidence the relationship. By adjusting the concealment cost measure further, by dropping the components considered as weak, we can examine whether tapering down the measure has any impact of the significance of its relationship with EBITDA. Furthermore, this will help us understand what drives the non-finding of significant results in our main regressions. This is investigated and discussed further in subsection 6.4.

The regressions from (2) and (4) through (13) and (14) include both the firm and country level controls, and we observe that the estimated coefficients of the statutory corporate tax rate increases, in addition to now being only significant at the 10% level. The coefficient of the weighted and maximum tax difference decreases, suggesting that there exists heterogeneity characterizing the profit shifting decisions of the multinational company. This is captured by the firm-level control variable firm size, log(sales). Looking at the coefficients of the concealment cost variable, we observe that when including the control variables; the coefficients turn positive.

Table 5: Impact of tax mechanisms on EBITDA and EBIT margin

EBITDA and EBIT are the dependent variables in all regressions. Variable definitions are presented in Appendix C. For regressions (1), (2), (5) and (7); EBITDA is the dependent variable and for regression (3), (4) and (6); EBIT is the dependent variable. For regressions (1) and (3), the three tax mechanisms and the concealment cost indicator with 14 components are included. Regressions (2) and (4) also includes the control variables. Regressions (5) and (6) assess the omitted variable bias resulting from omitting the weighted tax difference from the analysis, while regression (7) examine the omitted variable bias that occurs when the maximum tax differential is omitted from the analysis when the dependent variable is EBITDA. The sample comprises the worldwide web of majority-owned subsidiaries of European multinational companies over a period of nine years (2009-2017). The results report White's (1980) heteroskedasticity-robust standard errors in parentheses under each coefficient. Lastly, * denotes significance at 10% level, ** denotes significance at 5% level, *** denotes significance at 1% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Statutory tax rate	-5.346**	-4.115*	-6.640***	-5.923***	-3.396*	-5.865***	-3.238*
	(1.741)	(1.743)	(1.713)	(1.714)	(1.633)	(1.589)	(1.651)
Weighted tax difference	0.012	0.008	0.007	0.001			0.010
	(0.008)	(0.008)	(0.006)	(0.006)			(0.008)
Maximum tax difference	2.049*	1.535	2.206*	1.636	1.718	1.650	
	(0.903)	(0.905)	(0.889)	(0.890)	(0.898)	(0.891)	
Concealment cost indicator	-0.182*	0.071	0.015	0.202	0.069	0.201	0.077
	(0.090)	(0.173)	(0.092)	(0.142)	(0.173)	(0.142)	(0.173)
Log(Sales)		4.586***		3.885***	4.587***	3.885***	4.587***
		(0.156)		(0.129)	(0.156)	(0.129)	(0.156)
Inflation		0.006		0.045**	0.006	0.045**	0.006
		(0.019)		(0.015)	(0.019)	(0.015)	(0.019)
Corruption index		-1.243***		-1.464***	-1.247***	-1.465***	-1.235***
		(0.264)		(0.264)	(0.264)	(0.264)	(0.265)
Growth opportunities		-1.208*		-1.790***	-1.215*	-1.791***	-1.224*
		(0.535)		(0.394)	(0.535)	(0.394)	(0.535)
Real GDP growth (Annual percentage)		0.167***		0.040*	0.167***	0.040*	0.167***
		(0.016)		(0.018)	(0.016)	(0.018)	(0.016)
Lowest-taxed affiliate excluded	No	No	No	No	No	No	No

Table 5 (continued)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	398,039	398,004	488,359	488,301	398,004	488,301	398,004
Number of total observations	869,454	869,454	869,454	869,454	869,454	869,454	869,454
R^2	0.003	0.038	0.003	0.029	0.038	0.029	0.038

Table 6: Impact of tax mechanisms on EBITDA and EBIT margin

This is the second part of the regression results, continued from Table 5. For regressions (9), (11) and (13); EBITDA is the dependent variable and for regression (8), (10), (12) and (14); EBIT is the dependent variable. Regression (8) examine the omitted variable bias that occurs when the maximum tax differential is omitted from the analysis when the dependent variable is EBIT, whereas regression (9) and (10) omits both the weighted and maximum tax difference. Regression (11) and (12) omits the statutory tax rate while (13) and (14) omits both the statutory tax rate and the weighted tax difference. The sample comprises the worldwide web of majority-owned subsidiaries of European multinational companies over a period of nine years (2009-2017). The results report White's (1980) heteroskedasticity-robust standard errors in parentheses under each coefficient. Lastly, * denotes significance at 10% level, ** denotes significance at 5% level, *** denotes significance at 1% level.

	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Statutory tax rate	-4.912**	-2.203	-4.640**				
	(1.615)	(1.501)	(1.460)				
Weighted tax difference	0.002			0.004	-0.006		
	(0.006)			(0.007)	(0.006)		
Maximum tax difference						0.977	0.255
						(0.826)	(0.819)
Concealment cost indicator	0.198	0.076	0.196	-0.029	0.120	-0.041	0.112
	(0.142)	(0.173)	(0.142)	(0.170)	(0.141)	(0.170)	(0.141)
Log(Sales)	3.886***	4.588***	3.887***	4.587***	3.886***	4.587***	3.885***
	(0.129)	(0.156)	(0.129)	(0.156)	(0.129)	(0.156)	(0.129)
Inflation	0.045**	0.006	0.045**	0.008	0.049**	0.008	0.049**
	(0.015)	(0.019)	(0.015)	(0.019)	(0.015)	(0.019)	(0.015)
Corruption index	-1.455***	-1.238***	-1.457***	-1.241***	-1.472***	-1.248***	-1.472***
	(0.264)	(0.265)	(0.264)	(0.265)	(0.264)	(0.264)	(0.264)
Growth opportunities	-1.808***	-1.235*	-1.812***	-1.253*	-1.814***	-1.248*	-1.799***
	(0.393)	(0.535)	(0.394)	(0.535)	(0.393)	(0.535)	(0.394)

Table 6 (continued)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Real GDP growth (Annual percentage)	0.041*	0.167***	0.041*	0.169***	0.042*	0.169***	0.043*
	(0.018)	(0.016)	(0.018)	(0.016)	(0.018)	(0.016)	(0.018)
Lowest-taxed affiliate excluded	No	No	No	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	488,301	398,004	488,301	398,004	488,301	398,004	488,301
Number of total observations	869,454	869,454	869,454	869,454	869,454	869,454	869,454
R^2	0.029	0.038	0.029	0.038	0.029	0.038	0.029

The three tax mechanisms that forms our model are, by design, interrelated both among each other but also between subsidiaries all over the world that belong to the same European multinational firm. Table 7 reports the pairwise correlation estimates between the tax differentials. The tax mechanisms all include the statutory corporate income tax rate. From Table 7, we observe correlation coefficients of approximately 0.56 and 0.43 for the maximum and weighted tax differentials.

Firstly, as we capture the maximum tax differential by the lowest-taxed affiliate in the multinational group, however, we avoid correlation problems in the maximum tax difference measure. For the correlation between the statutory corporate income tax rate and the weighted tax difference, the coefficient indicates that following an increase in a country's corporate tax rate, the weighted tax difference between all affiliates located there increases. Accordingly, this leads to further incentives for the multinational owner to allocate income away from these affiliates.

Table 7: Correlation matrix between tax mechanisms (14 components)

Table 7 reports the pairwise correlation estimates between the TAX variables used in the study. By their design, these tax mechanisms are correlated. Appendix C provides detailed variable definitions.

