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Tax Sensitivities in the Profit Distribution

A Study of European Multinationals

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Abstract

The main purpose of this study is to analyze the tax sensitivity of European Multinationals. In income shifting literature, it has become a common approach to assume that the most tax aggressive MNCs tend to bunch around zero profits. Due to concerns raised in recent literature in terms of income shifting constraints and lack of flexibility, we aim to examine whether tax sensitivities are heterogeneous in the profit distribution. Consequently, we perform interquantile range regressions using the capital-weighted tax incentives measure developed by Huizinga and Laeven (2008), and the dependent variable ln(ROA+1) introduced by De Simone et al. (2017). When analyzing financial and ownership data from the Amadeus database, we found that the tax sensitivity is greater around the narrow range of zero profitability. This implies that the assumption of bunching around zero is valid, and that the profit distribution displays heterogeneous levels of tax sensitivity. However, we observe higher levels of tax sensitivity than anticipated in other parts of the profit distribution, which suggests that the distribution of tax sensitivity could be less heterogeneous than initially presumed.

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Contents

1. Introduction

In terms of trade, Europe has become one large internal market without internal frontiers, which fosters growth and development (Schreiber, 2013). However, the flipside of the coin is that cross border transactions raise the threat of tax minimizing actions of MNCs, which causes the erosion of governments´ tax bases. The extensive use of tax minimizing strategies has become a frequently discussed issue both in the media, and in recent literature. Grubert et al. (1993) found that the most tax aggressive MNCs tend to bunch around zero profits, which has become a common assumption in literature on income shifting ever since. As an example, Habu (2017) attributed the entire difference in reported income between MNCs and domestic standalones, to MNCs reporting zero taxable profits. Another study, conducted by Johannesen et al. (2017), utilized the assumption of bunching around zero as an indicator of tax aggressive MNCs. The assumption is based on the fact that MNCs have incentives to shift profits to the lowest taxed affiliate, leaving all other affiliates in the group with approximately zero profits. However, other studies have raised some concerns relating to the assumption of tax aggressive MNCs bunching around zero.

Hopland et al. (2018) proposed that affiliates with income shifting constraints could bunch around zero as a result of low levels of sales, and not as a result of tax minimizing strategies. Moreover, Hopland et al. (2015) suggested that some highly tax aggressive MNCs could be limited by the level of flexibility, which could result in precautionary behavior due to higher uncertainty when predicting future earnings. Thus, lack of flexibility and inability to predict future earnings could cause affiliates of highly tax aggressive MNCs to report profits or losses. As a direct consequence of the extensive use of the assumption of bunching around zero, as well as the concerns regarding the assumption raised in recent literature, we would like to contribute to the existing literature by investigating whether tax sensitivities are heterogeneous in the profit distribution. Moreover, we control for affiliates restricted by income shifting constraints, as well as affiliates affected by precautionary behavior.

Because of the crucial role the assumption of bunching around zero plays in the literature surrounding income shifting, we developed our main hypothesis (H1), which is stated as follows:

H1: Tax-sensitivities are heterogeneous within the profit distribution.

In addition, we provide two additional hypotheses to control for the concerns regarding the assumption, as presented above. The sub-hypotheses (H2 and H3) in this thesis are:

H2: Affiliates with income shifting constraints reduce the observed tax-sensitivities in the profit distribution

H3: Affiliates less dependent on precautionary behavior inflate the observed tax sensitivities in the profit distribution

In order to provide conclusive evidence supporting the above mentioned hypotheses we use unbalanced panel data from the Amadeus database. With the intention of properly studying the tax sensitivities in the full profit distribution, we apply the capital-weighted tax incentives measure proposed by Huizinga and Laeven (2008), as well as the dependent variable ln(ROA+1) presented in De Simone et al. (2017). The multilateral approach of the tax incentives measure allows us to take into account the income shifting between all affiliates in a given MNC. The dependent variable allows for the inclusion of both profitable and unprofitable affiliates, which is essential for the purpose of our study. Finally, in order to observe potential fluctuations in tax sensitivity throughout the distribution, we employ quantile regressions. We calculate semi-elasticities for different parts of the profit distribution with the intent of interpreting the tax sensitivity by calculating the percent change in expected ROA as a result of a 1% change in the composite tax rate.

In the interest of studying the possible heterogeneity in the profit distribution, we observe the marginal effect and semi-elasticities resulting from estimates stemming from an interquantile range regression. The findings imply that we have a heterogeneous distribution of tax sensitivities, though, possibly to a smaller extent than previously anticipated. Finding relatively higher tax sensitivities throughout the profit distribution than presumed suggests a more homogeneous distribution, despite the fact that the test provides the highest estimates of tax sensitivity in the narrow range of zero. Indeed, the semi-elasticity related to affiliates bunching around zero implies that a 1% increase in the composite tax incentives is associated with a decrease in expected ROA of 3%. Although the findings support our main hypothesis, H1, we perform tests for our additional hypotheses to investigate the concerns related to the commonly accepted view of the distribution of tax sensitivity.

At first, the results stemming from the tests related to H2 seemed to support our hypothesis, meaning that, at least for affiliates bunching around the zero profitability mark, affiliates with income shifting constraints are the source of a downward bias in the estimates derived when testing H1. However, we did not find clear evidence for the other parts of the profit distribution and even the promising results pertaining to the affiliates closest to zero became dubious with further analysis. Moreover, the effect on the semi-elasticity was rather small even for affiliates located in the narrow range around zero profitability. We merely estimated a 0.05 percentage point increase in tax sensitivity in this part of the profitability distribution, an increase that could potentially be attributed to the exclusion of unprofitable affiliates from the interval. Hence, we were unable to provide conclusive evidence confirming our second hypothesis.

The third hypothesis was designed with the purpose of testing the effect of precautionary behavior on our estimates related to H1. Affiliates in fairly stable markets were defined as better suited to predict future earnings, and thus, less affected by precautionary behavior. Although we expected such affiliates to display higher tax sensitivity than affiliates in relatively unstable markets, thereby biasing our estimates from the tests performed in the context of H1, the outcome of the tests contradicted our expectations, leaving us unable to confirm the validity of our third hypothesis.

Additionally, we performed a robustness test using the difference in an affiliate´s statutory tax rate and the statutory tax rate of the lowest taxed affiliate in the group as the tax incentives measure. The test was performed to control for possible interpretation difficulties as well as measurement errors in the capital-weighted tax incentives measure. The outcome of the robustness test confirmed H1, although the findings were less in line with our expectations.

Finally, we conducted a robustness test on a smaller sample, with quantiles containing equal intervals of ROA. The test was performed as a result of concerns related to extreme observations present in our sample, as well as the desire to study some parts of the distribution more closely. Subsequently, the sample was restricted to affiliates with ROA levels in the range of -10% to 10%, and affiliates were separated into ten different quantiles with a 2% range in ROA. The result displayed some tendencies in tax sensitivities suggesting that the bunching around zero assumption could be a valid approach, and consequently, implied that the distribution of tax sensitivity was heterogeneous, confirming H1. Nevertheless, the approach with smaller quantiles appeared to be too narrow, yielding estimates that varied in significance, leaving us unable to provide evidence supporting H1.

In the remainder of this paper, section 2 provides an overview of related literature. Section 3 presents the hypotheses development. Furthermore, section 4 discusses the implemented methodology. Section 5 presents data and descriptive statistics. Section 6 consists of empirical results and analysis. Section 7 provides the findings related to the robustness tests. Finally, concluding remarks are given in section 8.

2. Related Literature

The use of tax avoidance by MNCs through income shifting has become a public and frequently debated issue (Hopland, Lisowsky, Mardan, & Schindler, 2015). The realization by the media and the public that some of the biggest and most profitable MNCs, such as Apple and Google, hardly pay any income related taxes has fueled the debate further ((Bergin, 2012); (Levin & McCain, 2013)). Habu (2017), studying MNCs in the UK, exemplified the importance of this issue by showing that even though such entities were 25% more productive than domestic firms on average, they reported lower profits. The most common strategies employed by MNCs in order to reduce their global tax burden are profit shifting via abusive transfer pricing and debt shifting. The literature claims that applying transfer pricing strategies are easier and less costly than thin capitalization strategies. This is related to the difficulty in observing and enforcing the arm´s length prices compared to effective TC-rules. Indeed, the authorities more easily detect the use of artificially high interest rates, used by MNCs to shift income through debt shifting, than the mispricing of repeated intra-firm transactions. Because of the detectability of interest rates, MNCs are potentially forced to use lower interest rates, hence reducing the attractiveness of debt shifting as a tool to shift large amounts of profits. On the other hand, finding comparable transactions applicable to prove abusive mispricing has shown itself to be a challenging task for tax authorities around the world. Consequently, abusive transfer pricing is generally regarded as the cheapest tax avoidance measure, due to lower concealment costs. (Hopland, Lisowsky, Mardan, & Schindler, 2015).

Over the years, several studies have been conducted in order to research income shifting which utilizes the relationship between profitability and tax rates to optimize after tax profits. There has been provided substantial evidence that multinational companies reduce their global tax bill by shifting taxable income from high-tax countries to low-tax countries, leading to governments´ distress concerning the erosion of their respective tax bases. ((Hines & Rice, 1994); (Klassen, Lang, & Wolfson, 1993); (Habu, 2017)). Thus, the income shifting behavior of MNCs has figured as an important subject when devising policy in several parts of the world. Another compelling argument for its place in the public limelight is the competitive advantage it provides for MNCs compared to domestic firms. Indeed, the MNCs´ presence across countries allows them to exploit the tax rate differentials in a way that is inherently impossible for domestic firms. Over time, the reduced tax bill accumulates to substantial after-tax profits, which allows the MNCs to launch investments they otherwise could not afford, and that comparable domestic firms would not be able to undertake because of their relatively smaller after-tax profits. ((Keen & Konrad, 2014); (Dharmapala & Riedel, 2013)).

With the amplified globalization, MNCs employing tax minimizing strategies has increased substantially. Consequently, there has been a prolific increase in the size of the existing literature related to income shifting, causing the development of several approaches to study the practice. As an illustration, Grubert and Mutti (1991) used an approach relying on the interaction between tax rates and profitability to evaluate income shifting. Furthermore, Klassen et al. (1993) partly replicated this methodology by slightly shifting their focus towards changes in tax rates and the subsequent response in profit shifting of MNCs. Nevertheless, the use of tax havens was the focal point of the methodology employed by Hines and Rice (1994). The latter approach has since imposed itself as a common model for studies of the income shifting behavior of MNCs (Dharmapala, 2014). This discussion illustrates the magnitude of approaches devised to study the income shifting practices of MNCs.

In the literature concerning income shifting, many have focused on studying the most aggressive MNCs to find patterns identifying their behavior. This has generated valuable insights which are crucial when designing laws and actions to curb tax planning. In this context, the literature has repeatedly shown that multinationals tend to bunch around zero profits in high-tax countries as a result of abusive transfer pricing strategies ((Koethenbuerger, Mardan, & Stimmelmayr, 2019); (Hopland, Lisowsky, Mardan, & Schindler, 2015)). As an illustration, Habu (2017) studied unconsolidated corporate tax returns in the UK and found that foreign multinational subsidiaries underreport their taxable income by 50% compared to domestic standalones. The difference in reported profits was in a large extent, attributed to MNCs reporting zero profits in the UK. Also, bunching around zero has been widely used as an indicator of tax aggressive income shifting ever since Grubert et al. (1993) provided evidence that MNCs does so to a greater extent than domestic companies. As an example, Johannesen et al. (2017) uses bunching around zero as a signal of aggressive income shifting when studying whether there are systematic differences with regards to profit shifting between developed and less developed countries. This method is based on the logic anchored in the literature stating that optimally, an aggressive MNC would shift all profits to the affiliate with the lowest tax rate in order to minimize the tax costs, resulting in all other affiliates reporting zero profits. The study, therefore, employs a binary variable to identify MNCs that report profits within a narrow range of zero in all other affiliates than the lowest taxed affiliate, when calculating the difference in tax sensitivity of affiliates operating in developed countries and less developed countries. The bunching around zero assumption would potentially hint at observations of higher tax sensitivities around the zero profitability mark.

When studying the tax aggressiveness of MNCs, researchers study the responsiveness to tax incentives by estimating the tax sensitivity. A tax aggressive MNC is associated with a higher tax sensitivity due to an observed higher responsiveness to increased tax incentives, when compared to its peers. An illustration of such studies is Habu (2017), who found that MNCs reported a ratio of taxable profits to total assets that was 12.8 percentage points lower than that of comparable domestic companies. The difference was attributed to MNCs reporting zero taxable profits. Johannesen et al. (2017) found that a decrease in the statutory tax rate of a foreign affiliate of 10 percentage points, is associated with a 3.5 percentage points increase in the likelihood of an affiliate reporting zero profits in low/middle-income countries, and a 1,5 percentage point increase in what is considered to be high-income countries. Although, the above mentioned studies demonstrate that tax sensitivities are becoming the focal point when researching income shifting patterns of MNCs, they also confirm the heavy reliance on the bunching around zero assumption when exploring the aggressiveness of MNCs. Indeed, the approaches used in these studies implicitly imply that affiliates pertaining to aggressive tax planners should be located around the zero profitability mark.

There are two mechanisms that contribute to multinationals bunching around zero: First, the MNCs can shift profits out of relatively higher taxed profitable affiliates. Second, the MNCs can shift profits in to loss making affiliates were the effective tax rate is lower than the statutory tax rate. The dual effect reduces the taxable profits, and thereby, the tax burden of the MNC. ((De Simone, Klassen, & Seidman, 2017); (Hopland A. O., Lisowsky, Mardan, & Schindler, 2018)). However, while the "bunching around zero" assumption is generally accepted as valid and employed by many prominent researchers, it has been challenged or nuanced in recent work. In fact, Hopland et al. (2018), refined the understanding of Johannesen et al. (2017) regarding the bunching around zero as a proxy for aggressiveness by suggesting that for some affiliates, the bunching could stem from the lack of profits to shift. In reality, affiliates with low sales would consequently have low profits and bunch around zero, although, for reasons unrelated to aggressive income shifting. This implies that these affiliates could potentially bias the results when using bunching around zero as an indicator of highly tax aggressive MNCs.

In addition, although Hopland et al. (2015) concluded that multinationals tend to bunch around zero, they provided evidence that firms reporting a profit or loss, could be just as tax-aggressive as the firms that bunches around zero. This is due to a low degree of flexibility and anticipations surrounding the probability of operational losses resulting in the need to plan their income shifting activities ex ante. This implies that multinational firms with less flexibility could be highly aggressive even though they report profits different than zero in high tax jurisdictions. The discussion presented by Hopland et al. (2015) would implicitly mean that very aggressive tax avoiders could report higher profits than previously anticipated as a result of lacking flexibility. They also state that the flexibility can be reduced due to incentives tied to local management and the efforts of tax authorities to divulge income shifting practices. These two factors could also decrease the ability of MNCs to converge their relatively higher taxed affiliates´ profits towards zero.

The discussion above is unveiling to critical points. Firstly, as the bunching around zero assumption has become a fundamental pillar when studying tax aggressiveness, it generates a need to validate the assumption. Secondly, the findings of Hopland et al. (2015) amplifies the need to test this assumption, as it raises sound concerns surrounding the assumption´s credibility due to the study implying that tax aggressive affiliates can be located further away from zero, for instance, as a result of lacking flexibility.

3. Hypothesis Development

As previously stated, recent literature provides evidence that the most aggressive MNCs tend to bunch around zero profits. A common approach for determining the tax sensitivity of MNCs is to rely on the bunching around zero assumption, as seen in the research performed by both Habu (2017) and Johannesen et al. (2017). This assumption implies that the most tax aggressive affiliates are located in the narrow range of zero as a result of income shifted to the lowest taxed affiliate of the group. To exemplify, if a MNC has ten affiliates located in different tax jurisdictions across Europe, where nine of them face relatively higher tax rates than the last one, we would expect to observe approximately zero profits in the first nine affiliates, and unexplainably high profits in the last one. This example, while un-nuanced, shows the basic logic behind the assumption. If a majority of affiliates attached to tax aggressive MNCs do in fact bunch around zero, it would imply that the observed tax sensitivity would be relatively higher around the zero profitability mark than the rest of the profit distribution, hence yielding a heterogeneous tax sensitivity throughout the profit distribution.

Interestingly enough, one finding that raises questions about the levels of tax sensitivity observed around the zero profitability mark is income shifting constraints, which has been brought up in the research performed by Hopland et al. (2015). Affiliates with income shifting constraints would presumably have low levels of profitability, potentially in the narrow range around zero, due to low levels of economic performance. This consideration would potentially yield a lower tax sensitivity in the range around zero, not as a result of intensive income shifting activities, and hide the true extent of income shifting.

A second finding that potentially impacts the observed tax sensitivity of affiliates is the level of flexibility found in Hopland et al. (2018). As a consequence of the lack of flexibility, MNCs might be forced to set transfer prices ex ante. Due to the difficulties in predicting future earnings accurately, some tax aggressive MNCs might be influenced by precautionary behavior when setting the transfer prices. This could create a reality where tax sensitive affiliates fall outside the narrow range around zero, where the tax sensitivity is expected to be highest. This specific finding could entail the observation of relatively high levels of tax sensitivity in other parts of the profit distribution. This could result in more fluctuations in the tax sensitivity throughout the profit distribution. Moreover, firms with more flexibility are less affected by precautionary behavior. This could in part mimic ex-post shifting behavior when setting transfer prices, which indicates that such affiliates are more likely to land at zero profitability and generate higher tax sensitivities.

We believe that the clear dependency on the bunching around zero assumption and the concerns raised surrounding its validity impose the importance of studying the tax sensitivity across the profit distribution. As a result, we developed a main hypothesis, H1, to research whether the assumption of bunching around zero is correct:

H1: Tax-sensitivities are heterogeneous within the profit distribution.

In addition, we control for the concerns relating to the assumption as discussed above by providing two additional hypotheses:

H2: Affiliates with income shifting constraints reduce the observed tax-sensitivities in the profit distribution

H3: Affiliates less dependent on precautionary behavior inflate the observed tax sensitivities in the profit distribution

However, to correctly test the above mentioned hypotheses we need to research the full profit distribution of MNCs. Although there exists extensive literature that provides us with evidence of MNCs shifting profits from high-tax to low-tax countries, the effect of income shifting under loss has, to a great extent, been neglected. Klassen et al. (1993) found that loss making affiliates could face a marginal tax rate of zero, but opted to drop loss making affiliates from their sample due to the difficulty in measuring the tax incentives of unprofitable firms and the uncertain effect it could impose on the tax-motivated income shifting behavior. Since then, it has become a common practice not to include loss-making affiliates.