	Statutory tax rate	Maximum tax difference	Weighted tax difference
Statutory tax rate	1.000		
Maximum tax difference	0.563	1.000	
Weighted tax difference	0.426	0.173	1.000

6.2 Omitted variable bias

By their design, the tax mechanisms are correlated, but their impact on multinational firms can still be statistically identified. Due to the correlation, this indicates an omitted variable bias if any of the tax mechanisms are omitted from the regression. From table 5 and 6, we have omitted one of the tax mechanisms, in regressions (5) to (8) and two tax mechanisms in regressions (9) to (14). In regression (5), by removing the weighted tax difference, the statutory tax variable is biased upward by 21.17% on the EBITDA as dependent variable, and it remains statistically significant at the 10% level. Moreover, in regression (6) where the dependent variable is the EBIT, the statutory tax rate is biased upward by 13.2%. The latter regression remains statistically significant at the 1% significance level. However, omitting the maximum tax difference in regression (7), the statutory tax rate variable regressed on the dependent variable EBITDA is biased upward by 27.08% and remains statistically significant at the 10% level. In regression (8), the statutory tax rate variable remains statically significant at the 5% level, and it is biased upward by 20.58%. In regression (10), the statutory tax rate is biased upward by 27.7% and it is statistically significant at the 5% level. The other tax mechanisms in the last regressions are not statistically significant at any significance level. Moreover, the omitted variable bias overestimates the importance of the tax mechanisms on affiliates' EBITDA margin. This does not imply that the tax sensitivity is overestimated. Since the statutory tax rate variable is statistically significant throughout the regressions, the omitted variable bias allocates inappropriately on the tax mechanisms, not evenly distributing on the other mechanisms.

6.3 Control variables

The estimated coefficients on all firm-level and country-level control variables which is regressed on the EBITDA margin are statistically significant, except the inflation variable. This is because the dependent variable, EBITDA, accounts for depreciation and amortization which capture the change in inflation rate, hence it is not statistically significant. The firm-level variable, the logarithm of sales, is positively related to the EBITDA margin, which is true for larger firms are more profitable. Of the country-level variables, the corruption index enters the regression negatively, which indicates that firms in corrupt countries have a greater EBITDA margin.

Growth opportunities have a negative relationship on firms' EBITDA. Thus, implying that multinational companies allocate income away from affiliates located in countries with high growth opportunities. Real GDP growth enters the regression positively, which indicates that affiliates of multinational firms located in countries experiencing an increase in real GDP have a positive effect on the EBITDA.

The estimated coefficients on all firm-level and country-level control variables which are regressed on the EBIT are statistically significant. The firm-level and country-level control variables enter the regression in the same manner as the variables regressed on EBITDA. Of the country-level control variables, inflation rate enters positively in the regression, as it increases the real value of operating revenue and in turn the EBIT margin.

6.4 Impact of changes in concealment cost indicator

The construction and inclusion of the concealment cost parameter gamma *i*, to the extent that it should capture the strictness of tax regulation for countries in which the multinational owns affiliates, represents a necessary revision of models use in previous research on the topic. Huizinga and Laeven (2008) included a cost parameter in their paper, this was in relation to the transfer pricing of European multinational firms, but the term was theoretical and as a result the researchers stated that the multinationals' optimal profit shifting is essentially a weighted average of a country's statutory tax rate in relation to the tax rates in the other countries where the multinational also owns subsidiaries.

As reported in Chapter 4, the concealment cost measure in our model is based on the inverse of weighted average of 14 of the total 20 components that comprise the TAX. Furthermore, we identified and characterized ten of them as core components, as they capture income shifting directly. Similarly, four out of the 14 items that make up our concealment cost indicator, are considered weak. To examine whether leaving out the weak components of our concealment cost measure makes a difference to the regression results, we adjusted the concealment cost measure and ran the regressions with the updated gamma variable. As reported in subsection 6.1 the results from the original regressions were not statistically significant, thus implying that our model, given the studied sample, do not adequately capture the real cost of shifting income via intangible and intermediate goods. Hence, it is interesting to see whether removing the weaker components of the indicator will make a difference in terms of the reported statistical significance.

Table 8 consists of the same dependent and independent variables as the original regressions found in subsection 6.1. Moreover, as the weak components has been removed from the cost measure, we examine whether the relationship between the weighted tax differential and EBITDA displays a higher level of significance. The results from the regressions, however, show no improvement in relation to the correlation between the weighted tax differential and EBITDA or EBIT. The tax mechanisms do not change, in terms of significance levels. The statutory tax rate remains significant at the 1% level. However, the new regression results report that the coefficient of the improved concealment indicator, that now comprise only the ten core components, is significant at the 5% level for regressions (2), (5), (7), (9), (11) and (13). All these regressions use EBITDA as the dependent variable.

Focusing on regression (2), we observe a coefficient for the concealment cost indicator of -0.327, implying that an increase in the strictness of regulation in country *i*, will cause the multinational company to shift income out of the affiliates in this location as the EBITDA falls by 32%. The results for the other regressions that use EBITDA tell the same story.

Table 8: Impact of tax mechanisms with updated concealment cost parameter

Table 8 reports the new results for regressions (1)-(7) after changing the concealment cost measure. The sample comprises the worldwide web of majority-owned subsidiaries of European multinational companies over a period of nine years (2009-2017). The results report White's (1980) heteroskedasticity-robust standard errors in parentheses under each coefficient. Lastly, * denotes significance at 10% level, ** denotes significance at 5% level, *** denotes significance at 1% level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Statutory tax rate	-5.208**	-3.186	-6.610***	-5.423**	-2.356	-5.290***	-2.330
	(1.712)	(1.694)	(1.688)	(1.678)	(1.610)	(1.576)	(1.593)
Weighted tax difference	0.013	0.009	0.007	0.001			0.011
	(0.007)	(0.007)	(0.006)	(0.006)			(0.007)
Maximum tax difference	1.960*	1.460	2.121*	1.556	1.702	1.594	
	(0.903)	(0.905)	(0.890)	(0.891)	(0.898)	(0.891)	
Concealment cost indicator (core components)	-0.256**	-0.327**	-0.075	-0.080	-0.328**	-0.081	-0.327**
	(0.082)	(0.111)	(0.059)	(0.069)	(0.111)	(0.069)	(0.111)
Log(Sales)		4.587***		3.883***	4.588***	3.884***	4.588***
		(0.156)		(0.129)	(0.156)	(0.129)	(0.156)

Table 8 (continued)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Inflation		0.004		0.049**	0.004	0.049**	0.004
		(0.019)		(0.015)	(0.019)	(0.015)	(0.019)
Corruption index		-1.232***		-1.460***	-1.240***	-1.462***	-1.223***
		(0.264)		(0.264)	(0.264)	(0.264)	(0.264)
Growth opportunities		-1.355*		-1.585***	-1.373**	-1.588***	-1.373**
		(0.526)		(0.391)	(0.526)	(0.392)	(0.526)
Real GDP growth (Annual percentage)		0.166***		0.034	0.165***	0.034	0.166***
		(0.016)		(0.018)	(0.016)	(0.018)	(0.016)
Lowest-taxed affiliate excluded	No	No	No	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	398,039	398,013	488,359	488,310	398,013	488,310	398,013
Number of total observations	869,454	869,454	869,454	869,454	869,454	869,454	869,454
R^2	0.003	0.038	0.003	0.029	0.038	0.029	0.038

Table 9: Impact of tax mechanisms with new concealment cost parameter

Table 9 is the continuation of Table 8 and reports regressions (8)-(14). The sample comprises the worldwide web of majority-owned subsidiaries of European multinational companies over a period of 9 years (2009-2017). The results report White's (1980) heteroskedasticity-robust standard errors in parentheses under each coefficient. Lastly, * denotes significance at 10% level, ** denotes significance at 5% level, *** denotes significance at 1% level.

	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Statutory tax rate	-4.457**	-1.155	-4.111**				
	(1.577)	(1.474)	(1.447)				
Weighted tax difference	0.003			0.007	-0.003		
	(0.006)			(0.006)	(0.005)		
Maximum tax difference						1.157	0.306
						(0.822)	(0.818)
Concealment cost indicator (core components)	-0.083	-0.329**	-0.085	-0.362**	-0.095	-0.363**	-0.093
	(0.069)	(0.111)	(0.069)	(0.111)	(0.069)	(0.111)	(0.069)
Log(Sales)	3.884***	4.590***	3.885***	4.588***	3.885***	4.588***	3.884***
	(0.129)	(0.156)	(0.129)	(0.156)	(0.129)	(0.156)	(0.129)
Inflation	0.049**	0.004	0.050**	0.005	0.052***	0.005	0.052***
	(0.015)	(0.019)	(0.015)	(0.019)	(0.015)	(0.019)	(0.015)
Corruption index	-1.450***	-1.231***	-1.454***	-1.230***	-1.470***	-1.241***	-1.469***
	(0.264)	(0.264)	(0.264)	(0.264)	(0.264)	(0.264)	(0.264)
Growth opportunities	-1.602***	-1.399**	-1.609***	-1.386**	-1.623***	-1.386**	-1.611***
	(0.391)	(0.526)	(0.391)	(0.526)	(0.391)	(0.527)	(0.392)
Real GDP growth (Annual percentage)	0.034	0.165***	0.034	0.167***	0.036*	0.167***	0.037*
	(0.018)	(0.016)	(0.018)	(0.016)	(0.018)	(0.016)	(0.018)
Lowest-taxed affiliate excluded	No	No	No	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	488,310	398,013	488,310	398,013	488,310	398,013	488,310
Total number of observations	869,454	869,454	869,454	869,454	869,454	869,454	869,454
R^2	0.029	0.038	0.029	0.038	0.029	0.038	0.029

Table 10: Correlation matrix of the tax mechanisms (10 components)

Table 10 reports the pairwise correlation estimates between the tax variables after changing the concealment cost indicator. We observe a minor change in the weighted tax differential as expected. Appendix C provides detailed variable definitions.

	Statutory tax rate	Maximum tax difference	Weighted tax difference
Statutory tax rate	1.000		
Maximum tax difference	0.563	1.000	
Weighted tax difference	0.413	0.154	1.000

7. Conclusion

Corporate income taxation of European multinationals continues to puzzle academics and policymakers as it tackles the underlying policy issues of tax efficiency and tax equity (Dyreng & Maydew, 2017). As a result, the study of the behavior of European multinational companies in response to different tax environments is an important matter for both these firms and for tax regulators that aim to minimize tax avoidance. Previous research on the topic has established that the multinational optimizes their tax liability through the shifting of profits as a result of different statutory corporate tax rates around the world. However, there still exists uncertainty around how the European multinational company balance differences in tax rates with the cost of concealing income in a country where the multinational owns affiliates.

Accordingly, our study aims to contribute to a better understanding of how the behavior of multinational companies is impacted by income shifting targeted regulation. By incorporating a measure for the cost of concealing income, constructed with the aim of capturing the differences in the real cost of shifting income, we examine whether such differences are significant determinants of the pre-tax earnings of affiliates that are majority-owned by European multinational companies available in the Orbis database. More specifically, we extend the approach used by Huizinga and Laeven (2008), the C-measure, to test the effect when income shifting not only depends on tax differentials but also considers variations in costs of shifting income from or to a specific country, in which the European multinational controls affiliates.

This is done by considering the sensitivity of majority-owned affiliates' EBITDA to statutory corporate income tax rates, the maximum tax difference in the multinational firm that controls affiliate *i*, and the sum of the maximum tax difference across all affiliates of the multinational, divided by the weighted differences in the concealment cost parameter.

We use the model specification proposed by a working paper by Hopland et al. (2018) and test the model's prediction on a sample of European multinational companies and their majority-owned affiliates all over the world during the period 2009-2017. We find no significant relationship between the regulation adjusted weighted tax differential and the dependent variable EBITDA.

However, when adjusting our concealment cost by dropping four of its 14 components, considered weak determinants of income shifting targeted regulation, we observe a coefficient for the concealment cost indicator of approximately -0.32 and statistically significant at the

10% level. This implies that an increase in the strictness of regulation in country *i*, will cause the multinational company to shift income out of the affiliates in this location as the EBITDA falls by 32.7%.

Finally, based on the obtained results, we are unable to provide sufficient evidence to answer our research question on whether European multinationals' transfer pricing through intangibles and intermediate goods dependent on not only differences in statutory corporate tax rates, but also a weighted average of differences in tax regulation between all countries where the multinational is active.

7.1 Suggestions for future research

As reported by the statistical insignificance of our main regression results, our model and the adjusted weighted tax differential were not able to identify a relationship between EBITDA and a weighted average of differences in tax regulation between all countries where the multinational operates majority-owned affiliates. In this section, we discuss potential improvements to our model and how the issues present in our model can be handled for future empirical research.

Firstly, our main contribution is the inclusion of our own concealment cost indicator. When constructing this indicator, we used an index that aims to measure the attractiveness of tax regulation and arrived at our concealment cost measure by taking the inverse of this index. Moreover, the insignificance of our obtained results indicate that such a cost measure construction should be based on the real costs European multinationals' face when concealing income through transfer pricing. A better understanding of the parties involved in these cross-border transactions, for instance advisors and attorneys, should support the process of refining the concealment cost measure. Finally, our robustness test that narrowed down the cost measure, by dropping four of its 14 components, indicates that the model used could form the basis of future research, but that the construction of the cost measure needs to be refined further.

Secondly, as discussed in subsection 5.1, cross-country research, which aims to compare and evaluate the behavior of unrelated companies by using standardized financial records, which is based on different accounting practices should be handled with caution (Klapper et al., 2004). As we are considering European multinationals' and all their majority-owned affiliates worldwide, the lack of significant results could be influenced by variations in

accounting methods. Future researchers should focus on handling this issue. Sampling multinationals' and their affiliates that are under the same accounting practice and operates in the same industry could be insightful.

Appendix A. Statutory corporate tax rates

Table A1 illustrates the statutory corporate tax rates by the countries in the data sample over the sample period (2009 – 2017). The statutory corporate tax rate data was obtained from KPMG's corporate tax rates table survey (KPMG, 2017).

Table A1: Statutory corporate tax rates

Country	2009	2010	2011	2012	2013	2014	2015	2016	2017
Algeria	0.000	0.000	0.000	0.000	0.250	0.190	0.260	0.260	0.260
Angola	0.350	0.000	0.350	0.350	0.350	0.350	0.300	0.300	0.300
Argentina	0.350	0.350	0.350	0.350	0.350	0.350	0.300	0.300	0.300
Australia	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
Austria	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
Bahrain	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Bangladesh	0.275	0.275	0.275	0.275	0.275	0.275	0.250	0.250	0.250
Belarus	0.240	0.240	0.240	0.180	0.180	0.180	0.180	0.180	0.180
Belgium	0.340	0.340	0.340	0.340	0.340	0.340	0.340	0.340	0.340
Bolivia	0.000	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
Botswana	0.250	0.250	0.220	0.220	0.220	0.220	0.220	0.220	0.220
Brazil	0.340	0.340	0.340	0.340	0.340	0.340	0.340	0.340	0.340
Bulgaria	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
Canada	0.330	0.310	0.280	0.260	0.260	0.265	0.265	0.265	0.265
China	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
Colombia	0.330	0.330	0.330	0.330	0.250	0.250	0.250	0.250	0.340
Costa Rica	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
Croatia	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
Cyprus	0.100	0.100	0.100	0.100	0.125	0.125	0.125	0.125	0.125
Czech Republic	0.200	0.190	0.190	0.190	0.190	0.190	0.190	0.190	0.190
Denmark	0.250	0.250	0.250	0.250	0.250	0.245	0.220	0.220	0.220
Dominican Republic	0.250	0.250	0.290	0.290	0.290	0.280	0.270	0.270	0.270
Ecuador	0.250	0.250	0.240	0.230	0.220	0.220	0.220	0.220	0.220
Egypt	0.200	0.200	0.200	0.250	0.250	0.250	0.225	0.225	0.225
El Salvador	0.000	0.000	0.000	0.300	0.300	0.300	0.300	0.300	0.300
Estonia	0.210	0.210	0.210	0.210	0.210	0.210	0.200	0.200	0.200
Finland	0.260	0.260	0.260	0.245	0.245	0.200	0.200	0.200	0.200
France	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.330	0.333
Germany	0.294	0.294	0.294	0.295	0.296	0.296	0.297	0.297	0.298
Greece	0.250	0.240	0.200	0.200	0.260	0.260	0.290	0.290	0.290

Table A1 (continued)