When studying the level of tax sensitivities, we consider it important to take the full profit distribution into account, thereby also including loss affiliates. The importance of this inclusion is highlighted by De Simone et al. (2017) that found that the mere presence of one loss affiliate would alter the behavior of income shifting compared to a wholly profitable group. Their study provides evidence that the tax incentives variable is reversed for loss affiliates compared to profitable affiliates. Thus, MNCs apply this strategy and respond to temporary tax-minimizing opportunities although the costs associated could potentially be high. This is clearly highlighted by their findings stating that the semi-elasticity for profitable affiliates rises from 0.81 to 1.50 when including loss affiliates. In terms of tax sensitivity, they documented that profitable affiliates in groups with loss affiliates are less sensitive to the traditional strategy, than profitable affiliates of entirely profitable groups. These findings highlight the need to include the unprofitable affiliates to correctly assess the levels

4. Methodology

4.1 Theoretical Background

Our methodology does, to a great extent, follow the model specification of De Simone et al. (2017). By reproducing their model, we are able to research the full profit distribution of multinationals, including both profitable and unprofitable affiliates. However, we extend their approach by applying quantile regressions in order to research the tax sensitivity of multinationals throughout the profit distribution.

Hines and Rice (1994) developed a model that has become the common approach when studying the income shifting of multinationals. A multinational group consists of several affiliates that each reports a pre-tax profit, p_i. The pre-tax profit consists of the economic activity conducted in the affiliate, q_i, and the amount of profit shifted in or out of the affiliate, ψ_i, less the cost of shifting, $a/2*\psi_i^2/ p_i$. The amount of profit shifted into or out of the affiliate, ψ_i, would be positive for what is considered a low-tax affiliate, and negative for what is considered a high-tax affiliate. Their model is shown as:

$$\pi_i = p_i + \psi_i - \frac{a}{2}\frac{\psi}{p}$$

The model is based on aggregated income shifting of all affiliates, where a multinational would seek to maximize its aggregated after-tax profits. However, Huizinga and Laeven (2008) expanded the model in order to research income shifting at the affiliate-level. They included a variable C_i that represents the affiliate´s incentive to shift profits in or out depending on whether the C variable is positive or negative. The profits shifted in equilibrium in an affiliate is a function of the incentive and the cost of shifting, and can be mathematically illustrated as follows:

$$\psi_i = \frac{-p_i}{a} C$$

In the model devised by Huizinga and Laeven, C_i is the tax incentive for a certain affiliate relative to all other affiliates within the same multinational group in that year. If the group contains a high-tax affiliate, C would have a relatively higher value, implying a tax incentive to shift profits to the affiliates with lower values of C. The tax incentive variable C_i, is composed of the parameter for the cost of shifting, a, the affiliate´s statutory tax rate, τ_i, and the weighted difference between the affiliate´s tax rate and all other related affiliates´ tax rates. The C is displayed as:

$$C_i = \frac{\sum_{n \neq i}^{N} \frac{p_n}{(1 - \tau_n)} (\tau_i - \tau_n)}{(1 - \tau_i) \sum_{n=1}^{N} \frac{p_n}{(1 - \tau_n)}}$$

However, this model excludes profitable affiliates. Therefore, in order to include the unprofitable affiliates, we employ the model proposed by De Simone et al. (2017). Furthermore, they imposed two modifications to the cost of shifting in Huizinga and Laeven´s model. Firstly, the pre-tax profit, p_i, was substituted for K_i as the driver of the cost of income shifting. K_i represents the affiliate´s economic activity in terms of capital or labor. Secondly, the cost of shifting is not tax deductible. Including these two modifications, the model can be demonstrated as follows:

$$\psi_i = \frac{-K_i}{a} C_i \; where \; C_i = \frac{\sum_{n \neq i} K_n (\tau_i - \tau_n)}{\sum_n K_n}$$

The derivatives of the model would then yield:

$$\frac{\partial \psi_i}{\partial C_i} = \frac{-K_i}{a} \; and \; \frac{\partial \psi_i}{\partial \tau_i} = \frac{K_i}{a} x \left(\frac{K_i}{\sum_n K_n} - 1 \right)$$

The derivatives show that there exists a negative relation between tax incentives and the profit reported in an affiliate. In other words, higher values of the tax incentive, C, implies that the affiliate would shift more profits out to the groups´ affiliates with lower values of C. Moreover, the effect is equivalent for the tax rate: increased tax rate implies that more profits are shifted out of the affiliate to the groups´ affiliates in lower taxed jurisdictions.

As previously discussed in the hypothesis development section, loss could have a significant impact on the affiliate´s marginal tax rate. If affiliate j experiences a loss, it is assumed that the expected present value of the tax rate for affiliate j is affected by the loss, and that this is denoted as $\theta\tau_j$, where $0 <= \theta <= 1$. In this case, θ represents the degree of which the loss affects affiliate j´s tax rate, all else equal. The capital and cost of shifting are not influenced by the loss. The difference in equilibrium shifting stemming from the loss, L, in comparison to the equilibrium shifting if the affiliate had been profitable, P, is computed as follows:

$$\psi_j^L - \psi_j^P = \frac{K_j}{a}(1 - \theta)($$

If the difference is positive, the loss affiliate receives greater amounts of profits, leading to higher reported profits in affiliate j. The interpretation of the derivative reveals the loss´ effect on the equilibrium relation between the tax incentives and the shifted income of affiliate j:

$$\frac{\partial(\psi_j^L - \psi_j^P)}{\partial C_j} = \frac{\partial(\psi_j^L - \psi_j^P)}{\partial \tau_j} = \frac{K_j}{a}(1 - \theta$$

In conclusion, the difference in shifting behavior of the loss affiliate compared to if the same affiliate was profitable, is positive in terms of the tax incentive. When θ approaches zero, meaning when affiliate j´s tax rate drops to zero, the degree to which it is positive increases. If θ=0, the derivate with respect to the tax rate is positive.

4.2 Empirical Strategy

In order to estimate profits as a result of economic activity, the following Cobb-Douglas production function is utilized by both Hines and Rice (1994) and Huizinga and Laeven (2008):

$$\rho = Q - wL = (1 - \beta_3)cK^{\beta_2}L^{\beta_3}A^{\beta_4}e$$

In the formula, in line with equation (1) in the theoretical background, $_i$ is the profit before shifting. Taking log transformations on both sides and incorporating equilibrium income shifting, provides us with the following estimation equation:

$$\log \pi_i = \beta_1 + \beta_2 \log K_i + \beta_3 \log L_i + \beta_4 \log A_i + \beta_5 \log TI_i + \iota$$

In the formula, π is a measure of affiliate i´s profits, K_i is a measure of the affiliate´s capital, L_i is a measure of the affiliate´s labor, A_i is a measure of the affiliate´s productivity, TI_i is a measure of the affiliate´s tax incentive, and β is an empirical estimate of the affiliate´s sensitivity to profit shifting incentives.

The estimation equation above is a common approach in the income shifting literature. However, due to the log specification, loss affiliates are excluded from estimation. In order to circumvent this limitation, De Simone et al. (2017) applies the approach of Claessens and Laeven (2004) where they scale the Cobb-Douglas function by total assets and adds one before taking logs. By specifying the dependent variable as return on assets plus one, (ROA+1), they are able to research a sample of both profitable and unprofitable affiliates.

Furthermore, De Simone et al. extended the model by adding economic factors that they expected would induce losses. Due to the difference in probability of loss depending on where in the lifecycle a firm is located, they added a proxy for age. In addition, they added two shock variables: the change in GDP which represents changes in the local economy of a jurisdiction, and the change in market size, which displays changes in a given industry. Moreover, due to their focus on loss affiliates and their effect on income shifting behavior, they added a binary variable to identify unprofitable affiliates. These modifications resulted in the following estimation equation:

$$\ln(\pi_i + 1) = \beta_0 + \beta_1 * \ln(\text{TangibleAssets}_{it}) + \beta_2 * \ln(\text{CompExp}_{it}) + \beta_3 * \text{IndustryROA}_t + \beta_4 * \text{Age}_{it} + \beta_5 * \Delta\text{GDP}_t + \beta_6 * \Delta\text{MarketSize}_t + \beta_7 * \text{TaxIncentive}_{it} + \beta_8 * \text{Loss}$$

To test our main hypothesis, H1, we utilize the De Simone et al. (2017) approach, by applying it on quantile regressions. Our model can be expressed as the following regression specification, which provides point estimates for the percentiles that represents the cut off point between two quantiles:

$$\ln(\pi_i + 1)^p = \beta_0^p + \beta_1^p * \ln(\text{TangibleAssets}_{it}) + \beta_2^p * \ln(\text{CompExp}_{it}) + \beta_3^p * \text{IndustryROA}_t + \beta_4^p * \text{Age}_{it} + \beta_5^p * \Delta\text{GDP}_t + \beta_6^p * \Delta\text{MarketSize}_t + \beta_7^p * \text{TaxIncentive}_{it}$$

To obtain information regarding the intervals between the quantiles, the following model will provide us with inter-quantile estimates:

$$\ln(\pi_i + 1)^q = \beta_0^q + \beta_1^q * \ln(\text{TangibleAssets}_{it}) + \beta_2^q * \ln(\text{CompExp}_{it}) + \beta_3^q * \text{IndustryROA}_t + \beta_4^q * \text{Age}_{it} + \beta_5^q * \Delta\text{GDP}_t + \beta_6^q * \Delta\text{MarketSize}_t + \beta_7^q * \text{TaxIncentive}_{it}$$

In our specification, q represents the respective quantile. Profit, πi, is represented by ROA which is calculated as the affiliate´s EBIT scaled by total assets (TOAS). As previously stated, we add one to circumvent the limitation of loss affiliates being neglected, before taking the natural logarithm. Replicating the approach of Huizinga and Laeven (2008), that is also applied by De Simone et al. (2017), tangible fixed assets (TFAS) is employed as a proxy for capital and compensation expense (STAF) fills the same role for labor. IndustryROA is a measure of productivity and is calculated using a two-digit NACE industry-country-year code, based on all affiliated and standalone companies. The European Commission reports the percent change in GDP per capita, which we include as a shock variable. The second shock variable, change in market size, is derived as the country-industry-year total sales of all affiliated and standalone companies in year *t*, minus the total sales in year *t-1*, scaled by 1,000,000. We mainly apply the tax incentives measure C, developed by Huizinga and Laeven (2008). Equation (3) displays the calculation of C. The tax incentives measure is a capital weighted differential tax rate of the affiliate relative to all other affiliates in the same multinational group-year. In the calculations of C, the affiliates´ statutory tax rate, STR, is mean-centered to avoid collinearity if interactions are applied (Guenther & Sansing 2010; Aiken & West 1991). β represents the responsiveness to income shifting incentives in the quantile we are researching.

To test our second hypothesis, whether affiliates with income shifting constraints bias our results from H1, we add a binary variable, LowSales to identify affiliates with income shifting constraints. LowSales equals one for affiliates located in the lowest quartile in terms of sales. In addition, we include an interaction term between the binary variable and the tax incentive, C, to separate the responsiveness of the two different groups. We control for income shifting constraints on the entire sample, as well as in each quantile.

Designed model for testing H2 using OLS regression on the full sample:

$$\ln(ROA_{it}+1) = \beta_0 + \beta_1 * \ln(TangibleAssets_{it}) + \beta_2 * \ln(CompExp_{it}) + \beta_3 * IndustryROA_t + \beta_4 * Age_{it} + \beta_5 * \Delta GDP_t + \beta_6 * \Delta MarketSize_t + \beta_7 * TaxIncentive_{it} + \beta_8 * LowSales_{it} + \beta_9 * TaxIncentive_{it} * LowSales_{it}$$

Designed model for testing H2 using interquantile range regression in each quantile:

$$\ln(\mathrm{ROA}_{it}+1)^{q_n} = \beta_0^{q_n} + \beta_1^{q_n} * \ln(\mathrm{TangibleAssets}_{it}) + \beta_2^{q_n} * \ln(\mathrm{CompExp}_{it}) + \beta_3^{q_n} * \mathrm{IndustryROA}_t + \beta_4^{q_n} * \mathrm{Age}_{it} + \beta_5^{q_n} * \Delta\mathrm{GDP}_t + \beta_6^{q_n} * \Delta\mathrm{MarketSize}_t + \beta_7^{q_n} * \mathrm{TaxIncentive}_{it} + \beta_8^{q_n} * \mathrm{LowSales}_{it} + \beta_9^{q_n} * \mathrm{TaxIncentive}_{it} * \mathrm{LowSales}_{it}$$

Finally, to test H3, controlling for precautionary behavior, we generate a binary variable to identify affiliates in relatively stable markets based on the change in industryROA for each industry-country-year. We defined the lower quartile of changes in industryROA as fairly stable markets, and let the binary variable be equal to one for affiliates in this category. Furthermore, we introduced the interaction term between the tax incentive, C, and the binary variable StableMarkets to separate the observed effects of the two different groups. Also, we control for precautionary behavior on the entire sample, as well as in each quantile.

Designed model for testing H3 using OLS regression on the full sample:

$$\ln(ROA_{it}+1) = \beta_0 + \beta_1 * \ln(TangibleAssets_{it}) + \beta_2 * \ln(CompExp_{it}) + \beta_3 * IndustryROA_t + \beta_4 * Age_{it} + \beta_5 * \Delta GDP_t + \beta_6 * \Delta MarketSize_t + \beta_7 * TaxIncentive_{it} + \beta_8 * StableMarkets_{it} + \beta_9 * TaxIncentive_{it} * StableMarkets_{it}$$

Designed model for testing H3 using interquantile range regression in each quantile:

$$\ln(ROA_{it}+1)^{q_n} = \beta_0^{q_n} + \beta_1^{q_n} * \ln(TangibleAssets_{it}) + \beta_2^{q_n} * \ln(CompExp_{it}) + \beta_3^{q_n} * IndustryROA_t + \beta_4^{q_n} * Age_{it} + \beta_5^{q_n} * \Delta GDP_t + \beta_6^{q_n} * \Delta MarketSize_t + \beta_7^{q_n} * TaxIncentive_{it} + \beta_8^{q_n} * StableMarkets_{it} + \beta_9^{q_n} * TaxIncentive_{it} * StableMarkets_{it}$$

These models are employed to provide estimates, which are presented in the upcoming analysis section.

5. Data and Descriptive Statistics

5.1 Data Sources and Sample Restrictions

We obtained information about subsidiary ownership from the BvDEP Ownership database provided by Bureau Van Dijk. The database provides 21 million active and archived links between subsidiaries and owners of over 7 million companies. We were able to access information of both direct and total ownership, allowing us to include indirect ownership of subsidiaries. The database provided us with 4.204.063 observations of subsidiary ownership in Europe, of which, 1.135.262 were majority owned, either directly or indirectly.

Furthermore, we extracted information from the Amadeus database also provided by Bureau Van Dijk. The Amadeus database contains comprehensive information of about 21 million companies. (Wharton Research Data Services, 2019). We excerpted data for the period 2008-2017, providing us with financial information of 128.494.120 observations. In order to avoid duplicates and double counting of observations, we restricted our sample to only include unconsolidated data. In this thesis, we only included multinationals, which we define as a company with a controlling interest in at least one foreign affiliate. Moreover, we require that an affiliate has information regarding earnings before interests and taxes (EBIT) as this variable is used to derive our dependent variable, ROA+1. These requirements leave us with a preliminary sample of 724.368 affiliate-years across Europe.

Our sample selection is in line with De Simone et al. (2017), and is summarized in table 1. In regards to sample selections, we require the affiliate to have information about the NACE code, which is an industry classification that allows us to include an industry-level shock variable. We exclude banks and insurance companies due to the difficulty in estimating profits as a result of assets and compensation expense. Moreover, we require the consolidated group to be profitable, reporting profit or loss before taxes scaled by revenues greater than 3%. Furthermore, we require tangible fixed assets (TFAS), total assets (TOAS) and compensation expense (STAF) to be positive. In addition, we exclude affiliates missing age, or missing shock measures (change in GDP or change in market size). At last, we require the dependent variable ROA+1 to be greater than, or equal to, zero. By including these sample restrictions, we are left with 216.193 observations. The sample consists of 22.199 unique groups, where 31.094 are loss-affiliates, and 185.099 are profitable affiliates.

Table 1: Sample Selection

Affiliate Sample Selection	
European affiliate-years with at least one foreign EU affiliate and not issing EBIT 2008-2017	724 368
Less: Missing NACE code (NACE_PRIM_CODE)	-7647
Less: Banks and insurance companies (NACE codes 65, 66 and 67)	-7018
Less: Group consolidated return on sales (PLBT/REV) less than 3%	-341517
Less: Assets less than or equal to zero, or missing (TOAS and TFAS)	-71210
Less: Compensation expense less than or equal to zero, or missing (STAF)	-54420
Less: Missing age or a measure of economic shock	-25632
Less: ROA+1 less than or equal to zero	-731
Total affiliate-years used for estimation	**216 193**

Table 2 provides an overview of where the affiliates in our sample are located, as well as their parent company´s location. Moreover, the table provides the mean statutory tax rate over the sample period for each respective country. From the table, we notice that our sample used for estimation consists of affiliates from 32 European countries, linked to 22.199 different MNCs with their headquarters situated in a selection of 40 European countries.

Table 2: Country specification

Country	Affiliate-Year n	Mother Affiliates-Year n	Mean Over Sample Period STR
Albania	0	1	0,26
Austria	4 006	1 232	0,25
Bosnia and Herzegovina	1 272	97	0,10
Belgium	10 654	1 277	0,33
Bulgaria	3 123	198	0,10
Switzerland	19	6	0,09
Cyprus	0	45	0,17
Czech republic	14 788	1 111	0,19
Germany	12 361	2 181	0,16
Denmark	3 466	830	0,23
Estonia	2 995	340	0,21
Spain	19 751	1 654	0,28
Finland	4 587	419	0,23
France	30 177	1 692	0,37
United Kingdom	8 098	1 235	0,23
Greece	0	32	0,15
Croatia	4 412	316	0,20
Hungary	3 938	531	0,18
Ireland	1 028	139	0,13
Iceland	77	15	0,20
Italy	24 583	2 124	0,27
Lithuania	0	45	0,21
Luxembourg	1 215	709	0,22
Latvia	184	57	0,15
Moldova	0	10	0,16
Montenegro	259	30	0,09
Macedonia	0	21	0,14
Malta	63	130	0,35
Netherlands	1 731	1 883	0,25
Norway	6 824	683	0,27
Poland	10 408	199	0,19
Portugal	7 658	373	0,28
Romania	11 793	140	0,16
Serbia	4 242	207	0,14
Russia	0	33	0,18
Sweden	9 584	1 308	0,24
Slovenia	3 943	460	0,18
Slovakia	8 199	396	0,21
Turkey	0	24	0,19
Ukrain	755	16	0,21
SUM	**216 193**	**22 199**	

5.2 Model Variables

5.2.1 Dependent Variable

In this study, the dependent variable is the profitability measure ROA+1. Return on assets, ROA, is calculated as earnings before interest and taxes (EBIT) scaled by total assets. By adding 1, we are able to include loss affiliates (De Simone, Klassen, & Seidman, 2017). Using a similar dataset, De Simone et al. (2017) tested different profitability measures. Despite the fact that other profitability measurer such as ln(EBIT) had stronger predicting ability, the use of ROA+1 was preferable as it enabled the researchers to include loss affiliates. Likewise, the use of ROA+1 as the dependent variable provides a great upside as it allows us to research a wider range of the profit distribution.

5.2.2 Economic activity

In line with De Simone et al. (2017), we use capital and labor as proxies for economic activity of an affiliate. First, we use tangible fixed assets (TFAS) as a proxy for capital, which is retrieved from the affiliates´ balance sheet. Second, we use compensation expense (STAF) as a proxy for labor. Compensation expense or costs of employees is extracted from the affiliates´ annual income statement.

5.2.3 Productivity

In the regressions, industryROA is a measure of the average level of productivity in the respective industry. In order to separate different industries, we use a two-digit NACE code to calculate an industryROA variable for each industry, in each country, every year. The Amadeus database provides a four-digit NACE code where the two former digits represents the main industry, and the two latter represents the subcategory. For the purpose of calculating industryROA, it is advantageous to use the main categories instead of the subcategories. By using too narrow classifications, some industries will have too few observations to get a reliable average. As a result, we transform the four-digit NACE code into a two-digit NACE code before calculating industryROA.

5.2.4 Age

Age is calculated as the difference between year *t*, and the year of incorporation. De Simone et al. (2017) uses the difference between year *t* and the first year the affiliate appears in the database. However, due to some issues in the Amadeus database in terms of archived data in the BvDEP ownership database, we chose another calculation. Indeed, prior to 2003, more recent ownership information replaced previous information. However, the BvDEP ownership database includes archived data stemming from 2003 and onwards. (Bureau van Dijk Electronic Publishing, 2006). Therefore, we believe it to be more correct to calculate age with regards to the year of incorporation than in regards to the first year it appeared in the database.

5.2.5 Shock variables

Following the approach applied in De Simone et al. (2017), we include two shock variables. Firstly, we include a measure of change in GDP to represent the changes in the local economy of affiliates. The change in GDP is reported by the European Commission, and is an annual percent change in the GDP per capita (The World Bank Group, 2019). Secondly, we include the change in market size per industry, by using the two-digit NACE code, in each country. This is calculated as the sum of all affiliates´ sales in year *t* less the sum of all affiliates´ sales in year *t-1*, scaled by 1.000.000.

5.2.6 Tax Incentives – C

Conforming with the approach described in De Simone et al. (2017), the tax incentives measure is a capital weighted tax rate differential of the affiliate relative to all other affiliates in the same multinational group-year. In the model, K represents the economic activity in terms of capital or labor. In this thesis, we use capital as a measure of economic activity in an affiliate when calculating the tax incentives measure. In the nominator, we summarize the difference between the affiliate´s tax rate τ_i and the tax rate of all other affiliates in the same group τ_n, multiplied by the capital, or economic activity, in affiliate *i*. In the denominator, we use total capital, operating as a proxy for economic activity in the entire group. By using this measure for tax incentives, we are able to include the net sum of shifting between all affiliates in the group. Although we believe the tax incentives measure, C, to be a reliable measure, it has some inherent difficulties in terms of interpretation and measurement errors. The interpretation difficulties are related to the fact that the standard deviation of C is sensitive to the number of affiliates in a group, and their relative size to one another. Furthermore, the measurement errors stem from the requirement of complete information of all affiliates. As the C variable calculate the difference between all affiliates within a group, it is especially sensitive to lacking information in the fat tails of the tax rate distribution. This is related to the fact that the MNC will have incentives to shift to the lowest taxed affiliate in the group. If the information of this affiliate is missing, it will appear as if the group has incentives to shift to a relatively higher taxed affiliate, causing the tax incentives measure to be in the lower bound.

5.2.7 Tax Incentives – STR Differential

Due to the interpretation and measurement errors in the tax incentives variable, C, we conduct a robustness test using the statutory tax rate differential as an alternative measure for tax incentives. The STR differential is calculated as an affiliate´s statutory tax rate less the statutory tax rate of the lowest taxed affiliate within the group as MNCs will have incentives to shift profits to the lowest taxed affiliate, in line with previous literature. Although this measurement does not eliminate the measurement errors due to lacking information of affiliates, it is easier to interpret.

5.2.8 LowSales

When controlling for income shifting constraints, we employ a binary variable to identify affiliates faced with these constraints. We use affiliates´ sales to categorize the sample, where the lowest quartile contains the affiliates with income shifting constraints. The binary variable, LowSales, assumes the value one if the affiliate is located in the lowest quartile.

5.2.9 StableMarkets

When controlling for precautionary behavior, we generate a binary variable to identify affiliates in relatively stable markets based on the change in industryROA for each industry-country-year. We defined the lower quartile of changes in industryROA as fairly stable markets, and let the binary variable be equal to one for affiliates in this category. We used industryROA as an indicator of fairly stable markets as it is easy to measure and compare, and is not affected by firm size or number of affiliates in the sample. The alternative measure would have been change in market size, however, this measure is biased by the number of affiliates in our sample. If relatively many affiliates are missing from our sample in one year, it would affect the market size, as it is the sum of all affiliates´ sales. We observe, in table 3, that we are in fact missing information of sales for a fairly large part of the sample, which confirms our concern regarding this measurement. Also, in the upcoming estimates, market size is hardly ever significant. For the reasons mentioned above, we do not consider market size as a good measure of market stability, and consequently chose industryROA instead.

Table 3: Summary statistics

Descriptive Statistics: All Affiliates	**n**	**Mean**	**Std.**	**Min**	**Max**
Income Prediction Variables					
EBIT	216.193	4.665.557	6,60E+07	-2,52E+09	8,96E+09
ROA	216.193	10,74226 %	0,3288807	-99,84044 %	9099,814 %
Tangible Assets	216.193	1,50E+07	3,33E+08	0,2535269	5,16E+10
CompExp	216.193	8.303.137	3,17E+08	1	1,43E+11
ln(ROA+1)	216.193	0,0864307	0,1915694	-6,440533	4,521769
ln(Tangible Assets)	216.193	12,69195	2,860255	-1,372285	24,66663
ln(CompExp)	216.193	13,87151	2,075168	0	25,68461
Industry ROA	216.193	3,68162 %	0,0285723	-496,5148 %	110,1829 %
Age	216.193	19,69219	17,25469	0	329
ChangeGDP	216.193	1,6332 %	0,0266291	-14,55986 %	23,94065 %
ChangeMarketsize	216.193	992,4041	9174,017	-111485,5	185.169,4
Tax Variables					
C	216.193	-0,0010617	0,0486904	-0,3541124	0,3425334
STR	216.193	24,61885 %	0,0736228	8,5 %	44,429 %
STR Differentials within Group	216.193	3,79503 %	0,0601298	-1,31E+07	35,429 %
Other Firm Attributes					
Sales	197.369	5,32E+07	4,97E+08	-1,37E+07	4,41E+10
Assets	216.193	1,11E+08	1,91E+09	948	1,99E+11
Low Sales	216.193	0,2282498	0,4197054	0	1
Stable Markets	216.193	0,3069063	0,4612113	0	1

Table 3 outlies the summary statistics for sample affiliate-years present in our final data sample. For each variable, the descriptive statistics include the number of observations, the mean, the standard deviation, the median, and the observed minimum and maximum. Our unconsolidated financial data yields a positive mean ROA, which was anticipated given our requirement of consolidated profits for the group during the data selection process. Also, we observe an average statutory tax rate of 24,6%. Furthermore, as expected, we notice a positive mean for both tangible fixed assets and compensation expenses.

By investigating our summary statistics, we can deduce that, on average, our European affiliates have benefited from both economic growth, GDP, and positive levels of return on assets in the different industries during the defined time horizon stretching from 2008 to 2017. Additionally, the statistics attached to the tax incentive variable, C, indicate that our average affiliate had incentives to shift profits out of the affiliate during this span of time. Moreover, we notice that the average difference between an affiliate and the lowest taxed affiliate within a group is 3,79% providing incentives to shift profits to lower taxed jurisdictions. Finally, we observe that 22,8% of affiliates are classified as LowSales due to possible income shifting constraints and 30,7% are categorized as affiliates in stable markets. However due to stable markets being based on the change in industryROA which is equal for all affiliates in the same industry every year, it is difficult to separate the quartile at exactly 25%. Nevertheless, we do not consider this as a decisive concern as we have managed to separate a small enough subsample of affiliates pertaining to stable markets.

Table 4: Correlations

	1	2	3	4	5	6	7	8	9	10	11
(1) ln(ROA+1)	1.000										
(2) ln(TangibleAssets)	-0,0349	1.000									
(3) ln(CompExp)	0,0291	0,5520	1.000								
(4) industryROA	0,0948	0,0780	0,1984	1.000							
(5) ln(Age)	0,0103	0,3281	0,3889	0,0938	1.000						
(6) ChangeGDP	0,0504	-0,0254	-0,0843	0,0606	-0,0298	1.000					
(7) ChangeMarketsize	0,0029	-0,0220	0,0058	0,0635	0,0110	0,0535	1.000				
(8) C	-0,0333	-0,0003	0,0589	-0,0352	0,0756	-0,1342	0,0362	1.000			
(9) STR Differentials within Group	-0,0725	0,0650	0,1850	-0,0311	0,1391	-0,1240	0,0210	0,5148	1.000		
(10) LowSales	-0,0756	-0,3999	-0,6144	-0,1545	-0,3011	0,0452	-0,0144	-0,0276	0,0104	1.000	
(11) StableMarkets	-0,0224	-0,0071	0,0007	-0,0836	-0,0110	-0,0781	0,0279	0,0258	-0,2388	-0,0033	1.000

Table 4 displays correlations between the income prediction variables. We find a positive and statistically significant correlation between ln(TangibleAssets) and ln(CompExp) at 0,552. However, it causes no concern as it is in line with correlations presented in De Simone et al. (2017). Moreover, we find a positive correlation and statistically significant between the capital weighted tax rate differential and the difference in STR between an affiliate and the lowest taxed affiliate in the group. The correlation of 0,5148 is expected as the two variables both measure the tax rate differential within groups. The difference is related to one measure all of the differences within a group and capital-weights them, whereas the other merely measures a bilateral difference. However, as these two variables are substitutes in terms of tax incentive, it causes no concern.

6. Analysis & Results

In the beginning of the upcoming part, we include a replication of the main analysis performed by De Simone et al. (2017). In Table 5, we include the test to provide evidence that loss affiliates do affect income shifting behavior of multinationals, and thereby, should be included in the sample when studying the full profit distribution. By reproducing the selected test, we are able to transfer and confirm findings that are of crucial importance for the validity of our study of the profit distribution.

Moreover, we perform simultaneous-quantile regressions providing point estimates, as well as interquantile estimates, to research where the most tax-aggressive affiliates are located in the profit distribution. By studying the marginal effects and the semi-elasticities in each quantile, we are able to determine the exact percentage change in the mean ROA as a result of profit shifting, which allows us to compare the tax sensitivity across quantiles. Furthermore, we control our initial hypothesis for income shifting constraints. That is, whether affiliates with low sales, and hence, low levels of profits to shift, could bias the results downwards due to low tax sensitivity. Also, we research whether there is a significant difference in tax sensitivity between firms pertaining to stable markets and affiliates operating in relatively more unstable markets. Firms in stable markets have been considered better equipped to predict future earnings, which could affect the firms´ need for precautionary behavior, and subsequently, our estimates. Finally, we conduct a robustness test using the difference between an affiliate´s statutory tax rate and the lowest statutory tax rate in the group as a proxy for the tax incentive. This is conducted in order to control for difficulties in interpretation and possible measurement errors tied to our main tax incentive variable, C.

6.1 Replicating the Test of the Effect of Loss on Tax Motivated Income Shifting

We replicate the test for the main hypothesis of De Simone et al. (2017), which is stated as follows:

"The relation between unexplained profit and the tax incentives is less negative for loss affiliates than for profitable affiliates."

Their hypothesis indicates that loss affiliates affect the income shifting behavior of MNCs, which is of great importance for our main analysis as it proves the necessity to include loss affiliates when studying the tax sensitivity of MNCs in the profit distribution. As previously discussed, the common approach is to exclude loss affiliates from income shifting studies. Nonetheless, the consequence of excluding unprofitable affiliates is that one mechanism of income shifting, shift-to-loss strategy, is neglected and could potentially bias our results.

By using the tax incentives measure C, provided by Huizinga and Laeven (2008), and the production factors in the Cobb Douglas function, we estimate the effect of loss on tax motivated income shifting. In the first column, we predict profitability using the proxies for economic activity, the shock variables, and the tax incentives variable, C. The R^2 of 1,50% is very low. By including the binary variable identifying unprofitable affiliates, Loss, we get a relatively significant leap in R^2 in the second column. In other words, by including the Loss variable, the other variables better predict profitability. As anticipated, the coefficient for Loss is negative since predicted profitability should be negatively affected by unprofitability.

In the third column we test the hypothesis by including an interaction term between the tax incentives variable and the binary variable Loss. Although the C variable has a negative coefficient in the main regression, the interaction between loss and tax incentive has a positive and significant coefficient. A negative coefficient for C indicates that predicted profits are reduced, due to profits being shifted out of the affiliate. However, a positive coefficient for the interaction term suggests that expected profits are higher in the unprofitable affiliates due to less profits being shifted out of these affiliates, and potentially, profits being shifted in due to the low marginal tax rate. These findings are consistent with the results of De Simone et al. (2017), and proves that the income shifting behavior of MNCs are affected by the presence of loss affiliates.

For profitable affiliates, the coefficient for the composite tax incentives variable is -0.0971. An increase of one unit in the composite tax incentive, equaling an increase in the standard deviation, and a mean ROA of 10.74% yields a predicted ROA of 10.22%, meaning a decrease of 0.52 percentage points. This implies a semi-elasticity of -0.9986 at the mean ROA, meaning that an increase in the composite tax incentive variable of 1% is associated with an almost 1% decrease in ROA. Although we find a higher semi-elasticity, it is consistent with the research of De Simone et al. (2017).

Table 5: Test of the Effect of Losses on Tax-Motivated Income Shifting

$$\ln\left(ROA_{it}+1\right) = \beta_0 + \beta_1 {*} \ln\left(TangibleAssets_{it}\right) + \beta_2 {*} \ln(CompExp_{it}) + \beta_3 {*} IndustryROA_t + \beta_4 {*} \ln(Age)_{it} + \beta_5 {*} \Delta GDP_t + \beta_6 {*} \Delta MarketSize_t + \beta_7 {*} C_{it} + \beta_8 {*} Loss + \beta_9 {*} Loss {*} C_{it}$$

VARIABLES	(1) ln(ROA+1)	(2) ln(ROA+1)	(3) ln(ROA+1)
ln(TangibleAssets)	-0.00447***	-0.00430***	-0.00429***
	(0.000358)	(0.000311)	(0.000311)
ln(CompExp)	0.00429***	0.00116**	0.00114**
	(0.000637)	(0.000468)	(0.000468)
industryROA	0.403***	0.234***	0.234***
	(0.143)	(0.0813)	(0.0812)
ln(age)	0.00632***	0.000794	0.000767
	(0.00140)	(0.00112)	(0.00112)
changeGDP	0.154***	0.0792***	0.0789***
	(0.0178)	(0.0147)	(0.0147)
changeMarketsize	3.68e-08	1.17e-08	1.39e-08
	(3.54e-08)	(3.09e-08)	(3.09e-08)
C	-0.0791***	-0.0675***	-0.0971***
	(0.0170)	(0.0142)	(0.0126)
Loss		-0.235***	-0.235***
		(0.00314)	(0.00314)
C*Loss			0.154***
			(0.0442)
Constant	0.0430***	0.142***	0.143***
	(0.00666)	(0.00522)	(0.00522)
Observations	215,536	215,536	215,536
Number of numeric_subs_bvdepnr	51,146	51,146	51,146

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

ln(TangibleAssets)= the logarithm of tangible fixed assets *ln(CompExp)= the logarithm of compensation expense*

industryROA= return on assets based on a two-digit NACE code for each industry-country-year

ln(age)= the logarithm of age

changeGDP= the percent change in GDP per capita for each country-year

changeMarketsize= the change in market size calculated as total revenues in each industry in year t less year t-1, scaled by 1,000,000.

C= the capital weighted tax incentive variable C

Loss= a binary variable equal to one if the affialite´s ebit is less than zero

*C*Loss= interaction between the tax incentive, C, and the binary variable Loss*

Table 5.1 Semi-Elasticity

Variables	All Affiliates
Mean ROA	10,74 %
Coefficient of C	-0,0971
Std. of C	0,0486904
Expected ROA	10,22 %
Semi-Elasticity	-0,99864405

Mean ROA: retrieved from table 3

Coefficient of C: retrieved from table 5, column 3

Std. of C: retrieved from table 3

Expected ROA: $exp^{(Coefficient\ of\ C*Std.\ of\ C)+ln(mean\ ROA+1)} - 1$

Semi-Elasticity: [((Expected ROA/meanROA)-1)/Std of C]

6.2 Testing whether tax-sensitivities are heterogeneous within the profit distribution (H1)

When conducting estimations using the standard Ordinary Least Squared method, it is common to apply the assumption of homoscedasticity. Homoscedasticity implies that the variance is constant. However, this is not always the case in large datasets. As a result, we conduct a Breusch-Pagan test (Appendix A). We consider our sample to be large enough not to encounter any validity concerns relating to the test. In the Breusch-Pagan test, the null hypothesis is that the residual variance is constant, translating to homoscedasticity. The test resulted in a p-value of 0.0000. Therefore, we can safely reject the null hypothesis and state that we observe heteroscedasticity in our dataset.