Country	2009	2010	2011	2012	2013	2014	2015	2016	2017
Guatemala	0.310	0.310	0.310	0.310	0.310	0.280	0.250	0.250	0.250
Hong Kong	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165
Hungary	0.190	0.190	0.190	0.190	0.190	0.190	0.190	0.190	0.090
Iceland	0.180	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
India	0.340	0.340	0.324	0.325	0.340	0.340	0.346	0.346	0.346
Indonesia	0.280	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
Ireland	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
Israel	0.260	0.250	0.240	0.250	0.250	0.265	0.250	0.250	0.240
Italy	0.314	0.314	0.314	0.314	0.314	0.314	0.314	0.314	0.240
Japan	0.407	0.407	0.407	0.380	0.380	0.356	0.339	0.309	0.309
Jersey	0.000	0.000	0.000	0.000	0.000	0.000	0.200	0.200	0.200
Kazakhstan	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
Kenya	0.000	0.000	0.000	0.300	0.300	0.300	0.300	0.300	0.300
Latvia	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150
Lebanon	0.000	0.000	0.000	0.000	0.150	0.150	0.150	0.150	0.150
Lithuania	0.200	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150
Macedonia (Fyrom)	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
Malaysia	0.250	0.250	0.250	0.250	0.250	0.250	0.240	0.240	0.240
Malta	0.350	0.350	0.350	0.350	0.350	0.350	0.350	0.350	0.350
Mauritius	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150	0.150
Montenegro	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090	0.090
Morocco	0.000	0.000	0.000	0.000	0.300	0.300	0.310	0.310	0.310
Namibia	0.000	0.000	0.340	0.340	0.330	0.330	0.330	0.320	0.320
Netherlands	0.255	0.255	0.250	0.250	0.250	0.250	0.250	0.250	0.250
New Zealand	0.300	0.300	0.280	0.280	0.280	0.280	0.280	0.280	0.280
Nicaragua	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.300
Nigeria	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
Norway	0.280	0.280	0.280	0.280	0.280	0.270	0.270	0.250	0.240
Pakistan	0.350	0.350	0.350	0.350	0.350	0.340	0.330	0.320	0.310
Panama	0.300	0.275	0.250	0.250	0.250	0.250	0.250	0.250	0.250
Paraguay	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
Peru	0.300	0.300	0.300	0.300	0.300	0.300	0.280	0.280	0.295
Philippines	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
Poland	0.190	0.190	0.190	0.190	0.190	0.190	0.190	0.190	0.190
Portugal	0.250	0.250	0.250	0.250	0.250	0.230	0.210	0.210	0.210
Republic of Korea	0.242	0.242	0.220	0.242	0.242	0.242	0.242	0.242	0.220
Romania	0.160	0.160	0.160	0.160	0.160	0.160	0.160	0.160	0.160
Russian Federation	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200

Table A1 (continued)

Country	2009	2010	2011	2012	2013	2014	2015	2016	2017
Saudi Arabia	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
Serbia	0.100	0.100	0.100	0.100	0.150	0.150	0.150	0.150	0.150
Singapore	0.180	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170
Slovakia	0.190	0.190	0.190	0.190	0.230	0.220	0.220	0.220	0.210
Slovenia	0.210	0.200	0.200	0.180	0.170	0.170	0.170	0.170	0.190
South Africa	0.346	0.346	0.346	0.346	0.280	0.280	0.280	0.280	0.280
Spain	0.300	0.300	0.300	0.300	0.300	0.300	0.280	0.250	0.250
Sweden	0.263	0.263	0.263	0.263	0.220	0.220	0.220	0.220	0.220
Switzerland	0.190	0.188	0.183	0.181	0.180	0.179	0.179	0.179	0.178
Thailand	0.300	0.300	0.300	0.230	0.200	0.200	0.200	0.200	0.200
Tunisia	0.300	0.300	0.300	0.300	0.300	0.250	0.250	0.250	0.250
Turkey	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
Ukraine	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
United Arab Emirates	0.550	0.550	0.550	0.550	0.550	0.550	0.550	0.550	0.550
United Kingdom	0.280	0.280	0.260	0.240	0.230	0.210	0.200	0.200	0.190
United States of America	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400
Uruguay	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
Venezuela	0.340	0.340	0.340	0.340	0.340	0.340	0.340	0.340	0.340
Vietnam	0.250	0.250	0.250	0.250	0.250	0.220	0.220	0.220	0.200
Zimbabwe	0.309	0.258	0.258	0.258	0.258	0.258	0.258	0.258	0.250

Appendix B. TAX and concealment cost indicator

Table B1 presents the values obtained from the Tax Attractiveness Index and the corresponding inverse values that make up our concealment cost parameters. The table shows the values for both the original regression with 14 of the 20 components and the robustness test with the ten core components.

Table B1: Tax Attractiveness Index and Concealment Cost Indicator (CCI)

	Tax Attractiveness (14 of 20)	Concealment Cost Indicator (14 of 20)	Tax Attractiveness (10 of 20)	Concealment Cost Indicator (10 of 20)
Algeria	0.437	2.302	0.467	2.160
Angola	0.359	2.839	0.393	2.692
Argentina	0.059	23.655	0.071	21.975
Australia	0.293	3.410	0.326	3.074
Austria	0.590	1.695	0.663	1.508
Bahrain	0.874	1.144	0.823	1.215
Bangladesh	0.297	3.421	0.362	2.812
Belarus	0.339	3.038	0.360	2.959
Belgium	0.490	2.069	0.554	1.816
Bolivia	0.503	1.999	0.603	1.671
Botswana	0.453	2.206	0.524	1.907
Brazil	0.197	5.195	0.171	6.203
Bulgaria	0.509	1.965	0.552	1.811
Canada	0.278	3.621	0.331	3.046
China	0.251	4.005	0.229	4.386
Colombia	0.254	4.208	0.232	5.233
Costa Rica	0.428	2.348	0.518	1.943
Croatia	0.422	2.378	0.457	2.214
Cyprus	0.754	1.326	0.818	1.223
Czech Republic	0.531	1.883	0.633	1.579
Denmark	0.422	2.369	0.429	2.332
Dominican Republic	0.343	2.948	0.397	2.595
Ecuador	0.361	2.788	0.366	2.776
Egypt	0.244	4.163	0.211	4.824
El Salvador	0.367	2.779	0.393	2.600
Estonia	0.536	1.871	0.598	1.678
Finland	0.482	2.077	0.552	1.822

Table B1 (continued)

	Tax Attractiveness (14 of 20)	Concealment Cost Indicator (14 of 20)	Tax Attractiveness (10 of 20)	Concealment Cost Indicator (10 of 20)
France	0.458	2.192	0.490	2.042
French Guiana (France)	0.458	2.192	0.490	2.042
Germany	0.444	2.250	0.523	1.911
Greece	0.343	2.941	0.387	2.624
Guatemala	0.453	2.376	0.514	2.167
Hong Kong	0.472	2.118	0.501	1.996
Hungary	0.561	1.782	0.608	1.645
Iceland	0.529	1.933	0.579	1.781
India	0.350	2.861	0.374	2.668
Indonesia	0.254	3.954	0.281	3.583
Ireland	0.489	2.056	0.513	1.958
Israel	0.243	4.173	0.176	5.989
Italy	0.426	2.351	0.434	2.303
Japan	0.248	4.076	0.244	4.182
Jersey (United Kingdom)	0.494	2.027	0.804	1.243
Kazakhstan	0.290	3.501	0.298	3.441
Kenya	0.371	2.723	0.430	2.360
Latvia	0.557	1.809	0.603	1.682
Lebanon	0.506	1.978	0.473	2.113
Lithuania	0.444	2.253	0.483	2.070
Macedonia (Fyrom)	0.397	2.540	0.412	2.457
Malaysia	0.522	1.915	0.542	1.844
Malta	0.779	1.285	0.848	1.180
Martinique (France)	0.458	2.192	0.412	2.546
Mauritius	0.658	1.523	0.687	1.457
Montenegro	0.490	2.041	0.482	2.079
Morocco	0.601	1.670	0.651	1.546
Namibia	0.471	2.123	0.570	1.756
Netherlands	0.650	1.539	0.712	1.406
New Zealand	0.313	3.192	0.350	2.858
Nicaragua	0.486	2.077	0.581	1.737
Nigeria	0.461	2.181	0.548	1.843
Norway	0.468	2.140	0.546	1.836
Pakistan	0.383	2.628	0.407	2.493
Panama	0.473	2.117	0.559	1.795
Paraguay	0.537	1.863	0.619	1.616

Table B1 (continued)