As a result of observing heteroscedasticity in our panel data, we perform quantile regressions instead of standard OLS regressions, as quantile regressions do not assume constant variance. While OLS only models the conditional mean of the response, quantile regressions are most commonly applied to model for the specific quantiles of the response. This allows us to determine the effect of the independent variables on point estimates in the distribution. However, quantile regressions as a statistical technique cannot be limited by this use, as its full potential lies in modelling the entire conditional distribution. Indeed, while simultaneous-quantile regressions allow us to look at the effect of multiple explanatory variables on a dependent variable at different points in the profit distribution, only interquantile range regressions enable us to study the effects within the defined quantiles of the distribution.

For the majority of models presented in our study, the dependent variable, ln(ROA+1), is divided into 8 quantiles, where each quantile level represents an equal proportion of the population. Our choice of dividing the population into eight quantiles was based on several factors. For one, it was important to separate the distribution into enough quantiles in order to precisely study the specific parts of the distribution that were of interest. Nevertheless, we did not want to introduce too many quantiles, as this could inflate the estimates, and subsequently limit the observability of clear changes in tax sensitivity along the profit distribution. Consequently, we decided to use eight quantiles which allowed us to have one quantile centered around zero (q=2), and the remaining quantiles evenly partitioned, according to frequency, along the profit distribution. Due to an uneven distribution of profitable and unprofitable affiliates, it resulted in one quantile exclusively including unprofitable affiliates (q=1), and six quantiles containing only profitable affiliates.

Table 6 provides the results from simultaneous regression of equation (10). The coefficients provide point estimate effects of the explanatory variables on the dependent variable for all cut off point between each quantile. For instance, the point estimates given by the simultaneous regression at p=4, represents the effects for the 50th percentile in the profit distribution.

Table 6: Simultaneous-Quantile Regression

$$\ln(ROA_{it}+1)^{p} = \beta_0^{p} + \beta_1^{p}*\ln(\text{TangibleAssets}_{it}) + \beta_2^{p}*\ln(\text{CompExp}_{it}) + \beta_3^{p}*\text{IndustryROA}_{t} + \beta_4^{p}*\ln(\text{age})_{it} + \beta_5^{p}*\Delta\text{GDP}_{t} + \beta_6^{p}*\Delta\text{MarketSize}_{t} + \beta_7^{p}*\text{TaxIncentive}_{it}$$

VARIABLES	(1) q125	(2) q250	(3) q375	(4) q500	(5) q625	(6) q750	(7) q875
ln(TangibleAssets)	0.00154***	-0.000587***	-0.00268***	-0.00513***	-0.00803***	-0.0119***	-0.0176***
	(0.000145)	(7.85e-05)	(8.32e-05)	(9.68e-05)	(0.000119)	(0.000159)	(0.000235)
ln(CompExp)	0.00231***	0.00254***	0.00381***	0.00495***	0.00590***	0.00704***	0.00862***
	(0.000162)	(9.61e-05)	(0.000103)	(0.000111)	(0.000156)	(0.000198)	(0.000329)
industryROA	0.453***	0.617***	0.676***	0.681***	0.679***	0.701***	0.702***
	(0.0115)	(0.00974)	(0.00929)	(0.0113)	(0.0154)	(0.0203)	(0.0285)
ln(age)	0.00758***	0.000425*	-0.00246***	-0.00573***	-0.00920***	-0.0142***	-0.0212***
	(0.000444)	(0.000250)	(0.000311)	(0.000320)	(0.000441)	(0.000526)	(0.000793)
changeGDP	0.205***	0.143***	0.172***	0.209***	0.236***	0.275***	0.324***
	(0.0117)	(0.00744)	(0.00854)	(0.0107)	(0.0112)	(0.0133)	(0.0179)
changeMarketsize	-3.41e-08	-6.88e-08***	-6.98e-08***	-5.69e-08**	-9.39e-08***	-1.50e-07***	-2.08e-07***
	(2.38e-08)	(2.55e-08)	(2.35e-08)	(2.90e-08)	(2.67e-08)	(3.84e-08)	(4.84e-08)
C	-0.00281	-0.0357***	-0.0690***	-0.103***	-0.134***	-0.163***	-0.203***
	(0.00643)	(0.00362)	(0.00484)	(0.00561)	(0.00709)	(0.00944)	(0.0137)
Constant	-0.0975***	-0.0240***	0.0154***	0.0654***	0.129***	0.216***	0.352***
	(0.00229)	(0.00125)	(0.00149)	(0.00167)	(0.00231)	(0.00267)	(0.00374)
Observations	215,536	215,536	215,536	215,536	215,536	215,536	215,536

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

ln(TangibleAssets)= the logarithm of tangible fixed assets

ln(CompExp)= the logarithm of compensation expense

industryROA= return on assets based on a two-digit NACE code for each industry-country-year

ln(age)= the logarithm of age

changeGDP= the percent change in GDP per capita for each country-year

change_marketsize= the change in market size calculated as total revenues in each industry in year t less year t-1, scaled by 1,000,000.

C= the capital weighted tax incentive variable C

The proxy for capital, ln(TangibleAssets), is significant and positive for the first point estimate, whereas for the remaining point estimates it is significantly negative. Unprofitable affiliates have an EBIT<0, which yields a negative ROA (EBIT/total assets). When assets increase, ROA subsequently becomes less negative, which in turn generates a positive effect on ROA. However, for profitable affiliates, ROA is reduced with an increase in assets, which implies a negative effect. As a result, due to ROA being deflated by assets, one would expect these coefficients to be positive for unprofitable affiliates and negative for profitable affiliates.

The proxy for labor, ln(CompExp), is significant and positive for all point estimates. This is to be presumed as increased production as a result of an increase in labor could increase an affiliate´s profitability.

IndustryROA is positive and significant at 1% level for all cut off points between quantiles, which is as anticipated because a positive increase in the returns of an industry, should unequivocally yield an increase in ROA of an affiliate located in the respective industry-country-year.

When observing the impact of an affiliate´s age on ROA, we notice an inversion of the sign after the second point estimate. Indeed, for the first two cut off points, an affiliate´s age positively affect the ROA, while the opposite is true for the remaining point estimates. This is not surprising, as it concurs with current findings regarding the lifecycle of firms (Coad, Segarra, & Teruel, 2013). Start-ups are often unprofitable in their first few years before becoming profitable, and therefore, an increase in age in its early stage could positively affect the ROA. Throughout the lifecycle, a firm generally becomes more profitable and ROA increases. However, after a certain point, the firm generally becomes less profitable, leading to a negative effect on ROA. Therefore, one could argue that if the share of relatively young affiliates is higher in the lower parts of the profit distribution, age should positively impact the ROA in the estimates for the first point estimate.

As expected, the first shock variable, change in GDP, is positive and significant for all point estimates. Naturally, when the local economy is growing, the affiliates in the respective economy should also experience growth.

The second shock variable, change in market size, is significantly negative for all point estimates except for p=0.125. An increase in market size could imply an increase in the number of competitors in the markets, and thereby, affect ROA negatively. However, the negative effect is almost non-existent, and is therefore not the most influential explanatory variable.

We observe that the tax incentives variable, C, is negative and significant at the 1% level for all point estimates, except for p= 0.125. For this test, the coefficient for C represents the point estimate responsiveness to income shifting incentives. Due to the coefficient being negative, it implies that increased tax incentives induce lower ROA, concurrent with applied income shifting strategies. From p=0.25 and onwards the tax incentives coefficient is becoming continuously more negative. It appears as if the affiliates in the end of the distribution with higher ROA will be the most affected by increased tax incentives. Although this points to a heterogeneous distribution of tax sensitivity, it is surprising to observe the highest marginal effect in the percentiles furthest away from zero. For the most unprofitable affiliates, we assumed that the tax incentives variable would positively affect the ROA consistent with our findings in table 5. Our predetermined expectation was based on the fact that loss affiliates become temporary tax havens when the marginal tax rate is much lower than the statutory tax rate, which provides incentives for MNCs to shift profits in to the unprofitable affiliates, thereby increasing ROA. However, the unprofitable affiliates are located at p=0.125, where the coefficient is not significant, and therefore, we cannot conclude with profits being shifted into loss affiliates. Nevertheless, for the profitable affiliates, from p=0.25 and onwards, we can derive that profits are being shifted out.

The findings presented above are in line with our main hypothesis as we find indications of a heterogeneous distribution of tax sensitivities. On the other hand, we did not observe the effects in the point estimates closest to zero, as we initially expected. Instead, we found that the marginal effect of tax incentives is higher for the point estimates the furthest away from zero. However, these results are not the most reliable as they merely provide point estimates based on the cut off point we chose for the quantiles. Consequently, in the upcoming tests, we will use interquantile range regressions to observe the marginal effects and semi-elasticities within the eight intervals, instead of at the cut off points between quantiles.

The discussions concerning all explanatory variables unrelated to tax incentives and tax sensitivity will not be replicated as thoroughly for the following models as the observed effects have been of similar magnitude. The purpose of providing the above stated considerations is to show that all effects are consistent with previous literature and especially De Simone et al. (2017). If the estimations weren´t similar to well established research, we could have had concerns regarding the sample, and subsequently the validity of our tax related estimates. By showing convergence of our results towards commonly accepted estimates, we can safely exclude this concern.

To shed light on whether the tax-sensitivities are heterogeneous within the profit distribution, we must determine whether or not the affiliates within the different quantiles respond differently to income shifting incentives. Therefore, we use interquantile range regressions in order to test our hypotheses. Tax sensitivities within the profit distribution can be studied by observing the marginal effect through the coefficient of C, as well as the expected percentage change in ROA through the semi-elasticities. We expect a negative coefficient for C for profitable affiliates, which implies that an increase in tax incentives is associated with a reduction in ROA, consistent with shifting profits out of the affiliates. Oppositely, we anticipate a positive coefficient for unprofitable affiliates, suggesting that increased tax incentives result in decreased ROA as a result of MNCs implementing a shift-to-loss strategy. Furthermore, in line with previous literature, we expect to observe relatively higher tax sensitivity around zero.

Table 7: Interquantile Range Regression to test H1

$$\ln(ROA_{it}+1)^{q_n} = \beta_0^{q_n} + \beta_1^{q_n} * \ln(TangibleAssets_{it}) + \beta_2^{q_n} * \ln(CompExp_{it}) + \beta_3^{q_n} * IndustryROA_t + \beta_4^{q_n} * \ln(age)_{it} + \beta_5^{q_n} * \Delta GDP_t + \beta_6^{q_n} * \Delta MarketSize_t + \beta_7^{q_n} * TaxIncentive_{it}$$

VARIABLES	(1) ln(ROA+1)	(2) ln(ROA+1)	(3) ln(ROA+1)	(4) ln(ROA+1)	(5) ln(ROA+1)	(6) ln(ROA+1)	(7) ln(ROA+1)	(8) ln(ROA+1)
ln(TangibleAssets)	-0.0211	-0.00213***	-0.00209***	-0.00244***	-0.00290***	-0.00385***	-0.00568***	0.157***
	(0.114)	(9.07e-05)	(5.82e-05)	(5.87e-05)	(7.57e-05)	(9.36e-05)	(0.000162)	(0.0397)
ln(CompExp)	-0.178	0.000232*	0.00127***	0.00114***	0.000945***	0.00114***	0.00159***	-0.351***
	(0.142)	(0.000127)	(7.33e-05)	(7.06e-05)	(9.81e-05)	(0.000145)	(0.000246)	(0.0772)
industryROA	-4.383*	0.163***	0.0594***	0.00441	-0.00179	0.0220**	0.00115	-2.220
	(2.404)	(0.00901)	(0.00664)	(0.00623)	(0.00903)	(0.0102)	(0.0203)	(1.998)
ln(age)	-0.878***	-0.00715***	-0.00289***	-0.00326***	-0.00348***	-0.00497***	-0.00702***	0.307
	(0.242)	(0.000312)	(0.000198)	(0.000196)	(0.000249)	(0.000333)	(0.000457)	(0.201)
changeGDP	-5.180	-0.0621***	0.0295***	0.0368***	0.0267***	0.0394***	0.0488***	9.294***
	(7.203)	(0.00976)	(0.00585)	(0.00610)	(0.00770)	(0.00788)	(0.0149)	(2.399)
changeMarketsize	6.96e-06	-3.47e-08	-9.98e-10	1.29e-08	-3.70e-08*	-5.62e-08**	-5.81e-08	-4.08e-06
	(9.49e-06)	(2.12e-08)	(1.49e-08)	(1.72e-08)	(1.93e-08)	(2.70e-08)	(4.46e-08)	(2.53e-06)
C	8.731**	-0.0329***	-0.0333***	-0.0335***	-0.0313***	-0.0295***	-0.0392***	-5.278
	(4.358)	(0.00446)	(0.00312)	(0.00324)	(0.00420)	(0.00548)	(0.00970)	(4.262)
Constant	10.18***	0.0735***	0.0394***	0.0500***	0.0637***	0.0868***	0.136***	4.960***
	(1.250)	(0.00177)	(0.000869)	(0.00101)	(0.00122)	(0.00182)	(0.00262)	(0.986)
Observations	215,536	215,536	215,536	215,536	215,536	215,536	215,536	215,536

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

ln(TangibleAssets)= the logarithm of tangible fixed assets

ln(CompExp)= the logarithm of compensation expense

industryROA= return on assets based on a two-digit NACE code for each industry-country-year

ln(age)= the logarithm of age

changeGDP= the percent change in GDP per capita for each country-year

changeMarketsize= the change in market size calculated as total revenues in each industry in year t less year t-1, scaled by 1,000,000.

C= the capital weighted tax incentive variable C

Table 7.1: Semi-elasticities

Quantiles	q=1	q=2	q=3	q=4	q=5	q=6	q=7	q=8
Interval Quantiles	(0.00, 0.125)	(0.125, 0.25)	(0.25, 0.375)	(0.375, 0.5)	(0.5, 0.625)	(0.625, 0.75)	(0.75, 0.875)	(0.875, 1)
Mininum ROA	-99,84 %	-0,58 %	2,63 %	5,36 %	8,20 %	11,62 %	16,43 %	25,25 %
Maximum ROA	-0,58 %	2,63 %	5,36 %	8,20 %	11,62 %	16,43 %	25,25 %	9099,81 %
Mean ROA	-12,71 %	1,11 %	4,01 %	6,76 %	9,84 %	13,85 %	20,24 %	42,84 %
Coefficient of C	8,731	-0,0329	-0,0333	-0,0335	-0,0313	-0,0295	-0,0392	-5,278
Std. of C	0,0568526	0,0497039	0,046582	0,0451042	0,0462493	0,0471084	0,0477335	0,0485375
Expected ROA	43,40 %	0,94 %	3,85 %	6,60 %	9,68 %	13,69 %	20,02 %	10,56 %
Semi-Elasticity	77,68004974	-3,00469588	-0,86351817	-0,52893308	-0,3491021	-0,24231414	-0,232646776	-15,52467599

Interval Quantiles: percentage cut off points in the distribution

Minimum ROA: Lowest observed ROA in the respective quantile, retrieved from Appendix B

Maximum ROA: Highest observed ROA in the respective quantile, retrieved from Appendix B

Mean ROA: The average ROA of the respective quantile, retrieved from Appendix B

Coefficient of C: retrieved from table 7.

Std. of C: Standard deviation of C, retrieved from Appendix B

Expected ROA: estimated ROA with 1 unit change in C, calculated using $exp^{(Coefficient\ of\ C*Std.\ of\ C)+ln(mean\ ROA+1)} - 1$

Semi-Elasticity: Tax-sensitivity calculated using [((Expected ROA/meanROA)-1)/Std of C]

At a first glance, when observing the coefficient of C in table 7, it appears as if the marginal effect is quite similar for all quantiles, except for the end tails. This indicates a rather homogeneous distribution of tax sensitivities contradicting our main hypothesis. Observing the marginal effects provides a overarching view of the states of the tax sensitivities, but in order provide conclusive evidence, we must plunge in to the specific semi-elasticities of each quantile.

The first quantile of table 7 (0.00, 0.125) includes solely unprofitable affiliates with an ROA between -99.84% and -0.58%. In the first quantile, we observe a high positive coefficient for C that is significant at the 5% level. As this quantile merely contains unprofitable affiliates, it is in line with the implementation of a shift-to-loss strategy by MNCs, and the coefficient indicates a high marginal effect to income shifting incentives. Furthermore, as seen in table 7.1, the first quantile yields a semi-elasticity of 77.68, which suggests that a 1% increase in the affiliates´ composite tax incentive is associated with an increase of 77.68% on the reported mean ROA. This finding entails an enormous tax sensitivity in this part of the profit distribution, which is a consequence of both profits being kept in the loss affiliates as well as profits being shifted in to loss affiliates. In line with the findings of De Simone et al. (2017), this suggests that firms respond to even temporary tax incentives imposed by loss affiliates.

The second quantile (0.125, 0.25) is composed of affiliates with an ROA centered around zero. Indeed, this interval is situated along ROA from -0.58% to 2.62%. There are some slightly unprofitable affiliates as well as some cautiously profitable affiliates in this section, implying a sample concentrated around zero profitability. This allows us to test the tax sensitivity in the area where previous literature, such as Habu (2017) and Johannesen et al. (2017), claims that the affiliates of the most tax-aggressive MNCs are located. For this interval, we observe a coefficient for C of -0.0329 which is significant at the 1% level. This suggests that affiliates would respond to increased tax incentives by shifting profits out of the affiliate, which reduces the reported ROA on average. Moreover, the semi-elasticity retrieved from table 7.1, amounts to -3.00 for the second quantile, which is a substantial decrease compared to the first interval. The semi-elasticity infers that an increase of 1% in the composite tax incentive on average results in a decrease of 3.00% in the mean ROA for affiliates bunching around zero. We observe that the sign of the semi-elasticity reverses from the first to the second quantile. The first plausible explanation for the sign change is that even though the second interval also includes negative affiliates, the lion share of the observations pertain to the profitable sequence of the range. When estimating the coefficient for C for this interval, the effect of the traditional income shifting practices prevail over the shift-to-loss strategy. Indeed, in Appendix B, we observe that only 15.06% of the observations present in q=2 are loss affiliates. As the profitable affiliates are dominating in numbers, it is understandable that the semi-elasticity is negative.

The next interval (0.25, 0.375) is ranging from a ROA of 2.62% to 5.36%. The coefficient for the capital-weighted tax incentive is as predicted, negative. In fact, the marginal effect barely differs from the previous quantile, and is estimated to be -0.0333, significant at 1%. This could indicate that the responsiveness to tax incentives is of a relatively similar level for barely profitable affiliates and affiliates bunching around zero. Nevertheless, the semi-elasticity for this interval amounts to -0,86, meaning that an increase of 1% in the composite tax incentive results in a decrease in ROA of 0,86%. Thus, we observe that the tax sensitivity is greater for affiliates bunching around zero, than for slightly profitable affiliates, contrary to the initial conclusions derived from only observing the marginal effects.

For the following four intervals, q=4, q=5, q=6, and q=7, we observe a coefficient for C in line with the two previous quantiles, although, with slight fluctuations. We estimate coefficients of -0.0335, -0.0313, -0.0295 and -0.0392 respectively, which are all significant at the 1% level, and indicative of profits being shifted out of the affiliates. Once again, the marginal effects seem to contradict our predefined expectation of heterogeneous tax sensitivities. However, these estimates yield semi-elasticities of -0.53, -0.35, -0.24, and -0.23 respectively. For these intervals, we observe a downwards sloping tax sensitivity, although, we note that the level of the leaps in tax sensitivity is continuously decreasing. The significant changes in semi-elasticity confirm our main hypothesis, and demonstrates that the level of tax sensitivity differs across the distribution.

Finally, for the last interval (0.875, 1.00) with a ROA ranging from 25.25% to 9099.81%, we experience a substantial decrease in the average responsiveness to income shifting incentives. Although, the coefficient estimated at -5.781 is not significant, it yields a semi-elasticity of -15.52. As this interval contains observations with abnormal levels of profitability, it could bias the estimates for the interval. For instance, we observe that the maximum ROA in this interval is 9099,81%, which is likely attributable to very low levels of assets. Due to the estimate not being significant, we do not take these extreme observations into consideration in our analysis.

When focusing on the full distribution, the marginal effects of income shifting incentives lead us to believe that the tax sensitivities distribution is homogeneous. However, due to a larger variance in the ROA throughout the profit distribution, we must additionally, observe the semi-elasticities when drawing conclusions about the levels of tax sensitivity. By cause of the first and last interval containing extreme observations, we are reluctant to rely on these estimates, although the first one is significant. Because of the variance in ROA, we rely on the semi-elasticities, which demonstrates a more heterogeneous distribution even when q=1 and q=8 are disregarded. Indeed, we note that the second interval containing affiliates bunching around zero, show the highest levels of tax sensitivity, confirming our main hypothesis. Even though the sensitivity is greatest around the zero profitability mark, we still observe significant and relatively high levels of tax sensitivity with increased levels of ROA. Interestingly enough, we also observe that the levels are decreasing throughout the profit distribution. The combination of these two findings is very interesting as it could indicate that the affiliates´ level of flexibility impact the tax sensitivity. If firms with low levels of flexibility are unable to predict future earnings accurately, they could potentially report higher levels of profitability than they intend to. If these affiliates are aggressive shifters of profits, they would still shift high amounts of profit, and hence, show relatively high levels of sensitivity throughout the profit distribution. This would give way for a less heterogeneous distribution than previously anticipated. Additionally, the continuously decreasing semi-elasticities could imply that aggressive tax planers with low levels of flexibility and decreasing ability to predict future earnings will be situated further away from the zero profitability mark. This finding does not contradict the assumption of heterogeneous tax sensitivities with an observed peak in the narrow range around zero, however, it nuances to which degree it is heterogeneous.

In conclusion, our findings support our main hypothesis. Although, it is important to note that we observe higher levels of tax sensitivity outside of the zero profitability range, implying that the tax sensitivities are less heterogeneous than expected. To refine our estimates, we would like to control for possible income shifting constraints and precautionary behavior, which might bias our results.

6.3 Testing whether the levels of tax sensitivities are biased downwards by income shifting constraints (H2)

The following model aims at testing whether our results are biased by affiliates with income shifting constraints. The level of sales of an affiliate could potentially affect our analysis more directly than simply through its EBIT related connection to our dependent variable. As previously stated, the literature has established that income shifting through the use of abusive transfer prices is a common practice amongst MNCs. In the case of an affiliate with incentives to shift profits out, the MNC will materialize this tax avoidance measure by transforming relatively high sales into a relatively low EBIT through inflated costs or deflated intra-firm sales. However, when assuming the standpoint of a profitable affiliate with low sales and incentives to shift profit out, the need to control our tax sensitivity analysis for sales levels become obvious. Indeed, in this scenario, the affiliate will feature low tax sensitivity and seem unaggressive simply because of income shifting constraints stemming from low sales. The simple fact that the affiliate lacks the opportunity to concretize its tax avoidance strategy does not mean that the MNC is not an aggressive tax planner. Thus, we expect that the existence of low sales affiliates could result in a downward bias in our estimate from table 7. To control for income shifting constraints, we generate a binary variable to identify affiliates with low sales, which assumes the value one if the affiliate is located in the lowest quartile in terms of sales. We expect that the effect of income shifting constraints will be more significant in the first profitable quantiles than in the later quantiles. This is related to our chosen division of the profit distribution with regards to ROA. We expect that the affiliates with low sales report relatively low levels of ROA, and therefore, will not be located in the later quantiles, or in the first as income shifting constraints limit the shifting of profits out of an affiliate. If the results from tables 7 and 7.1 are biased by affiliates with income shifting constraints, we expect to observe an increase in both the marginal effects and the semi-elasticities when controlling for low sales.

In table 8, we control for the effect of income shifting constraints on the full profit distribution using standard OLS regression. The marginal effect of the remaining sample is greater compared to table 7. However, it translates to a semi-elasticity of -0.70 for the remaining sample, which is less than the semi-elasticity for the affiliates bunching around zero and the barely profitable affiliates. Nevertheless, it is greater than the semi-elasticity for the remaining quantiles. The sum of coefficients with respect to the composite tax rate of low sales affiliates are -0.1202, translating to a semi-elasticity of -1.24, indicating a higher tax sensitivity for low sales affiliates. Initially, this appears to disprove our second hypothesis. The marginal effect of low sales affiliates is higher compared to the marginal effect in table 7 when disregarding the extreme observations in the fat tails. Furthermore, the semi elasticity for the full sample is higher than for most quantiles in table 7.1, however, in order to compare properly we estimate the effect of income shifting constraints within each quantile.

Table 8: Controlling for Income Shifting Constraints Using Standard OLS Regression

$$\ln\left(ROA_{it}+1\right) = \beta_0 + \beta_1 * \ln\left(TangibleAssets_{it}\right) + \beta_2 * \ln(CompExp_{it}) + \beta_3 * IndustryROA_t + \beta_4 * Age_{it} + \beta_5 * \Delta GDP_t + \beta_6 * \Delta MarketSize_t + \beta_7 * TaxIncentive_{it} + \beta_8 * LowSales_{\,it} + \beta_9 * TaxIncentive_{it} * LowSales_{\,it}$$

VARIABLES	(1) ln(ROA+1)
ln(TangibleAssets)	-0.00533***
	(0.000273)
ln(CompExp)	-0.00190***
	(0.000432)
industryROA	0.385***
	(0.0172)
ln(age)	0.00378***
	(0.000805)
changeGDP	0.154***
	(0.0132)
changeMarketsize	3.01e-08
	(3.53e-08)
C	-0.0676***
	(0.0138)
LowSales	-0.0598***
	(0.00158)
LowSales*C	-0.0526**
	(0.0250)
Constant	0.161***
	(0.00571)
Observations	215,536
Number of numeric_subs_bvdepnr	51,146
R^2	0.0186

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

ln(TangibleAssets)= the logarithm of tangible fixed assets

ln(CompExp)= the logarithm of compensation expense

industryROA= return on assets based on a two-digit NACE code for each industry-country-year

ln(age)= the logarithm of age

changeGDP= the percent change in GDP per capita for each country-year

changeMarketsize= the change in market size calculated as total revenues in each industry in year t less year t-1, scaled by 1,000,000.

C= the capital weighted tax incentive variable C

LowSales= binary variable equal to 1 if the affialite's sales are in the lowest quartile

*LowSales*C= Interaction term between LowSales and C*

Table 8.1 Semi-Elasticities

Variables	All Affiliates
Mean ROA	10,74226 %
Coefficient of C if LowSales=0	-0,0971
Std. of C	0,0486904
Expected ROA if LowSales=0	10,22 %
Semi-Elasticity if LowSales=0	-0,9986441
Coefficient of C if LowSales=1	-0,1202
Std. of C	0,0486904
Expected ROA if LowSales=1	10,10 %
Semi-Elasticity if LowSales=1	-1,2355261

Mean ROA: The average ROA , retrieved from table 3

Coefficient of C if LowSales=0: retrieved from table 8.

Std. of C: Standard deviation of C, retrieved from table 3

Expected ROA: estimated ROA with 1 unit change in C, calculated using $exp^{(Coefficient\ of\ C*Std.\ of\ C)+ln(mean\ ROA+1)} - 1$

Semi-Elasticity: Tax-sensitivity calculated using [((Expected ROA/meanROA)-1)/Std of C]

Coefficient of C if LowSales=1: the sum of coefficients of C, retrieved from table 8.

When interpreting the estimates from the model testing our second hypothesis, we first compare the levels of the marginal effect and semi-elasticities of the remaining sample to the estimates found for our main hypothesis. As previously stated, we expect to observe more negative estimates compared to the ones detected in table 7, as this would confirm that the estimates for our main hypothesis are biased downwards. Furthermore, we opt for comparing the marginal effects of income shifting incentives for low sales affiliates to the marginal effects of the remaining sample within table 9. Concurrent with our second hypothesis, the expectation is that the low sales affiliates will show less tax sensitivity than the the remaining sample.

Adhering to our first approach, we notice an overall decrease in tax sensitivity from the estimates in table 7 to the ones in table 9. This means that the affiliates not categorized as low sales affiliates display lower levels of tax sensitivity than the levels estimated for all affiliates in table 7. However, there are two exceptions, q=2 and q=7. Indeed, q=2 went from a marginal effect of -0.0329 to -0.0337 when controlling for the effect of income shifting constraints. This is interesting for two reasons. For one, it could confirm the fact that profitable low sales affiliates are located on the positive side of the zero profitability mark in the distribution as a result of low sales yielding low EBIT, and subsequently low levels of ROA. Indeed, as a consequence of dividing the sample into quantiles based on ROA, it is only natural that the affiliates with low sales are located in the second quantile. Secondly, and as a direct consequence of the above mentioned reason, it is interesting because an increased tax sensitivity in the second quantile implies that our results are biased for affiliates bunching around zero, where we expected the biggest changes, due to the lack of sufficient profits to shift. Even though, this particular quantile shows the expected change in tax sensitivity, it is important to state that these changes are relatively small. In this case, the semi-elasticities follow the same fluctuations across quantiles as the marginal effects, and these changes are also rather small. We chose not to focus on the changes in the fat tails, q=1 and q=8, as their estimates are not significant. Our estimates provide differing changes, making our findings inconclusive. Even though the estimates attached to the second quantile, the one closest to the zero profitability mark, are promising, the overall estimates make it impossible to confirm our second hypothesis. By comparing the estimates of both marginal effects and semi-elasticities between tables 7 and 9, we can state that we are unable to prove the existence of a downward bias in our estimate from table 7.

When following our second approach, we also observe unexpected and inconclusive results. Indeed, when comparing the marginal effects and the semi-elasticities of the low sales affiliates and the remaining sample within table 9, we observe a higher tax sensitivity for low sales affiliates in all quantiles except for q=1 and q=7, which are in fact insignificant. This is unexpected, but in line with the findings from the comparative analysis presented above. Additionally, the satisfying estimates for q=2 are not visible when studying the estimates within table 9, meaning that the second quantile display a higher tax sensitivity for low sales affiliates than the remaining sample. For most quantiles, the derived semi-elasticity is higher for low sales affiliates than for the remaining sample as shown in table 9.1. Again, the inconclusive findings make it impossible to confirm our second hypothesis, and more, it appears as if the opposite effect is displayed in the results. However, it is important to note that the interaction terms are only significant for some of the quantiles, and often at a low level.

One possible explanation for the observed estimates is that affiliates categorized as low sales affiliates are, in fact, aggressive tax shifters who deflate their own sales through transfer prices to shift profits out, and thereby, seem to be limited by income shifting constraints. This could be a potential explanation for why low sales affiliates in our sample seem to have such high levels of tax sensitivity. Another possible source of error is our categorization of low sales affiliates. We identified affiliates in the lowest quartile in terms of sales as low sales affiliates. However, it is possible that, given our sample restrictions, that the affiliates in the lowest quartile have relatively high sales. It is possible that we could have had more conclusive results if we used a fixed level of sales as the threshold to identify such affiliates. For instance, low sales affiliates have sales less than 100.000. By the use of the threshold method, we could have excluded affiliates with potentially high tax sensitivity from the low sales affiliate category. However, defining this threshold is challenging, which is why we chose a relative measure. These reasons could be part of the explanation for why we are unable to prove our second hypothesis.

In conclusion, at first glance, our findings when controlling for income shifting constraints are in line with our expectations for a specific part of the distribution, q=2. We found a downward bias for affiliates with low sales, and subsequently income shifting constraints, suggesting a lower bound estimate for the second quantile when testing the first hypothesis. However, it is important to note that the expected effect was only found in the quantile containing affiliates bunching around zero profitability. The increases in semi-elasticities found in the other quantiles undermine the relevance of the effect that was in line with our second hypothesis. Furthermore, our findings for q=2 are also dubious as the quantile contains unprofitable affiliates that should theoretically have a positive semi-elasticity. It is reasonable to assume that many of the low sales affiliates pertain to the unprofitable part of the interval, and as a result, the new semi-elasticity -3.05% is more negative compared to table 7.1, simply because we have removed the effect of affiliates with positive semi-elasticities. Additionally, for all quantiles excluding extreme ROA levels, both increases and decreases of the semi-elasticity are very small, and hence, the bias, if any, is not decisive for our main results. These considerations imply that we are not able to unequivocally confirm whether income shifting constraints create a downward bias in the tax sensitivities related to the different parts of the profit distribution.

Table 9: Effect of Income Shifting Constraints Using Interquantile Range Regression

$$\ln(ROA_{it}+1)^{q_n} = +\ \beta_1^{q_n}*\ln(TangibleAssets_{it}) + \beta_2^{q_n}*\ln(CompExp_{it}) + \beta_3^{q_n}*IndustryROA_t + \beta_4^{q_n}*Age_{it} + \beta_5^{q_n}*\Delta GDP_t + \beta_6^{q_n}*\Delta MarketSize_t + \beta_7^{q_n}*TaxIncentive_{it} + \beta_8^{q_n}*LowSales_{it} + \beta_9^{q_n}*TaxIncentive_{it}*LowSales_{it}$$

VARIABLES	(1) ln(ROA+1)	(2) ln(ROA+1)	(3) ln(ROA+1)	(4) ln(ROA+1)	(5) ln(ROA+1)	(6) ln(ROA+1)	(7) ln(ROA+1)	(8) ln(ROA+1)
ln(TangibleAssets)	0.00627	-0.00215***	-0.00193***	-0.00251***	-0.00294***	-0.00394***	-0.00551***	0.156**
	(0.130)	(9.72e-05)	(5.41e-05)	(6.65e-05)	(7.08e-05)	(9.81e-05)	(0.000177)	(0.0748)
ln(CompExp)	-0.0745	0.00141***	0.000715***	0.00143***	0.00138***	0.00189***	0.00267***	-0.349***
	(0.187)	(0.000134)	(7.79e-05)	(9.16e-05)	(9.91e-05)	(0.000140)	(0.000279)	(0.129)
industryROA	-4.708	0.144***	0.0828***	0.0196***	0.00989	0.0227**	0.0161	-3.240
	(3.141)	(0.01000)	(0.00736)	(0.00666)	(0.00758)	(0.0101)	(0.0196)	(1.976)
ln(age)	-0.777***	-0.00597***	-0.00292***	-0.00341***	-0.00363***	-0.00508***	-0.00664***	0.306**
	(0.169)	(0.000322)	(0.000186)	(0.000213)	(0.000222)	(0.000322)	(0.000531)	(0.144)
changeGDP	-4.809	-0.0454***	0.0157***	0.0388***	0.0224***	0.0433***	0.0536***	10.35**
	(7.246)	(0.00858)	(0.00567)	(0.00637)	(0.00630)	(0.00855)	(0.0165)	(4.583)
changeMarketsize	-3.24e-06	-1.31e-08	-7.37e-09	-1.84e-08	-5.58e-09	-4.94e-08**	-5.93e-08	-4.32e-06
	(7.94e-06)	(2.34e-08)	(1.60e-08)	(1.70e-08)	(1.72e-08)	(2.50e-08)	(4.06e-08)	(5.15e-06)
C	11.05	-0.0337***	-0.0313***	-0.0260***	-0.0275***	-0.0256***	-0.0402***	-5.416
	(7.393)	(0.00398)	(0.00350)	(0.00416)	(0.00435)	(0.00543)	(0.0105)	(4.077)
LowSales	0.215	0.0270***	-0.00368***	9.57e-05	0.00321***	0.00490***	0.0124***	-0.0816
	(0.624)	(0.00137)	(0.000370)	(0.000508)	(0.000617)	(0.000943)	(0.00156)	(0.886)
LowSales*C	-4.582	-0.0540*	-0.0113	-0.0197*	-0.00251	-0.0479***	0.0180	12.13***
	(8.232)	(0.0304)	(0.00843)	(0.0101)	(0.0139)	(0.0152)	(0.0318)	(4.481)
Constant	8.018***	0.0511***	0.0446***	0.0462***	0.0573***	0.0764***	0.115***	4.979***
	(1.569)	(0.00172)	(0.00100)	(0.00126)	(0.00144)	(0.00215)	(0.00320)	(1.282)
Observations	215,536	215,536	215,536	215,536	215,536	215,536	215,536	215,536

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

ln(TangibleAssets)= the logarithm of tangible fixed assets

ln(CompExp)= the logarithm of compensation expense

industryROA= return on assets based on a two-digit NACE code for each industry-country-year

ln(age)= the logarithm of age

changeGDP= the percent change in GDP per capita for each country-year

changeMarketsize= the change in market size calculated as total revenues in each industry in year t less year t-1, scaled by 1,000,000.