	Tax Attractiveness (14 of 20)	Concealment Cost Indicator (14 of 20)	Tax Attractiveness (10 of 20)	Concealment Cost Indicator (10 of 20)
Peru	0.142	7.624	0.084	19.683
Philippines	0.269	3.816	0.339	3.027
Poland	0.438	2.311	0.467	2.185
Portugal	0.393	2.546	0.369	2.740
Puerto Rico (United States of America)	0.110	9.141	0.342	2.925
Republic of Korea	0.197	5.162	0.142	7.045
Romania	0.467	2.144	0.533	1.875
Russian Federation	0.353	2.885	0.354	2.973
Saudi Arabia	0.358	2.795	0.364	2.745
Serbia	0.287	3.566	0.242	4.362
Singapore	0.639	1.565	0.589	1.698
Slovakia	0.510	1.978	0.568	1.780
Slovenia	0.477	2.098	0.553	1.807
South Africa	0.416	2.417	0.402	2.502
Spain	0.518	1.934	0.463	2.165
Sweden	0.550	1.818	0.668	1.498
Switzerland	0.532	1.882	0.597	1.680
Thailand	0.454	2.204	0.524	1.915
Tunisia	0.426	2.357	0.421	2.385
Turkey	0.346	2.896	0.369	2.712
Ukraine	0.319	3.186	0.340	3.026
United Arab Emirates	0.887	1.128	0.841	1.189
United Kingdom	0.494	2.027	0.482	2.078
United States of America	0.110	9.141	0.089	11.411
Uruguay	0.360	2.864	0.363	2.818
Venezuela	0.076	13.382	0.088	11.566
Vietnam	0.387	2.588	0.397	2.523
Zimbabwe	0.332	3.011	0.382	2.617

Appendix C. Variable defintitons and data sources

Table C1 offers definitions and data sources for the dependent and independent variables used in our study.

Table C1: Variable definitions and data sources

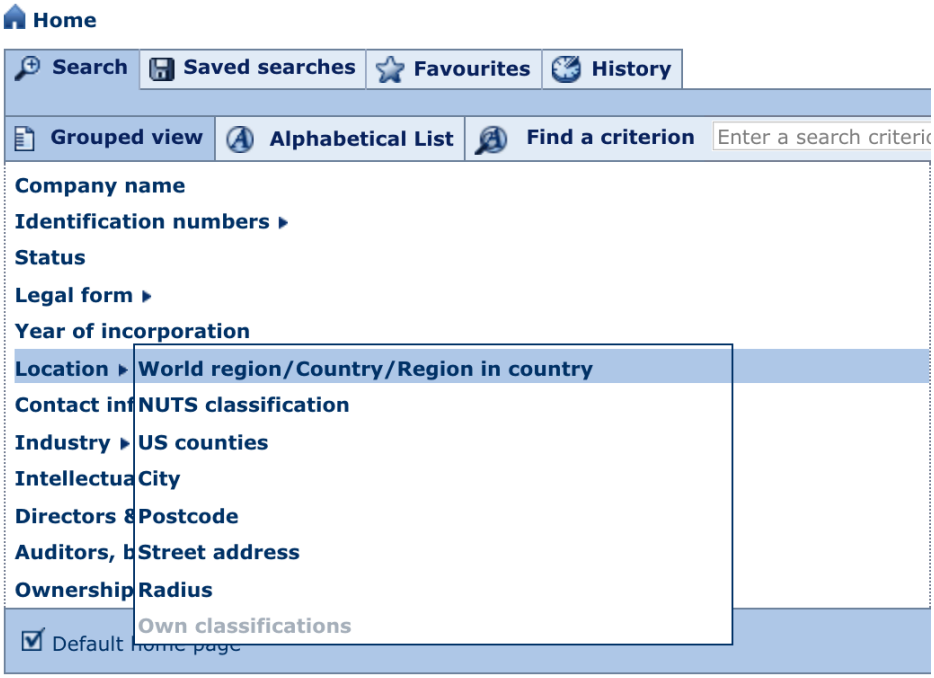
Variable	Definition	Source
EBITDA margin	Earnings before interest, tax, depreciation and amortization divided by operating revenue Describes a firm's operating profitability as a percentage of its total revenue	Orbis database
EBIT margin	Earnings before interest and tax divided by operating revenue	Orbis database
Statutory Corporate tax rate	Host country statutory corporate tax rate of an affiliate *i*	KPMG's corporate tax rates table and indirect tax survey
Maximum tax difference	Difference between the corporate tax rate faced by an affiliate *i* and tax rate of the lowest-taxed affiliate in the multinational company	KPMG's corporate tax rates table and indirect tax survey
Weighted tax difference	Concealment cost indicator sum of differences in the corporate tax rate faced by an affiliate *i* and tax rates faced by the parent firm and all other affiliates that belong to the multinational company	KPMG's corporate tax rates table and indirect tax survey

Table C1
(continued)

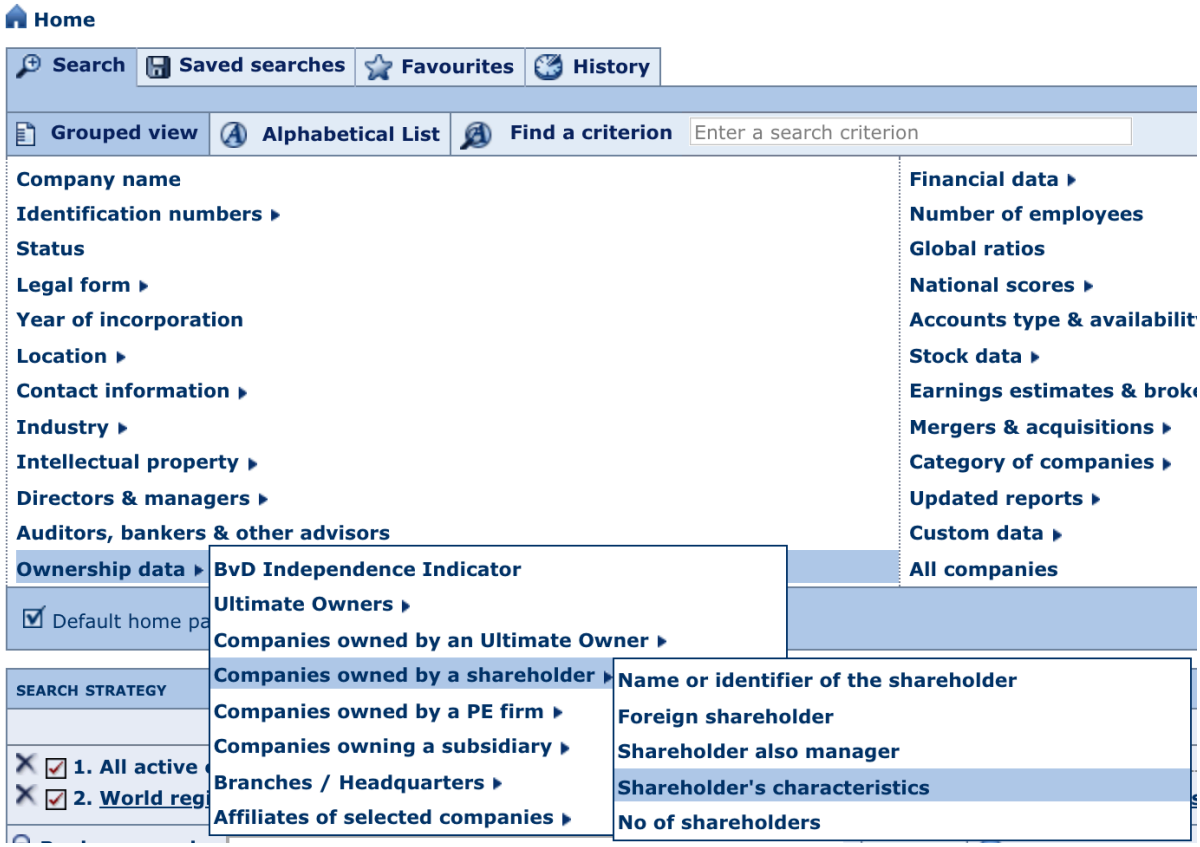
Variable	Definition	Source
Firm size	Logarithm of firm's operating revenue (turnover) for firms located worldwide.	Orbis database
Inflation	Annual percentage change in the consumer price index	World Development Indicators of the World Bank
Corruption	Logarithm of annual corruption index The index is within [-2.5;2.5] interval, 2.5 indicates a country with very low level of corruption	World Governance Indicators of the World Bank
Growth opportunities	Median annual growth in sales per country	Orbis database
Real GDP growth	Annual percentage change in the real Gross Domestic Product by country	World Development Indicators of the World Bank

Appendix D. Obtaining data in Orbis database

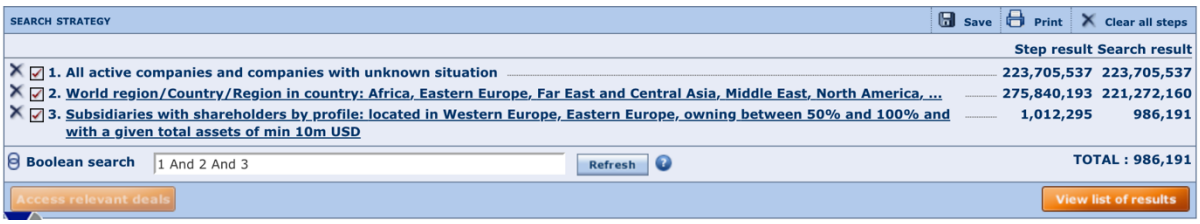
1. To find historical ownership data on European multinational companies, we use the Orbis database. To start, choose region of subsidiaries (Location – World region/ Country/ Region in country). As we study European multinationals and their worldwide web of subsidiaries, select all regions.