C= the capital weighted tax incentive variable C

LowSales= binary variable equal to 1 if the affialite´s sales are in the lowest quartile

*LowSales*C= Interaction term between LowSales and C*

Table 9.1: Semi-Elasticities

Quantiles	q=1	q=2	q=3	q=4	q=5	q=6	q=7	q=8
Interval Quantiles	(0.00, 0.125)	(0.125, 0.25)	(0.25, 0.375)	(0.375, 0.5)	(0.5, 0.625)	(0.625, 0.75)	(0.75, 0.875)	(0.875, 1)
Mininum ROA	-99,84 %	-0,58 %	2,63 %	5,36 %	8,20 %	11,62 %	16,43 %	25,25 %
Maximum ROA	-0,58 %	2,63 %	5,36 %	8,20 %	11,62 %	16,43 %	25,25 %	9099,81 %
Mean ROA	-12,71 %	1,11 %	4,01 %	6,76 %	9,84 %	13,85 %	20,24 %	42,84 %
Coefficient of C if LowSales=0	11,05	-0,0337	-0,0313	-0,026	-0,0275	-0,0256	-0,0402	-5,416
Std. of C	0,0568526	0,497039	0,046582	0,0451042	0,0462493	0,0471084	0,0477335	0,0485375
Expected ROA if LowSales=0	63,61 %	-0,57 %	3,86 %	6,63 %	9,70 %	13,71 %	20,01 %	9,82 %
Semi-Elasticity if LowSales=0	105,658763	-3,05462134	-0,81169301	-0,41058465	-0,30674605	-0,2102987	-0,238575951	-15,87962228
Coefficient of C if LowSales=1	6,468	-0,0877	-0,0426	-0,0457	-0,03001	-0,0735	-0,0222	6,714
Std. of C	0,0568526	0,497039	0,046582	0,0451042	0,0462493	0,0471084	0,0477335	0,0485375
Expected ROA if LowSales=1	26,09 %	-3,21 %	3,80 %	6,54 %	9,69 %	13,46 %	20,11 %	97,87 %
Semi-Elasticity if LowSales=1	53,7121495	-7,84382914	-1,10444171	-0,72136101	-0,33472417	-0,60310672	-0,131807497	26,46431582

Interval Quantiles: percentage cut off points in the distribution

Minimum ROA: Lowest observed ROA in the respective quantile, retrieved from Appendix B

Maximum ROA: Highest observed ROA in the respective quantile, retrieved from Appendix B

Mean ROA: The average ROA of the respective quantile, retrieved from Appendix B

Coefficient of C if LowSales=0: retrieved from table 9.

Std. of C: Standard deviation of C, retrieved from Appendix B

Expected ROA if LowSales=0: estimated ROA with 1 unit change in C for the remaining sample, calculated using $exp^{(Coefficient\ of\ C*Std.\ of\ C)+ln(mean\ ROA+1)} - 1$

Semi-Elasticity if LowSales=0: Tax-sensitivity for the remaining sample, calculated using [((Expected ROA/meanROA)-1)/Std of C]

Coefficient of C if LowSales=1: The sum of coefficients of C retrieved from table 9.

Std. of C: Standard deviation of C, retrieved from Appendix B

Expected ROA if LowSales=1: estimated ROA with 1 unit change in C for the affiliates with income shifting constraints, calculated using $exp^{(Coefficient\ of\ C*Std.\ of\ C)+ln(mean\ ROA+1)} - 1$

Semi-Elasticity if LowSales=1: Tax-sensitivity for the affiliates with income shifting constraints, calculated using [((Expected ROA/meanROA)-1)/Std of C]

6.4 Testing Whether Precautionary Behavior Affects the Reported Tax Sensitivity in the Profit Distribution (H3)

Besides a potential bias stemming from income shifting constraints, our results could also be affected by precautionary behavior as result of the difficulty in predicting future earnings when setting transfer prices in the beginning of the fiscal year. Precautionary behavior might differ across industries and over time, and is often increasingly relevant when the level of flexibility in setting transfer prices is decreasing. It is reasonable to assume that affiliates operating in fairly stable markets might be better suited to predict future earnings than firms in fairly unstable markets. As a consequence, these affiliates can shift profits more aggressively by setting more abusive transfer prices without the restraining fear of becoming unprofitable, and potentially jeopardize the minimization of the tax burden of the MNC. Hence, these affiliates should feature higher levels of tax sensitivity than the ones that have more difficulty predicting earnings. Therefore, when controlling for firms in relatively stable markets, we expect that the responsiveness to tax incentives and the tax sensitivity for the remaining sample will decrease. To control for precautionary behavior, we generated a binary variable to identify affiliates in relatively stable markets based on the change in industryROA for each industry-country-year. We defined the lower quartile as fairly stable markets, and let the binary variable be equal to one for affiliates in this category. Similarly to the approach used to test H2, we conduct an OLS regression of the full sample to detect the overall effect, as well as interquantile range regression to generate estimates for the different quantiles.

Table 10: Controlling for Precautionary Behavior Using OLS Regression

$$\ln(ROA_{it}+1) = \beta_0 + \beta_1 * \ln(TangibleAssets_{it}) + \beta_2 * \ln(CompExp_{it}) + \beta_3 * IndustryROA_t + \beta_4 * Age_{it} + \beta_5 * \Delta GDP_t + \beta_6 * \Delta MarketSize_t + \beta_7 * TaxIncentive_{it} + \beta_8 * StableMarkets_{it} + \beta_9 * TaxIncentive_{it} * StableMarkets_{it}$$

VARIABLES	(1) ln(ROA+1)
ln(TangibleAssets)	-0.00447***
	(0.000273)
ln(CompExp)	0.00429***
	(0.000401)
industryROA	0.403***
	(0.0172)
ln(age)	0.00631***
	(0.000805)
changeGDP	0.154***
	(0.0132)
changeMarketsize	3.67e-08
	(3.55e-08)
C	-0.0721***
	(0.0134)
StableMarkets	0.000300
	(0.000760)
StableMarkets*C	-0.0251
	(0.0155)
Constant	0.0429***
	(0.00479)
Observations	215,536
Number of numeric_subs_bvdepnr	51,146
R-squared	0.0140

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

ln(TangibleAssets)= the logarithm of tangible fixed assets

ln(CompExp)= the logarithm of compensation expense

industryROA= return on assets based on a two-digit NACE code for each industry-country-year

ln(age)= the logarithm of age

changeGDP= the percent change in GDP per capita for each country-year

changeMarketsize= the change in market size calculated as total revenues in each industry in year t less year t-1, scaled by 1,000,000.

C= the capital weighted tax incentive variable C

StableMarkets= binary variable equal to 1 if the affiliate is located in the lowest quartile in regards to change in industryROA

*StableMarkets*C= Interaction term between StableMarkets and C*

When using OLS regression, the estimates of the remaining sample after controlling for precautionary behavior are compared to our main results in tables 7 and 7.1. We observe an overall increase in the marginal effect, stated to -0.0721 for the remaining sample in table 10, which is higher than the majority of the estimates pertaining to the different quantiles in table 7. The marginal effect of the remaining sample translates to a semi-elasticity of -0.74. Even if the semi-elasticities of several quantiles in table 7 are higher than the ones for the remaining sample in table 10, we are unable to conclude that our third hypothesis is confirmed with certainty. In addition, when the sum of coefficients with respect to the composite tax rate of affiliates in stable markets are compared to table 7, we notice an even greater difference. The marginal effect of stable markets is -0.0972, which translates to a semi-elasticity of -1.00. Thus, we observe that affiliates in relatively stable markets have a greater tax sensitivity than affiliates in rather unstable markets in table 10.1. Even though this finding seem to confirm our expectations, it is important to note that the interaction term is insignificant. Therefore, based on the OLS regression, we do not find reliable evidence to support our third hypothesis. As a result, we perform an interquantile range regression to further investigate the effect of precautionary behavior on the specific parts of the profit distribution.

Table 10.1: Semi-Elasticities

Variables	All Affiliates
Mean ROA	10,74226 %
Coefficient of C if StableMarkets=0	-0,0721
Std. of C	0,0486904
Expected ROA if StableMarkets=0	10,35 %
Semi-Elasticity if StableMarkets=0	-0,7419778
Coefficient of C if StableMarkets=1	-0,0972
Std. of C	0,0486904
Expected ROA if StableMarkets=1	10,22 %
Semi-Elasticity if StableMarkets=1	-0,9996701

Mean ROA: The average ROA, retrieved from Table 3

Coefficient of C if StableMarkets=0: retrieved from table 10.

Std. of C: Standard deviation of C, retrieved from Table 3

Expected ROA: estimated ROA with 1 unit change in C, calculated using $\exp^{(\text{Coefficient of } C * \text{Std. of } C) + \ln(\text{mean ROA} + 1)} - 1$

Semi-Elasticity: Tax-sensitivity calculated using [((Expected ROA/meanROA)-1)/Std of C]

Coefficient of C if StableMarkets=1: the sum of coefficients of C, retrieved from Table 10.

When observing the estimates from interquantile range regressions controlling for precautionary behavior, we employ the same approaches as when analyzing the effect of income shifting constraints. First, by comparing the marginal effects of the remaining sample in table 11 to the estimates in table 7, we observe some unexpected and contradicting effects. Indeed, for quantiles 3, 4, 5, and 7, we find a smaller marginal effect compared to table 7, as expected. This implies that the estimates in table 7 could be biased upwards due to the presence of affiliates better able to predict future earnings. Oppositely, quantiles 1, 2, 6, and 8 estimate a larger marginal effect compared to table 7. Interestingly enough, when excluding the quantiles containing extreme levels of ROA, q=1 and q=8, four out of the remaining six quantiles display the expected effect when controlling for precautionary behavior. The semi-elasticities confirm the fluctuations seen in marginal effects. These preliminary findings could serve as an indication of the validity of our third hypothesis.

By pursuing our second investigation approach, we expect that affiliates in fairly stable markets show a higher marginal effect as well as a higher tax sensitivity compared to the remaining affiliates. Nonetheless, this is merely observed in quantiles 3, 5, and 8, of which only the two latter are significant. For the other quantiles, we observe the opposite effect, and only two significant estimates. Again, the semi-elasticities provide the same indications as the marginal effects. As a result, we are unable to provide conclusive evidence of the expected effect of precautionary behavior.

One possible explanation for these inconsistent findings could be related to the identification criteria for firms in stable markets. We chose to define affiliates within the lower quartile of the change in industryROA as affiliates in relatively stable markets. This consideration is related to the sample, which could be affected by the sample restrictions. As a result, the lower quartile of change in industryROA might not represent affiliates pertaining to truly stable markets. Furthermore, a quartile is a fairly large portion of the sample and consequently, it could include affiliates in fairly unstable markets. Another possible explanation is that the change in industryROA might not be the most appropriate proxy for affiliates that are well equipped to accurately predict future earnings. Hence, this categorization might not have distinguished affiliates more dependent on precautionary behavior from the ones less dependent. This could then imply that the designed model does not provide evidence for what we intended to test. However, based on our sample and the variables available, we still believe that the change in industryROA was the most suitable proxy at hand.

To summarize, our third hypothesis cannot be confirmed as the tests provide inconclusive and at times contradicting results.

Table 11: estimation of firms in fairly stable markets

$$\ln(ROA_{it}+1)^{qn} = \beta_0^{qn} + \beta_1^{qn} * \ln(TangibleAssets_{it}) + \beta_2^{qn} * \ln(CompExp_{it}) + \beta_3^{qn} * IndustryROA_t + \beta_4^{qn} * Age_{it} + \beta_5^{qn} * \Delta GDP_t + \beta_6^{qn} * \Delta MarketSize_t + \beta_7^{qn} * TaxIncentive_{it} + \beta_8^{qn} * StableMarkets_{it} + \beta_9^{qn} * TaxIncentive_{it} * StableMarkets_{it}$$

VARIABLES	(1) ln(ROA+1)	(2) ln(ROA+1)	(3) ln(ROA+1)	(4) ln(ROA+1)	(5) ln(ROA+1)	(6) ln(ROA+1)	(7) ln(ROA+1)	(8) ln(ROA+1)
ln(TangibleAssets)	-0.0499	-0.00210***	-0.00210***	-0.00250***	-0.00284***	-0.00395***	-0.00554***	0.109*
	(0.0850)	(0.000110)	(5.71e-05)	(7.06e-05)	(8.12e-05)	(0.000104)	(0.000158)	(0.0562)
ln(CompExp)	-0.204	0.000217*	0.00130***	0.00116***	0.000944***	0.00127***	0.00138***	-0.220***
	(0.157)	(0.000123)	(7.58e-05)	(8.89e-05)	(9.58e-05)	(0.000125)	(0.000225)	(0.0589)
industryROA	-4.334*	0.161***	0.0545***	0.00408	-0.00531	0.0143	0.00340	-2.142
	(2.247)	(0.00935)	(0.00641)	(0.00719)	(0.00732)	(0.0103)	(0.0182)	(1.412)
ln(age)	-0.813***	-0.00722***	-0.00288***	-0.00319***	-0.00361***	-0.00499***	-0.00689***	-0.0655
	(0.180)	(0.000336)	(0.000192)	(0.000188)	(0.000241)	(0.000284)	(0.000526)	(0.103)
changeGDP	-5.370	-0.0630***	0.0287***	0.0298***	0.0308***	0.0341***	0.0419***	8.465***
	(7.642)	(0.00922)	(0.00539)	(0.00598)	(0.00553)	(0.00965)	(0.0130)	(2.300)
changeMarketsize	-5.94e-06	-3.04e-08	1.07e-08	7.59e-09	-3.03e-08*	-5.44e-08**	-5.47e-08	-5.42e-06*
	(7.88e-06)	(2.26e-08)	(1.80e-08)	(1.70e-08)	(1.78e-08)	(2.69e-08)	(3.68e-08)	(3.12e-06)
C	9.240***	-0.0355***	-0.0329***	-0.0327***	-0.0250***	-0.0402***	-0.0372***	4.851***
	(3.237)	(0.00527)	(0.00422)	(0.00471)	(0.00475)	(0.00664)	(0.0107)	(1.632)
StableMarkets	-0.0993	-0.00102*	-0.00168***	-0.00180***	-0.00187***	-0.00224***	-0.00282***	1.083**
	(0.432)	(0.000583)	(0.000287)	(0.000310)	(0.000352)	(0.000522)	(0.000902)	(0.497)
StableMarkets*C	-16.42**	0.0150	-0.00171	0.00142	-0.0226***	0.0303***	0.00462	-12.84***
	(7.571)	(0.0124)	(0.00616)	(0.00738)	(0.00870)	(0.0114)	(0.0220)	(2.893)
Constant	10.71***	0.0740***	0.0397***	0.0510***	0.0639***	0.0871***	0.138***	3.865***
	(1.352)	(0.00173)	(0.00102)	(0.00107)	(0.00119)	(0.00153)	(0.00275)	(0.418)
Observations	215,536	215,536	215,536	215,536	215,536	215,536	215,536	215,536

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

ln(TangibleAssets)= the logarithm of tangible fixed assets

ln(CompExp)= the logarithm of compensation expense

industryROA= return on assets based on a two-digit NACE code for each industry-country-year

ln(age)= the logarithm of age

changeGDP= the percent change in GDP per capita for each country-year

changeMarketsize= the change in market size calculated as total revenues in each industry in year t less year t-1, scaled by 1,000,000.

C= the capital weighted tax incentive variable C

StableMarkets= binary variable equal to 1 if the affiliate is located in the lowest quartile in regards to change in industryROA

*StableMarkets*C= Interaction term between StableMarkets and C*

Table 11.1: Semi-elasticities

Quantiles	q=1	q=2	q=3	q=4	q=5	q=6	q=7	q=8
Interval Quantiles	(0.00, 0.125)	(0.125, 0.25)	(0.25, 0.375)	(0.375, 0.5)	(0.5, 0.625)	(0.625, 0.75)	(0.75, 0.875)	(0.875, 1)
Mininum ROA	-99,84 %	-0,58 %	2,63 %	5,36 %	8,20 %	11,62 %	16,43 %	25,25 %
Maximum ROA	-0,58 %	2,63 %	5,36 %	8,20 %	11,62 %	16,43 %	25,25 %	9099,81 %
Mean ROA	-12,71 %	1,11 %	4,01 %	6,76 %	9,84 %	13,85 %	20,24 %	42,84 %
Coefficient of C if StableMarkets=0	9,24	-0,0355	-0,0329	-0,0327	-0,025	-0,0402	-0,0372	4,851
Std. of C	0,0568526	0,497039	0,046582	0,0451042	0,0462493	0,0471084	0,0477335	0,0485375
Expected ROA if StableMarkets=0	47,62 %	-0,66 %	3,85 %	6,60 %	9,71 %	13,64 %	20,03 %	80,76 %
Semi-Elasticity if StableMarkets=0	83,5091334	-3,21634121	-0,85315352	-0,51631115	-0,27887616	-0,33012116	-0,220787578	18,23718106
Coefficient of C if StableMarkets=1	-7,18	-0,0205	-0,03461	-0,03128	-0,0476	-0,0099	-0,03258	-7,989
Std. of C	0,0568526	0,497039	0,046582	0,0451042	0,0462493	0,0471084	0,0477335	0,0485375
Expected ROA if StableMarkets=1	-41,96 %	0,08 %	3,84 %	6,61 %	9,60 %	13,80 %	20,05 %	-3,07 %
Semi-Elasticity if StableMarkets=1	-40,5045752	-1,86424432	-0,89746103	-0,49390611	-0,53070286	-0,08135653	-0,193388502	-22,08018883

Interval Quantiles: percentage cut off points in the distribution

Minimum ROA: Lowest observed ROA in the respective quantile, retrieved from Appendix B

Maximum ROA: Highest observed ROA in the respective quantile, retrieved from Appendix B

Mean ROA: The average ROA of the respective quantile, retrieved Appendix B

Coefficient of C if StableMarkets=0: The estimate of C pertaining to the remaining sample, retrieved from Table 11

Std. of C: Standard deviation of C, retrieved from Appendix B

Expected ROA if StableMarkets=0: estimated ROA with 1 unit change in C for the remaining sample, calculated using $exp^{(Coefficient\ of\ C*Std.\ of\ C)+ln(mean\ ROA+1)} - 1$

Semi-Elasticity if StableMarkets=0: Tax-sensitivity for the remaining sample, calculated using [((Expected ROA/meanROA)-1)/Std of C]

Coefficient of C if StableMarkets=1: The sum of coefficients of C, retrieved from Table 11

Std. of C: Standard deviation of C, retrieved from Appendix B

Expected ROA if StableMarkets=1: estimated ROA with 1 unit change in C for the affiliates in stable markets, calculated using $exp^{(Coefficient\ of\ C*Std.\ of\ C)+ln(mean\ ROA+1)} - 1$

Semi-Elasticity if StableMarkets=1: Tax-sensitivity for the affiliates in stable markets, calculated using [((Expected ROA/meanROA)-1)/Std of C]

7. Robustness Tests

7.1 Alternative Tax Incentives Measure Using the STR Differential

For all the tests provided above we used the capital-weighted tax incentives measure, C. However, as previously explained, there are some difficulties related to the interpretation of the variable, as well as potential measurement errors. Therefore, we conduct a robustness test using the difference between an affiliates tax rate, and the tax rate in the lowest taxed affiliate in the group, as a tax incentives measure. This is related to the fact that the MNCs will have incentives to shift all profits to the lowest taxed affiliate.

Using the difference in STRs as a tax incentives measure, provides us with estimates similar to the ones observed in table 7. Nevertheless, in the second quantile, we estimate a positive coefficient for the difference in STR. This finding implies that ROA increases when the difference increases, which is contradictory to our expectations. For profitable affiliates, one would expect profits to be shifted out if the affiliate has a relatively high tax rate compared to the group, and thereby, that expected ROA would decrease with an increase in the difference in STRs. Additionally, the bunching around zero assumption insinuates that the affiliates closest to zero are the ones with relatively high STRs compared to at least one affiliate in their respective group. With this assumption in mind, observing incentives to shift profits in, when looking at the quantile located in the narrow range around zero, become even more surprising. However, as this interval contains slightly unprofitable affiliates, it is possible that they could bias the estimation if they have relatively high STRs. The unprofitable affiliates are expected to have a positive marginal effect related to the tax incentives, as MNCs would have incentives to employ a shift-to-loss strategy to shift profits into loss affiliates. The semi-elasticities are positive and higher for q=1 and q=2 compared to table 7. This implies that unprofitable affiliates and affiliates bunching around zero display a relatively higher tax sensitivity, which is in line with our previous estimates. However, the incentives for affiliates in the narrow range around zero profits have changed. In table 7.1 it appeared as if MNCs had incentives to shift profits out of these affiliates, whereas in table 12.1, they have incentives to shift profits in. Furthermore, for the remaining quantiles, we observe a negative and somewhat smaller tax sensitivity compared to our main results. Nevertheless, we still observe a heterogeneous distribution of tax sensitivities in line with table 7.1.

To summarize, the estimates using the difference in STR provides us with an overall similar indication as the estimates of table 7. Although, there are some unexpected changes in the sign and levels of the tax sensitivities, we observe a heterogeneous distribution when conducting our robustness test using a different tax incentives measure.

Table 12: Robustness Test Using the Difference in STR as Tax Incentive

$$\ln(ROA_{it}+1)^{q_n} = \beta_0^{q_n} + \beta_1^{q_n} * \ln(TangibleAssets_{it}) + \beta_2^{q_n} * \ln(CompExp_{it}) + \beta_3^{q_n} * IndustryROA_t + \beta_4^{q_n} * Age_{it} + \beta_5^{q_n} * \Delta GDP_t + \beta_6^{q_n} * \Delta MarketSize_t + \beta_7^{q_n} * TaxIncentive_{it}$$

VARIABLES	(1) ln(ROA+1)	(2) ln(ROA+1)	(3) ln(ROA+1)	(4) ln(ROA+1)	(5) ln(ROA+1)	(6) ln(ROA+1)	(7) ln(ROA+1)	(8) ln(ROA+1)
ln(TangibleAssets)	-0.192*	-0.00222***	-0.00199***	-0.00252***	-0.00277***	-0.00383***	-0.00545***	0.125**
	(0.0987)	(0.000108)	(6.21e-05)	(6.54e-05)	(7.39e-05)	(9.60e-05)	(0.000174)	(0.0631)
ln(CompExp)	0.112	-3.26e-05	0.00119***	0.00116***	0.000891***	0.00108***	0.00144***	-0.310***
	(0.172)	(0.000145)	(8.19e-05)	(8.17e-05)	(9.32e-05)	(0.000122)	(0.000231)	(0.0794)
industryROA	-5.014*	0.154***	0.0651***	0.00877	0.00697	0.0181	0.00614	0.200
	(2.851)	(0.00920)	(0.00547)	(0.00585)	(0.00762)	(0.0125)	(0.0190)	(2.227)
ln(age)	-0.841***	-0.00726***	-0.00300***	-0.00298***	-0.00366***	-0.00466***	-0.00702***	0.669**
	(0.249)	(0.000353)	(0.000199)	(0.000209)	(0.000215)	(0.000322)	(0.000646)	(0.325)
changeGDP	8.460	-0.0264***	0.0305***	0.0445***	0.0301***	0.0408***	0.0348**	7.824***
	(10.15)	(0.00791)	(0.00501)	(0.00598)	(0.00711)	(0.00923)	(0.0152)	(2.243)
changeMarketsize	-1.35e-05	-3.59e-08*	-1.23e-08	-6.87e-10	-3.08e-08*	-6.85e-08***	-7.66e-08**	-4.62e-06**
	(1.05e-05)	(2.10e-08)	(1.86e-08)	(1.65e-08)	(1.87e-08)	(2.58e-08)	(3.59e-08)	(2.00e-06)
DifferenceSTR	9.620**	0.0485***	-0.0120***	-0.0146***	-0.00729***	-0.0107***	-0.0188***	-2.911
	(4.864)	(0.00452)	(0.00221)	(0.00204)	(0.00270)	(0.00339)	(0.00637)	(2.175)
Constant	7.783***	0.0769***	0.0397***	0.0502***	0.0631***	0.0868***	0.136***	4.187***
	(1.389)	(0.00189)	(0.00102)	(0.00108)	(0.00127)	(0.00164)	(0.00261)	(0.873)
Observations	215,536	215,536	215,536	215,536	215,536	215,536	215,536	215,536

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

ln(TangibleAssets)= the logarithm of tangible fixed assets

ln(CompExp)= the logarithm of compensation expense *industryROA= return on assets based on a two-digit NACE code for each industry-country-year*

ln(age)= the logarithm of age

changeGDP= the percent change in GDP per capita for each country-year

changeMarketsize= the change in market size calculated as total revenues in each industry in year t less year t-1, scaled by 1,000,000.

DifferenceSTR= The difference between the affiliate´s tax rate and the tax rate of the lowest taxed affiliate

Table 12.1: Semi-Elasticities

Quantiles	q=1	q=2	q=3	q=4	q=5	q=6	q=7	q=8
Interval Quantiles	(0.00, 0.125)	(0.125, 0.25)	(0.25, 0.375)	(0.375, 0.5)	(0.5, 0.625)	(0.625, 0.75)	(0.75, 0.875)	(0.875, 1)
Mininum ROA	-99,84 %	-0,58 %	2,63 %	5,36 %	8,20 %	11,62 %	16,43 %	25,25 %
Maximum ROA	-0,58 %	2,63 %	5,36 %	8,20 %	11,62 %	16,43 %	25,25 %	9099,81 %
Mean ROA	-12,71 %	1,11 %	4,01 %	6,76 %	9,84 %	13,85 %	20,24 %	42,84 %
Coefficient of STR (Diff)	9,62	0,0485	-0,012	-0,0146	-0,00729	-0,0107	-0,0188	-2,911
Std. of STR (Diff)	0,0671176	0,0654306	0,0617272	0,0599052	0,0594199	0,0575617	0,0555593	0,0498742
Expected ROA	66,49 %	1,43 %	3,93 %	6,66 %	9,79 %	13,78 %	20,12 %	23,54 %
Semi-Elasticity	92,8767729	4,44007881	-0,3113038	-0,2305934	-0,0813497	-0,0879242	-0,1116216	-9,0342583

Interval Quantiles: percentage cut off points in the distribution

Minimum ROA: Lowest observed ROA in the respective quantile, retrieved from Appendix B

Maximum ROA: Highest observed ROA in the respective quantile, retrieved from Appendix B

Mean ROA: The average ROA of the respective quantile, retrieved from Appendix B

Coefficient of STR: retrieved from table 12.

Std. of STR: Standard deviation of C, retrieved from Appendix B

Expected ROA: estimated ROA with 1 unit change in C, calculated using $exp^{(Coefficient\ of\ C*Std.\ of\ C)+ln(mean\ ROA+1)} - 1$

Semi-Elasticity: Tax-sensitivity calculated using [((Expected ROA/meanROA)-1)/Std of C]

7.2 Tax Sensitivities in a Sample Restricted to -10% < ROA < 10%

Due to concerns related to the effect of extreme observations in previous estimates, we conduct a robustness test with a sample restricted to an ROA between -10% and 10%. Moreover, we generate new quantiles based on equal intervals in ROA instead of basing the quantiles on the frequency of observations. The quantiles are constructed so that each one has a 2% ROA range. For instance, the first interval is ranging from a ROA of -10% to a ROA of -8%. There are several reasons why this robustness test is of interest. Firstly, it potentially allows us to determine the tax sensitivity in profitable and unprofitable quantiles around zero. Secondly, the estimates in the fat tails are not biased by extreme observations. And thirdly, this test potentially provides more accurate estimates in the selected part of the distribution.

Table 13: Sample Restricted to -10% < ROA < 10% and Quantiles Division Based on ROA

$$\ln(\pi_i + 1)^q = \beta_0^q + \beta_1^q * \ln(\text{TangibleAssets}_{it}) + \beta_2^q * \ln(\text{CompExp}_{it}) + \beta_3^q * \text{IndustryROA}_t + \beta_4^q * \text{Age}_{it} + \beta_5^q * \Delta\text{GDP}_t + \beta_6^q * \Delta\text{MarketSize}_t + \beta_7^q * \text{TaxIncentive}_{it}$$

VARIABLES	(1) ln(ROA+1)	(2) ln(ROA+1)	(3) ln(ROA+1)	(4) ln(ROA+1)	(5) ln(ROA+1)	(6) ln(ROA+1)	(7) ln(ROA+1)	(8) ln(ROA+1)	(9) ln(ROA+1)	(10) ln(ROA+1)
ln(TangibleAssets)	0.00195***	0.000748***	-0.000216	-0.000503***	-0.00100***	-0.000312***	-0.000561***	-0.000494***	-0.000230***	0.000583***
	(0.000182)	(0.000183)	(0.000175)	(9.78e-05)	(0.000100)	(4.85e-05)	(4.50e-05)	(4.83e-05)	(4.96e-05)	(4.82e-05)
ln(CompExp)	0.000249	0.000360	-1.14e-05	9.15e-05	6.66e-05	0.000619***	0.000586***	0.000227***	-0.000546***	-0.00156***
	(0.000285)	(0.000245)	(0.000216)	(0.000145)	(0.000113)	(6.23e-05)	(6.50e-05)	(7.52e-05)	(7.93e-05)	(9.03e-05)
industryROA	0.0724***	-0.0262	0.0665***	0.0454***	0.0844***	0.105***	-0.0104	-0.0841***	-0.113***	-0.140***
	(0.0193)	(0.0183)	(0.0164)	(0.0126)	(0.0107)	(0.00654)	(0.00637)	(0.00633)	(0.00605)	(0.0110)
ln(age)	0.00363***	0.00211***	9.11e-05	-0.00130***	-0.00314***	-0.00103***	-0.000399***	-0.000553***	5.08e-05	0.000461***
	(0.000580)	(0.000525)	(0.000530)	(0.000288)	(0.000302)	(0.000172)	(0.000151)	(0.000170)	(0.000160)	(0.000146)
changeGDP	0.0703***	0.0185	-0.00483	0.00132	-0.0252***	-0.00664	0.000476	0.000246	-0.0164***	-0.0340***
	(0.0156)	(0.0182)	(0.0135)	(0.0131)	(0.00887)	(0.00529)	(0.00447)	(0.00408)	(0.00456)	(0.00525)
changeMarketsize	-5.64e-08	-1.47e-08	9.41e-08**	-4.45e-08	5.65e-09	-2.22e-08	1.42e-08	4.85e-09	-2.35e-09	1.89e-08
	(5.06e-08)	(4.91e-08)	(4.41e-08)	(3.95e-08)	(2.34e-08)	(1.41e-08)	(1.59e-08)	(1.47e-08)	(1.42e-08)	(1.25e-08)
C	0.00845	0.0148**	0.00320	-0.00469	-0.00799*	-0.0160***	-0.00863***	-0.00110	8.28e-05	0.0106***
	(0.00722)	(0.00685)	(0.00632)	(0.00482)	(0.00474)	(0.00346)	(0.00238)	(0.00272)	(0.00251)	(0.00258)
Constant	-0.0175***	0.00144	0.0238***	0.0238***	0.0399***	0.0135***	0.0187***	0.0262***	0.0333***	0.0371***
	(0.00326)	(0.00278)	(0.00217)	(0.00196)	(0.00147)	(0.000963)	(0.000752)	(0.000976)	(0.000895)	(0.000991)
Observations	112,906	112,906	112,906	112,906	112,906	112,906	112,906	112,906	112,906	112,906

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

ln(TangibleAssets)= the logarithm of tangible fixed assets

ln(CompExp)= the logarithm of compensation expense

industryROA= return on assets based on a two-digit NACE code for each industry-country-year

ln(age)= the logarithm of age

changeGDP= the percent change in GDP per capita for each country-year

changeMarketsize= the change in market size calculated as total revenues in each industry in year t less year t-1, scaled by 1,000,000.

C= the capital weighted tax incentive variable C

Table 13.1: Semi-Elasticities

Quantiles	q=1	q=2	q=3	q=4	q=5	q=6	q=7	q=8	q=9	q=10
Interval Quantiles	(0.00, 0.015)	(0.015, 0.034)	(0.034, 0.066)	(0.066, 0.101)	(0.101, 0.187)	(0.187, 0.337)	(0.337, 0.507)	(0.507, 0.684)	(0.684, 0.851)	(0.851, 1)
Number of Observations	1.689	2.163	3.008	4.576	9.683	16.988	19.271	19.977	18.915	16.886
Mininum ROA	-10,00 %	-8,00 %	-6,00 %	-4,00 %	-2,00 %	0,00 %	2,00 %	4,00 %	6,00 %	8,00 %
Maximum ROA	-8,00 %	-6,00 %	-4,00 %	-2,00 %	0,00 %	2,00 %	4,00 %	6,00 %	8,00 %	10,00 %
Mean ROA	-8,95 %	-6,94 %	-4,93 %	-2,93 %	-0,82 %	1,01 %	3,01 %	5,00 %	6,99 %	8,98 %
Coefficient of C	0,00845	0,0148	0,0032	-0,00469	-0,00799	-0,016	-0,00863	-0,0011	0,0000828	0,0106
Std. of C	0,0583049	0,0566222	0,0542712	0,0557978	0,0522958	0,0491653	0,0479153	0,0458234	0,0451032	0,045977
Expected ROA	-8,90 %	-6,86 %	-4,91 %	-2,96 %	-0,86 %	0,93 %	2,97 %	4,99 %	6,99 %	9,03 %
Semi-Elasticity	0,086022588	0,198539661	0,061714081	-0,155357931	-0,969655892	-1,593406965	-0,294980238	-0,023120425	0,001267852	0,12866855

Interval Quantiles: percentage cut off points in the distribution

Number of Observations: the number of observations in each quantile

Minimum ROA: Lowest observed ROA in the respective quantile, retrieved from Appendix C

Maximum ROA: Highest observed ROA in the respective quantile, retrieved from Appendix C

Mean ROA: The average ROA of the respective quantile, retrieved from Appendix C

Coefficient of C: retrieved from table 13

Std. of C: Standard deviation of C, retrieved from Appendix C

Expected ROA: estimated ROA with 1 unit change in C, calculated using $exp^{(Coefficient\ of\ C*Std.\ of\ C)+ln(mean\ ROA+1)} - 1$

Semi-Elasticity: Tax-sensitivity calculated using [((Expected ROA/meanROA)-1)/Std of C]

By studying the marginal effects, we notice that the estimates vary in terms of significance. For the unprofitable quantiles, only q=2 and q=5 are significant. Moreover, the marginal effect of the fifth interval is opposite to what we expected. For the profitable quantiles, q=6, q=7, and q=10 are significant. However, for the 10th interval, we observe a positive marginal effect of an increase in tax incentives, which contradicts our expectations relating to the commonly acknowledged income shifting incentive of profitable affiliates.

With regards to the estimated semi-elasticities, a heterogeneous distribution concentrated around zero profitability is depicted. In fact, we observe the highest tax sensitivity in q=10, q=6, q=5, and q=2. We notice that the highest negative tax sensitivity is found in the intervals around the zero profitability mark. Additionally, we observe that the highest positive tax sensitivities are in the loss affiliates in quantile 2, as well as in the profitable affiliates in quantile 10. This could be an indication of the validity of the bunching around zero assumption. Indeed, it is possible that the affiliates in q=10 have a high ROA as a result of profits being shifted in due to low tax rates. In addition, MNCs seemingly employ the shift-to-loss strategy generating a relatively high negative ROA in the second quantile with correspondingly high income shifting incentives. The remaining affiliates, who are shifting profits out of their affiliates, display low levels of ROA, thereby placing them around the zero profitability mark. However, in some of the quantiles, the number of observations are very low, possibly affecting the level of significance. Moreover, it appears as if the results are somewhat deflated due to a too narrow range in each quantile, making it difficult to observe clear changes across quantiles. This concern was the direct cause for why we chose to have relatively few quantiles despite a larger sample in our main regression.

To summarize, we observe some tendencies in tax sensitivities that could suggest that the bunching around zero assumption appears to be valid, which confirms the presence of a heterogeneous distribution of tax sensitivity. However, due to too narrow ranges in quantiles, and estimates varying in significance, it is not possible to confirm the hypothesis.

8. Concluding Remarks:

In this thesis, we have studied the level of tax sensitivity within a profit distribution constructed with data from European MNC extracted from the Amadeus database, provided by Burean Van Dijk. We have designed models that allowed us to test our main hypothesis, which states that the tax sensitivity is heterogeneous throughout the profit distribution, as well as two additional hypotheses designed to quantify the effect of income shifting constraints and precautionary behavior on tax sensitivity of affiliates pertaining to European MNCs. In order to evaluate the tax sensitivity of affiliates, we have utilized a capital weighted tax incentives measure developed by Huizinga and Laeven (2008) as well as a dependent variable presented in De Simone et al. (2017) that allows the inclusion of unprofitable affiliates in the profit distribution. Also, we based our data sample selection process and a majority of our explanatory variables, used to test our hypotheses, on the approach described in De Simone et al. (2017). We further used three types of regressions to derive our estimates: OLS regressions, simultaneous-quantile regressions, and interquantile range regressions. Moreover and in line with De Simone et al. (2017), we supplement our analysis by studying the semi-elasticities at the different points of the distribution, in order to correctly derive the percentage change in ROA from a unit increase in the capital weighted tax incentives measure, which corresponds to a percentage change in tax incentives.