2. Secondly, we select only subsidiaries that are owned by a shareholder (Ownership data – Companies owned by a shareholder – Shareholder's characteristics). As we are only interested in European multinational companies, we select the regions Western Europe and Eastern Europe. Moreover, we select the option that at least one shareholder owns a minimum of 50% of the shares of the subsidiaries, as we study only majority-owned subsidiaries. Lastly, we select companies who has total assets of at least $10 million.



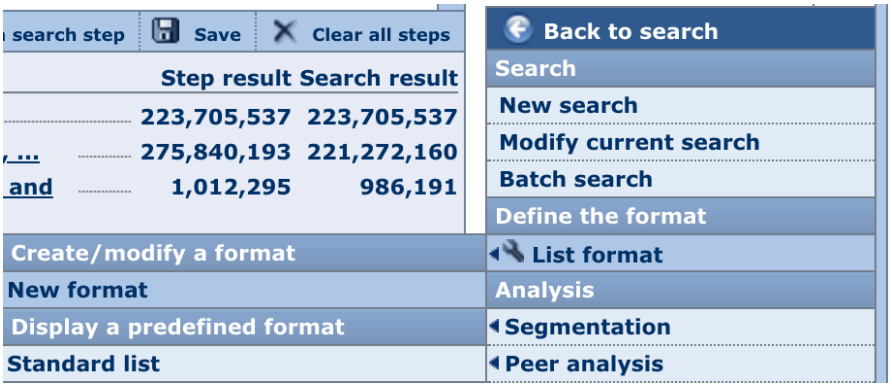
After outlining the regions of subsidiaries and their shareholders, we now have the search strategy that shows the number of subsidiaries found.



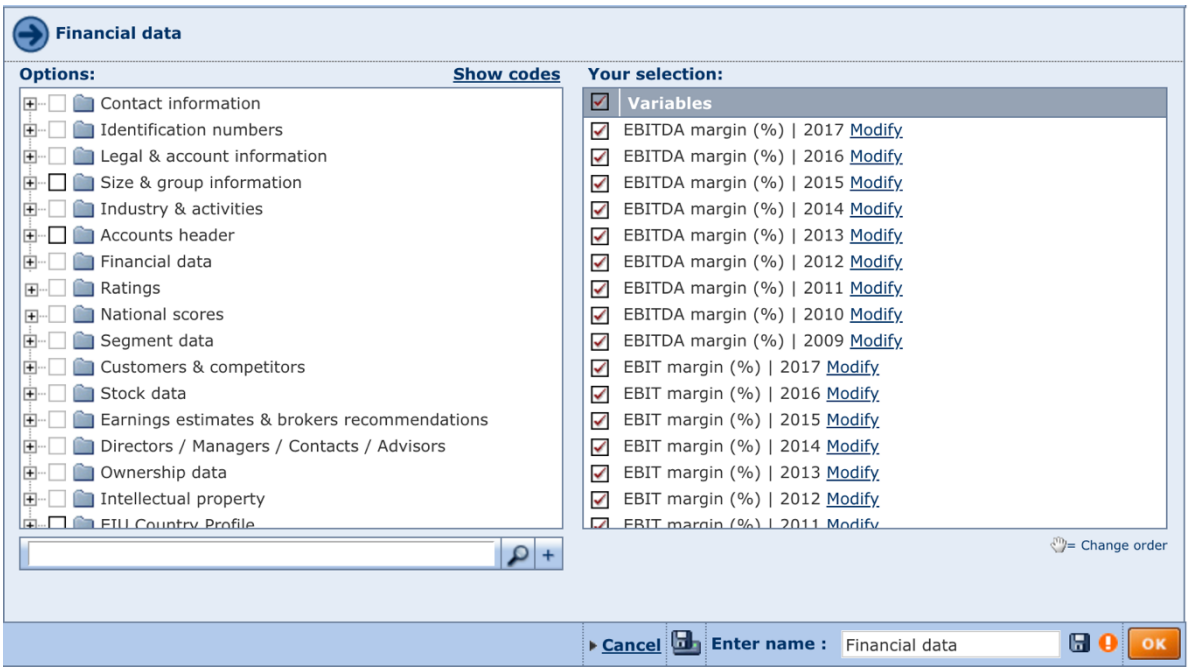
3. To view the list of subsidiaries found as a search result, along with the company's ISO code, turnover, global ultimate owner (GUO) with more, we select "View list of results".

	Company name	Country ISO Code	NACE Rev. 2 Core code (4 digits)	Cons. code	Last avail. year	Operating revenue (Turnover) th USD Last avail. yr	Number of employees Last avail. yr	BvD Indepe Indicat	GUO - Name	Add
1.	JOINT-STOCK COMPANY VTB CAPITAL	RU	6499	U1	2017	679,682,406	464	D	GOVERNMENT OF THE RU	
2.	VOLKSWAGEN AG	DE	2910	C1	2017	287,896,660	642,300	D	FAMILIEN PORSCHE/PIECH	
3.	VITOL HOLDING B.V.	NL	6420	C1	2016	151,623,290	2,194	D	VITOL HOLDING II SA	
4.	EXOR N.V.	NL	6420	C2	2016	147,745,757	302,562	D	JOHN ELKANN AND FAMIL	
5.	PUBLICHNOE AKTSIONERNOE OBSCH...	RU	1920	C2	2017	104,409,358	302,100	D	GOVERNMENT OF THE RU	
6.	TRAFIGURA PTE LTD	SG	6612	U1	2014	103,385,577	n.a.	D	FARRINGFORD N.V.	
7.	TRAFIGURA GROUP PTE. LTD.	SG	6420	C1	2016	98,097,800	4,107	D	FARRINGFORD N.V.	
8.	TRAFIGURA BEHEER B.V.	NL	4671	C1	2015	97,242,600	5,286	D	FARRINGFORD N.V.	
9.	UNIPER GLOBAL COMMODITIES SE	DE	4671	U1	2017	90,445,177	864	D	UNIPER SE	
10.	GLENCORE ENERGY UK LTD.	GB	6612	U1	2017	79,476,677	404	D	GLENCORE PLC	
11.	SHELL EASTERN TRADING (PTE) LTD	SG	8110	U1	2017	78,704,701	n.a.	D	ROYAL DUTCH SHELL PLC	
12.	AUDI AG	DE	2910	C1	2017	73,809,693	91,231	D	FAMILIEN PORSCHE/PIECH	
13.	SHELL TRADING INTERNATIONAL LIM...	GB	4671	U1	2017	71,609,734	649	D	ROYAL DUTCH SHELL PLC	
14.	PSA AUTOMOBILES SA	FR	2910	U1	2017	70,831,501	53,039	D	PEUGEOT S.A.	
15.	AIRBUS	FR	3030	U1	2017	70,001,619	8,041	D	AIRBUS SE	

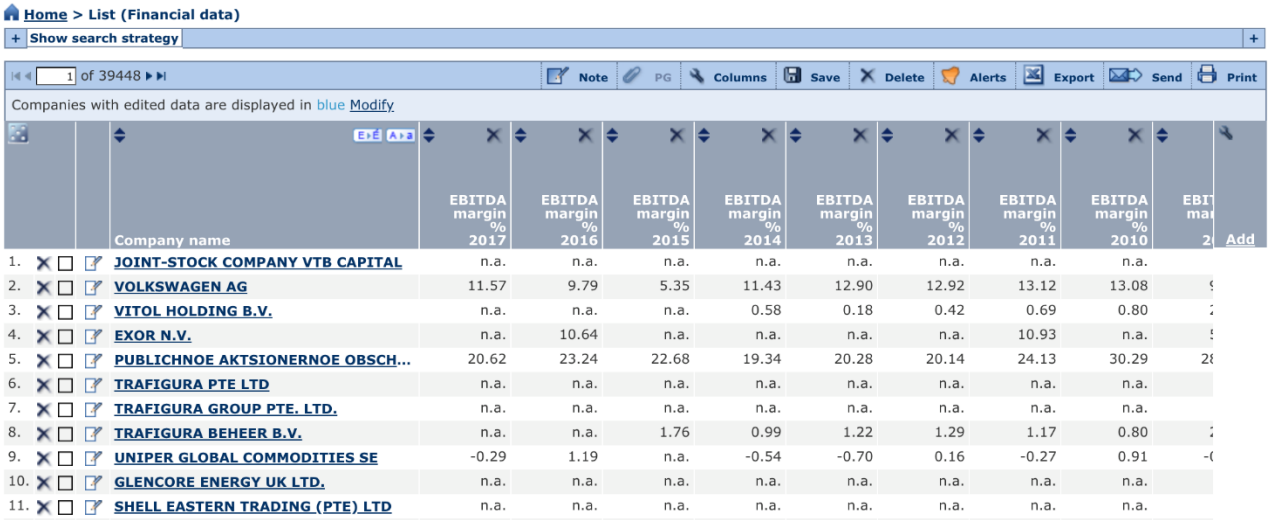
4. We then define a new list by selecting (Define the format – List format – Create/ modify a format – New format).



Moreover, we select BvD ID number, EBITDA margin, EBIT margin, turnover and total liabilities and debt.



The obtained list of financial data on subsidiaries with parent companies in Europe can now be exported to “Excel” by selecting the “Export” tab.



Appendix E. Do-file of the main specification

```
*** DO FILE OF THE MAIN SPECIFICATION
rename Turnover sales
label variable sales "Turnover"
label variable Liabilities "Total Liabilities(mln)"
label variable Total "Total assets"
label variable RDTurnover "R&D over Turnover(mln)"

*** GENERATING A PROXY FOR SALES BY USING OPERATING TURNOVER AS A
PROXY
egen sales = mean(sales), by (BvDIDnumber year)
egen total_assets = mean(Total), by(BvDIDnumber year)
gen total_assets_mil = total_assets/1000000
label variable total_assets_mil "Total assets(mln)"
label variable total_assets "Total assets"
gen log_sales = ln(sales)
label variable log_sales "Log(Sales)"
bysort BvDIDnumber: gen growth_opp=((sales-sales[_n-1])/sales[_n-1])
bysort countrycode year: egen growth_opp_final=median(growth_opp)
rename growth_opp growth_sales
rename growth_opp_final growth_opp
label variable growth_opp "Growth opportunities"

*** MEAN OF EBITDA AND EBIT
egen ebitda =mean(EBITDAmargin), by(BvDIDnumber year)
label variable ebitda "EBITDA margin"
egen ebit = mean(EBITmargin), by(BvDIDnumber year)
label variable ebit "EBIT margin"

*** MERGING THE DATASETS INTO, THE BVD ID NUMBERS OF THE GLOBAL
ULTIMATE OWNERS
merge m:m Companyname BvDIDnumber using
"\\Penny\Stud$\s145243\System\Desktop\Master\Orbis\Extra Orbis\allglobalowners.dta",
generate(_match)
drop if _match==1
drop if _match==2
merge m:m Companyname BvDIDnumber using
"\\Penny\Stud$\s145243\System\Desktop\Master\Orbis\another one\countrycodes.dta",
generate(_matches)
drop if _matches == 1
drop if _matches == 2

*** DROPPING PURELY DOMESTIC FIRM
generate foreign =(countrycode!=pcountrycode)
label variable foreign "=1 if foreign; 0 = if domestic"
egen id_parent = group(GUOBvDIDnumber)
bysort id_parent year: egen MNC=max(foreign)
label variable MNC "=1 if MNC; =0 if domestic firm"
```

```
drop if MNC == 0
drop if foreign == 0

*** SORTING BY COUNTRYCODES
sort countrycode
sort pcountrycode

*** MERGE OBSERVATIONS WITH TAX RATES
merge m:m year countrycode using
"\\Penny\Stud$\s145243\System\Desktop\Master\Orbis\data\taxrates.dta",
generate(_mergeTax)
drop if missing(A)
drop if _mergeTax==1
drop if _mergeTax==2
label variable taxrate "Statutory tax rate"
drop if missing(GUOBvDIDnumber)

*** MERGE PARENT OBSERVATIONS WITH TAX RATES
merge m:m year pcountrycode using
"\\Penny\Stud$\s145243\System\Desktop\Master\Orbis\data\parentaxrates.dta",
generate(_mergeParentTax)
rename taxrate parenttaxrate
drop if _mergeParentTax==1
drop if _mergeParentTax==2

*** CREATING OWN ID FOR THE SUBSIDIARIES
egen id_subsidiary = group(BvDIDnumber)

*** CONTROL VARIABLES
merge m:m year countrycode using
"\\Penny\Stud$\s145243\System\Desktop\Master\inflationrate.dta",
generate(_mergeInflation)
drop if _mergeInflation==1
drop if _mergeInflation==2
label variable inflationrate "Inflation"
merge m:m year countrycode using
"\\Penny\Stud$\s145243\System\Desktop\Master\gdp.dta", generate(_mergeGDP)
drop if _mergeGDP==1
drop if _mergeGDP==2
merge m:m year Country using
"\\Penny\Stud$\s145243\System\Desktop\Master\Orbis\wgidataset_stata\wgidataset.dta",
generate(_mergeCorruption)
drop if _mergeCorruption==1
drop if _mergeCorruption==2
rename cce Corruption_estimates
label variable Corruption_estimates "Corruption index"
merge m:m year countrycode using
"\\Penny\Stud$\s145243\System\Desktop\Master\Orbis\Tax index\subsreciprocal.dta",
generate(_mergeTaxindex)
drop if _mergeTaxindex == 2
```

```
drop if _mergeTaxindex == 1
rename Reciprocal subsreciprocal
merge m:m year pcountrycode using
"\\Penny\Stud$\s145243\System\Desktop\Master\Orbis\Tax index\parentreciprocal.dta",
generate(_mergeParentReciprocal)
drop if _mergeParentReciprocal==1
drop if _mergeParentReciprocal==2
drop _match _matches _mergeTax _mergeParentTax _mergeInflation _mergeGDP
_mergeCorruption _mergeTaxindex _mergeParentReciprocal

*** MAXIMUM TAX DIFFERENCE VARIABLE
bysort id_parent year: egen tax_min=min(taxrate)
gen max_tax_diff = (taxrate - tax_min)
label variable max_tax_diff "Maximum tax difference"
gen NLS = (max_tax_diff!=0)
label variable NLS "NLS(not the lowest taxed subsidiary)"

*** CREATING A MEAN FOR SUBSIDIARIES RECIPROCAL
egen subs_reciprocal = mean(subsreciprocal), by(id_subsidiary year)
label variable subs_reciprocal "Mean reciprocal value for subsidiaries"
*** WEIGHTING FACTOR
egen reciprocal_MNC = mean(parentreciprocal), by(id_parent year)
gen W = subs_reciprocal/reciprocal_MNC
drop if taxrate ==.

*** WEIGHTED TAX DIFFERENCE VARIABLE
sort id_parent year
set more off
local i=1
bysort id_parent year: egen Sb=count(id_subsidiary)
egen MaxSb = max(Sb)
while(taxrate[_n+`i']!=.)&`i'<=MaxSb{
bysort id_parent year: gen wdiff`i'=(taxrate-taxrate[_n+`i'])*(W[_n+`i'])
replace wdiff`i'=0 if wdiff`i'==.
bysort id_parent year: gen wdiff_`i'=(taxrate-taxrate[_n-`i'])*(W[_n-`i'])
replace wdiff_`i'=0 if wdiff_`i'==.
local i=`i'+1
}
egen weighted_tax_diff=rowtotal(wdiff*)
drop wdiff*
label variable weighted_tax_diff "Weighted tax difference"

*** DESCRIPTIVE STATISTICS
tabstat taxrate max_tax_diff weighted_tax_diff, by(Country)
ssc install asdoc, replace
asdoc tabstat taxrate max_tax_diff weighted_tax_diff, by(Country) using myfile.doc, replace

*** CORRELATION BETWEEN THE THREE TAX MECHANISMS
corr taxrate  max_tax_diff weighted_tax_diff
asdoc corr taxrate max_tax_diff weighted_tax_diff, using myfile.doc, replace
```

```
*** OVERVIEW OF THE TAX ATTRACTIVENESS INDEX AND THE CONCEALMENT COST INDICATOR
asdoc tabstat CustomizedTaxAttractivenessIn subsreciprocal reciprocal_MNC, by(Country), using myfile2.doc, replace
*** YEAR DUMMIES
tabulate year, gen(yr)

*** REGRESSIONS WITH EBITDA AND EBIT
xtreg ebitda taxrate weighted_tax_diff max_tax_diff subsreciprocal yr*, fe ro
di r(rho)^2
outreg, se sdec(3) starloc(1) starlevels(10 5 1) summstat(r2\N) summdec(0.00) summtitles("R-squared"\"Number of observations") varlabels colwidth(20) ctitles("OLS regression results""(1)") basefont(fs10)
estimates store est1
xtreg ebitda taxrate weighted_tax_diff max_tax_diff subsreciprocal log_sales inflationrate Corruption_estimates growth_opp RealGDPgrowth yr*, fe ro
di r(rho)^2
outreg, se sdec(3) starloc(1) starlevels(10 5 1) summstat(r2\N) summdec(0.00) summtitles("R-squared"\"Number of observations") varlabels colwidth(20) ctitles("OLS regression results""(2)") basefont(fs10)
estimates store est2
xtreg ebit taxrate weighted_tax_diff max_tax_diff subsreciprocal yr*, fe ro
di r(rho)^2
outreg, se sdec(3) starloc(1) starlevels(10 5 1) summstat(r2\N) summdec(0.00) summtitles("R-squared"\"Number of observations") varlabels colwidth(20) ctitles("OLS regression results""(3)") basefont(fs10)
estimates store est3
xtreg ebit taxrate weighted_tax_diff max_tax_diff subsreciprocal log_sales inflationrate Corruption_estimates growth_opp RealGDPgrowth yr*, fe ro
di r(rho)^2
outreg, se sdec(3) starloc(1) starlevels(10 5 1) summstat(r2\N) summdec(0.00) summtitles("R-squared"\"Number of observations") varlabels colwidth(20) ctitles("OLS regression results""(4)") basefont(fs10)
estimates store est4

*** REGRESSION WITHOUT WEIGHTED TAX DIFF (EBITDA AND EBIT)
xtreg ebitda taxrate max_tax_diff subsreciprocal log_sales inflationrate Corruption_estimates growth_opp RealGDPgrowth yr*, fe ro
di r(rho)^2
outreg, se sdec(3) starloc(1) starlevels(10 5 1) summstat(r2\N) summdec(0.00) summtitles("R-squared"\"Number of observations") varlabels colwidth(20) ctitles("OLS regression results""(5)") basefont(fs10)
estimates store est5
xtreg ebit taxrate max_tax_diff subsreciprocal log_sales inflationrate Corruption_estimates growth_opp RealGDPgrowth yr*, fe ro
di r(rho)^2
outreg, se sdec(3) starloc(1) starlevels(10 5 1) summstat(r2\N) summdec(0.00) summtitles("R-squared"\"Number of observations") varlabels colwidth(20) ctitles("OLS regression results""(6)") basefont(fs10)
estimates store est6
```

```
*** REGRESSION WITHOUT MAX TAX DIFF (EBITDA AND EBIT)
xtreg ebitda taxrate weighted_tax_diff subsreciprocal log_sales inflationrate
Corruption_estimates growth_opp RealGDPgrowth yr*, fe ro
di r(rho)^2
outreg, se sdec(3) starloc(1) starlevels(10 5 1) summstat(r2\N) summdec(0.00)
summtitles("R-squared"\"Number of observations") varlabels colwidth(20) ctitles("OLS
regression results""(4)") basefont(fs10)
estimates store est7
xtreg ebit taxrate weighted_tax_diff subsreciprocal log_sales inflationrate
Corruption_estimates growth_opp RealGDPgrowth yr*, fe ro
di r(rho)^2
outreg, se sdec(3) starloc(1) starlevels(10 5 1) summstat(r2\N) summdec(0.00)
summtitles("R-squared"\"Number of observations") varlabels colwidth(20) ctitles("OLS
regression results""(4)") basefont(fs10)
estimates store est8

*** THE REST EXAMINE IF THE TAX MECHANISMS ARE OMITTED FROM THE
ANALYSIS
xtreg ebitda taxrate subsreciprocal log_sales inflationrate Corruption_estimates
growth_opp RealGDPgrowth yr*, fe ro
di r(rho)^2
outreg, se sdec(3) starloc(1) starlevels(10 5 1) summstat(r2\N) summdec(0.00)
summtitles("R-squared"\"Number of observations") varlabels colwidth(20) ctitles("OLS
regression results""(4)") basefont(fs10)
estimates store est9
xtreg ebit taxrate subsreciprocal log_sales inflationrate Corruption_estimates growth_opp
RealGDPgrowth yr*, fe ro
di r(rho)^2
outreg, se sdec(3) starloc(1) starlevels(10 5 1) summstat(r2\N) summdec(0.00)
summtitles("R-squared"\"Number of observations") varlabels colwidth(20) ctitles("OLS
regression results""(4)") basefont(fs10)
estimates store est10
xtreg ebitda weighted_tax_diff subsreciprocal log_sales inflationrate Corruption_estimates
growth_opp RealGDPgrowth yr*, fe ro
di r(rho)^2
outreg, se sdec(3) starloc(1) starlevels(10 5 1) summstat(r2\N) summdec(0.00)
summtitles("R-squared"\"Number of observations") varlabels colwidth(20) ctitles("OLS
regression results""(4)") basefont(fs10)
estimates store est11
xtreg ebit weighted_tax_diff subsreciprocal log_sales inflationrate Corruption_estimates
growth_opp RealGDPgrowth yr*, fe ro
di r(rho)^2
outreg, se sdec(3) starloc(1) starlevels(10 5 1) summstat(r2\N) summdec(0.00)
summtitles("R-squared"\"Number of observations") varlabels colwidth(20) ctitles("OLS
regression results""(4)") basefont(fs10)
estimates store est12
xtreg ebitda max_tax_diff subsreciprocal log_sales inflationrate Corruption_estimates
growth_opp RealGDPgrowth yr*, fe ro
di r(rho)^2
```

```
outreg, se sdec(3) starloc(1) starlevels(10 5 1) summstat(r2\N) summdec(0.00)
summtitles("R-squared"\"Number of observations") varlabels colwidth(20) ctitles("OLS
regression results""(4)") basefont(fs10)
estimates store est13
xtreg ebit max_tax_diff subsreciprocal log_sales inflationrate Corruption_estimates
growth_opp RealGDPgrowth yr*, fe ro
di r(rho)^2
outreg, se sdec(3) starloc(1) starlevels(10 5 1) summstat(r2\N) summdec(0.00)
summtitles("R-squared"\"Number of observations") varlabels colwidth(20) ctitles("OLS
regression results""(4)") basefont(fs10)
estimates store est14

*** OUTPUT AS TABLES
esttab est1 est2 est3 est4 est5 est6 est7  ,label mtitles("(1)""(2)""(3)""(4)""(5)""(6)""(7)")
title("OLS regression results") drop(yr*) b(3) se(3) r2(3), using example3.rtf
esttab est8 est9 est10 est11 est12 est13 est14, label
mtitles("(8)""(9)""(10)""(11)""(12)""(13)""(14)") title("OLS regression results") drop(yr*)
b(3) se(3) r2(3), using example4.rtf
```

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