The estimates derived from testing our main hypothesis confirm our expectation of heterogeneous tax sensitivities across the profit distribution, which is closely linked to the bunching around zero assumption. Despite some concerns surrounding the estimates in the fat tails of the distribution, we observe high levels of significance and the expected tax sensitivity pertaining to the different sections of the profit distribution, meaning that profitable affiliates shift profits out and loss affiliates receives shifted profits. When disregarding the quantiles containing extreme levels of ROA, we observe the highest estimated tax sensitivity in the narrow range around the zero profitability mark, hereby providing validating evidence for the logic of using the distance from zero profitability as a proxy for tax aggressiveness, as done by Johannesen et al. (2017) and Habu (2017). Although, we find conclusive evidence of a heterogeneous distribution of tax sensitivity, it is important to note that our findings indicate that there exist high levels of tax sensitivity further away from the zero mark, which are decreasing with increased levels of ROA. This particular finding could serve as evidence of the combined impact of flexibility in tax planning and the ability to predict future earnings on the distribution of tax sensitivity. Indeed, the distribution of the tax sensitivity, while heterogeneous, is perhaps less so than previously anticipated, as discussed by Hopland et al. (2015).

The tests relating to our second hypothesis were reliant on an interaction term composed of the measure for the capital weighted tax incentives and a binary variable identifying affiliates with plausible income shifting constraints. Affiliates within the lowest quartile in terms of sales were, for the purpose of our test, deemed as affiliates faced with income shifting constraints. Distinguishing these affiliates from the remaining sample could possibly unveil the existence of an expected downwards bias stemming from income shifting constraints in our previously estimated tax sensitivities. However, the findings were inconclusive, and despite finding some semblance of the expected results for the quantile located in the narrow range around zero, we were unable to unequivocally confirm that income shifting constraints lowers the tax sensitivity across the distribution.

Our third and final hypothesis was also tested by including an interaction term, this time combining the variable for the capital weighted tax incentives and a binary variable pinpointing affiliates that are potentially least dependent on precautionary behavior. Industry ROA was chosen as the distinguishing criteria, and subsequently, the affiliates located in the lowest quartile in terms of changes in industry ROA were considered the most accurate predictors of future earnings. The selection criteria was based on the assumption that affiliates operating in fairly stable markets better predict future earnings, and consequently shift more income relatively to their size and thus, display higher levels of tax sensitivity. We then performed tests to determine whether these affiliates created an upward bias in the estimates derived in the test pertaining to our first hypothesis. The estimates were of a conflicting nature, and made it impossible to confirm our expectations related to precautionary behavior.

Finally, we conducted two robustness tests. The first one designed to confirm the evidence found when testing the main hypothesis with the use of a different tax incentives measure, the tax rate differentials within a group. The second one devised to estimate the tax sensitivity across a narrower range around the zero profitability mark, as well as exclude potential biases coming from the presence of extreme observations in the sample. The first robustness test showed similar results as the tests using the capital weighted tax incentives, thereby implying a heterogeneous distribution of the tax sensitivity and confirming our main hypothesis. The estimates from the second robustness test were not confirming the main hypothesis to the same degree, and were ambivalent.

Even though the analysis performed in this thesis confirms our main hypothesis and provide evidence of a heterogeneous distribution of tax sensitivity, we believe there are some limitations to the designed tests that, if resolved, could lay the foundations for further research on the subject treated in this thesis. These limitations have been discussed at the relevant points during the thesis. The first one relates to the age variable used in all our tests. We diverged from the approach of De Simone et al. (2017), and used the year of incorporation to derive the real age of an affiliate. Even though we still believe that this variable is more pertinent than the use of the date where the respective affiliates were included in the Amadeus database, our approach sometimes yields an inaccurate age variable due to mistakes in the Amadeus database. Secondly, our choice of quantiles led to the creation of a large first quantile including almost all unprofitable affiliates. By dividing the sample differently, we might have gained more precise insights about the levels of tax sensitivity on the unprofitable side close to the zero mark. Thirdly, our identification criteria for affiliates suffering from income shifting constraints might have been flawed, potentially biasing our findings relating to the test of the second hypothesis. By using a different cut off point then the lowest quartile in terms of sales, we might have been able to provide conclusive evidence. The fourth limitation pertains to the use of change in industry ROA as a proxy for the ability to predict future earnings. Although, we still believe it was the most appropriate proxy available in our sample, other variables could have been included in the test of our third hypothesis that would capture the effect of precautionary behavior more accurately. Finally, the capital-weighted tax incentives measure developed by Huizinga and Laeven (2008) has been criticized for the difficulties attached to interpreting it and potential measurement errors. An alternative measure of the tax incentives might have generated more accurate estimates when testing our three hypotheses. Especially by reconsidering our choices regarding the number of quantiles, the use of industry ROA as proxy for the ability to predict future earnings, and the quartile based selection of affiliates faced with income shifting constraints, researchers could potentially refine our findings.

9. Appendices

9.1 Appendix A

Appendix A provides the estimates from the standard OLS regression, as well as the associated Breusch-Pagan test.

VARIABLES	(1) lnROAplus1
ln(TangibleAssets)	-0.00476***
	(0.000174)
ln(CompExp)	0.00498***
	(0.000251)
industryROA	0.563***
	(0.0147)
ln(age)	0.00184***
	(0.000517)
changeGDP	0.322***
	(0.0156)
changeMarketsize	-1.22e-07***
	(4.47e-08)
C	-0.110***
	(0.00853)
Constant	0.0488***
	(0.00283)
Observations	215,536
R-squared	0.015

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of lnROAplus1

         chi2(1)      =   677.26
         Prob > chi2  =   0.0000
```

9.2 Appendix B

Appendix B provides an overview of the descriptive statistics for the eight quantiles used in the test pertaining to the three hypothesis.

Descriptive Statistics: Quantile 1 (0, 0.125)

	n	Mean	Std.	Min	Max
Income Prediction Variables					
EBIT	27.025	-2863780	3,85E+07	-2,52E+09	-69
ROA	27.025	-12,70516 %	0,1651955	-99,84044 %	-0,582 %
Tangible Assets	27.025	6.791.696	9,35E+07	1	6,54E+09
CompExp	27.025	1,09E+07	8,70E+08	1	1,43E+11
ln(ROA+1)	27.025	-0,1722159	0,3494036	-6,440533	-0,0058334
ln(Tangible Assets)	27.025	12,1895	2,813789	0	22,60158
ln(CompExp)	27.025	13,34095	2,189405	0	25,68461
Industry ROA	27.025	3,00050 %	0,025836	-56,1870 %	81,5980 %
Age	27.025	17,63804	16,67307	0	253
ChangeGDP	27.025	0,8199 %	0,0267964	-14,55986 %	23,94065 %
ChangeMarketsize	27.025	866,9474	8468,22	-111485,5	185.169,4
Loss	27.025	1	0	1	1
Tax Variables					
C	27.025	-0,000566	0,0568526	-0,3525098	0,297817
STR	27.025	25,47973 %	0,0769826	8,5 %	44,429 %
STR Differentials within Group	27.025	4,73259 %	0,0671176	-1,31E-08	35,429 %
Other Firm Attributes					
Sales	24.567	3,13E+07	4,16E+08	-1960513	2,86E+10
Assets	27.025	1,09E+08	2,17E+09	2234,59	1,21E+11
Low Sales	27.025	0,3813876	0,4857364	0	1
Stable Markets	27.025	0,3232192	0,4677143	0	1

Descriptive Statistics: Quantile 2 (0.125, 0.25)

	n	Mean	Std.	Min	Max
Income Prediction Variables					
EBIT	27.024	2.713.014	6,55E+07	-2,67E+08	4,41E+09
ROA	27.024	1,10616 %	0,0091726	-0,58149 %	2,628 %
Tangible Assets	27.024	3,29E+07	7,94E+08	0,2535269	5,16E+10
CompExp	27.024	1,23E+07	1,69E+08	1	8,59E+09
ln(ROA+1)	27.024	0,0109597	0,0090757	-0,58319	0,0259434
ln(Tangible Assets)	27.024	12,97751	2,979612	-1,372285	24,66663
ln(CompExp)	27.024	13,58211	2,388375	0	22,87398
Industry ROA	27.024	2,87283 %	0,0232804	-15,7913 %	28,3580 %
Age	27.024	21,04196	18,6478	0	261
ChangeGDP	27.024	0,8644 %	0,026089	-14,55986 %	23,94065 %
ChangeMarketsize	27.024	823,9389	8735,756	-111485,5	185.169,4
Loss	27.024	0,1505699	0,3576357	0	1
Tax Variables					
C	27.024	0,0027196	0,0497039	-0,3520966	0,2937721
STR	27.024	25,70584 %	0,0745332	8,5 %	44,429 %
STR Differentials within Group	27.024	4,56274 %	0,0654306	-1,31E-08	35,429 %
Other Firm Attributes					
Sales	24.529	8,01E+07	1,04E+09	0	4,41E+10
Assets	27.024	4,15E+08	4,51E+09	2401,48	1,99E+11
Low Sales	27.024	0,303286	0,4596862	0	1
Stable Markets	27.024	0,3261545	0,4688133	0	1

Descriptive Statistics: Quantile 3 (0.25, 0.375)

	n	Mean	Std.	Min	Max
Income Prediction Variables					
EBIT	27.024	4.668.481	6,03E+07	109,3639	4,60E+09
ROA	27.024	4,00776 %	0,0078606	2,62853 %	5,363 %
Tangible Assets	27.024	2,29E+07	3,03E+08	2	3,26E+10
CompExp	27.024	1,01E+07	1,03E+08	1	7,43E+09
ln(ROA+1)	27.024	0,0392668	0,0075584	0,0259458	0,0522456
ln(Tangible Assets)	27.024	13,3331	2,884465	0,6931472	24,20745
ln(CompExp)	27.024	14,02834	2,157604	0	22,72933
Industry ROA	27.024	3,47998 %	0,022732	-19,9319 %	53,5017 %
Age	27.024	21,55773	18,3964	0	326
ChangeGDP	27.024	0,9071 %	0,0264676	-14,55986 %	23,94065 %
ChangeMarketsize	27.024	962,1342	8862,531	-111485,5	185.169,4
Loss	27.024	0	0	0	0
Tax Variables					
C	27.024	0,0015421	0,046582	-0,3138002	0,2851985
STR	27.024	25,27149 %	0,0729566	8,5 %	44,429 %
STR Differentials within Group	27.024	4,13769 %	0,0617272	-1,31E-08	35,429 %
Other Firm Attributes					
Sales	24.634	6,39E+07	4,69E+08	0	3,89E+10
Assets	27.024	1,21E+08	1,55E+09	3137,904	1,34E+11
Low Sales	27.024	0,196307	0,3972108	0	1
Stable Markets	27.024	0,3284858	0,4696712	0	1

Descriptive Statistics: Quantile 4 (0.375, 0.5)

	n	Mean	Std.	Min	Max
Income Prediction Variables					
EBIT	27.024	5.945.351	6,79E+07	378,9146	6,31E+09
ROA	27.024	6,75631 %	0,0081787	5,36357 %	8,201 %
Tangible Assets	27.024	2,16E+07	2,98E+08	1	1,54E+10
CompExp	27.024	8.603.193	5,00E+07	3,204573	4,20E+09
ln(ROA+1)	27.024	0,0653492	0,0076604	0,0522468	0,0788217
ln(Tangible Assets)	27.024	13,28557	2,807814	0	23,45756
ln(CompExp)	27.024	14,18378	2,023031	1,164579	22,15753
Industry ROA	27.024	3,74196 %	0,0379522	-496,5148 %	28,8575 %
Age	27.024	21,53534	19,98071	0	329
ChangeGDP	27.024	1,0086 %	0,0263619	-14,55986 %	23,94065 %
ChangeMarketsize	27.024	978,037	8397,931	-111485,5	185.169,4
Loss	27.024	0	0	0	0
Tax Variables					
C	27.024	0,0009847	0,0451042	-0,3541124	0,2859832
STR	27.024	25,02210 %	0,073681	8,5 %	44,429 %
STR Differentials within Group	27.024	3,81890 %	0,0599052	-1,31E-08	35,429 %
Other Firm Attributes					
Sales	24.744	6,22E+07	3,43E+08	-236758	2,11E+10
Assets	27.024	8,93E+07	1,04E+09	6884,686	9,25E+10
Low Sales	27.024	0,1619671	0,3684275	0	1
Stable Markets	27.024	0,3187907	0,4660163	0	1

Descriptive Statistics: Quantile 5 (0.5, 0.625)

	n	Mean	Std.	Min	Max
Income Prediction Variables					
EBIT	27.024	5.599.414	6,33E+07	331,2371	7,48E+09
ROA	27.024	9,84107 %	0,0098463	8,20121 %	11,619 %
Tangible Assets	27.024	1,27E+07	1,58E+08	0,6613601	1,34E+10
CompExp	27.024	8.333.516	5,13E+07	4	3,72E+09
ln(ROA+1)	27.024	0,0938242	0,0089612	0,0788223	0,1099185
ln(Tangible Assets)	27.024	13,11009	2,742857	-0,4134568	23,31624
ln(CompExp)	27.024	14,23702	1,940795	1,386294	22,03639
Industry ROA	27.024	3,94632 %	0,0237551	-21,5911 %	27,7731 %
Age	27.024	21,07504	17,33989	0	324
ChangeGDP	27.024	1,0819 %	0,0257565	-14,55986 %	23,94065 %
ChangeMarketsize	27.024	1038,175	9629,938	-111485,5	185.169,4
Loss	27.024	0	0	0	0
Tax Variables					
C	27.024	-0,0005042	0,0462493	-0,3447528	0,3082449
STR	27.024	24,75641 %	0,0748662	8,5 %	44,429 %
STR Differentials within Group	27.024	3,72019 %	0,0594199	-1,31E-08	35,429 %
Other Firm Attributes					
Sales	24.835	5,94E+07	4,04E+08	-1,31E+07	1,98E+10
Assets	27.024	5,79E+07	6,95E+08	3121,909	8,51E+10
Low Sales	27.024	0,1505699	0,3576357	0	1
Stable Markets	27.024	0,3067644	0,4611593	0	1

Descriptive Statistics: Quantile 6 (0.625, 0.75)

	n	Mean	Std.	Min	Max
Income Prediction Variables					
EBIT	27.024	5.934.039	5,65E+07	510,9289	5,51E+09
ROA	27.024	13,85090 %	1,38897	11,61899 %	16,434 %
Tangible Assets	27.024	9.922.178	1,44E+08	1	1,30E+10
CompExp	27.024	6.947.550	2,93E+07	7	1,84E+09
ln(ROA+1)	27.024	0,1296452	0,0121901	0,109921	0,1521571
ln(Tangible Assets)	27.024	12,8067	2,747738	0	23,28578
ln(CompExp)	27.024	14,16912	1,8736	1,94591	21,33194
Industry ROA	27.024	4,09996 %	0,0253338	-21,8140 %	110,1829 %
Age	27.024	20,28464	17,18564	0	323
ChangeGDP	27.024	1,1677 %	0,026437	-14,55986 %	23,94065 %
ChangeMarketsize	27.024	1144,162	10449,78	-111485,5	185.169,4
Loss	27.024	0	0	0	0
Tax Variables					
C	27.024	-0,0024579	0,0471084	-0,3515383	0,342534
STR	27.024	24,19600 %	0,0730278	9,0 %	44,429 %
STR Differentials within Group	27.024	3,45349 %	0,0575617	-1,31E-08	35,429 %
Other Firm Attributes					
Sales	24.705	5,01E+07	3,13E+08	0	1,65E+10
Assets	27.024	4,29E+07	3,99E+08	3576,503	3,56E+10
Low Sales	27.024	0,1565645	0,3633964	0	1
Stable Markets	27.024	0,2921847	0,4547752	0	1

Descriptive Statistics: Quantile 7 (0.75, 0.875)

	n	Mean	Std.	Min	Max
Income Prediction Variables					
EBIT	27.024	6.148.498	4,19E+07	680	2,67E+09
ROA	27.024	20,24119 %	0,025035	16,43448 %	25,250 %
Tangible Assets	27.024	7.529.689	9,36E+07	2	6,62E+09
CompExp	27.024	5.615.838	2,04E+07	1	9,00E+08
ln(ROA+1)	27.024	0,1841135	0,0207648	0,1521585	0,225143
ln(Tangible Assets)	27.024	12,39826	2,714854	0,6931472	22,61374
ln(CompExp)	27.024	13,97838	1,854528	0	20,6181
Industry ROA	27.024	4,13671 %	0,0280459	-12,1261 %	110,1829 %
Age	27.024	18,91818	16,38456	0	323
ChangeGDP	27.024	1,2432 %	0,0268996	-14,55986 %	23,94065 %
ChangeMarketsize	27.024	1148,217	9641,331	-111485,5	185.169,4
Loss	27.024	0	0	0	0
Tax Variables					
C	27.024	-0,0032876	0,0477335	-0,3428698	0,2859952
STR	27.024	23,80761 %	0,0713148	8,5 %	44,429 %
STR Differentials within Group	27.024	3,23766 %	0,0555593	-1,31E-08	35,429 %
Other Firm Attributes					
Sales	24.640	4,21E+07	2,26E+08	0	1,23E+10
Assets	27.024	3,05E+07	2,06E+08	4076	1,17E+10
Low Sales	27.024	0,1852427	0,3885016	0	1
Stable Markets	27.024	0,286153	0,4519702	0	1

Descriptive Statistics: Quantile 8 (0.875,1)

	n	Mean	Std.	Min	Max
Income Prediction Variables					
EBIT	27.024	9.179.716	1,08E+08	350	8,96E+09
ROA	27.024	42,84073 %	0,80834	25,25066 %	9099,814 %
Tangible Assets	27.024	5.364.894	1,12E+08	1	8,38E+09
CompExp	27.024	3.701.534	1,38E+07	1	4,69E+08
ln(ROA+1)	27.024	0,3405123	0,1391529	0,2251467	4,521769
ln(Tangible Assets)	27.024	11,43487	2,656184	0	22,84963
ln(CompExp)	27.024	13,45242	1,895513	0	19,96611
Industry ROA	27.024	4,17474 %	0,0344409	150,0741 %	66,0979 %
Age	27.024	15,48668	14,01664	0	189
ChangeGDP	27.024	1,4139 %	0,0276917	-14,55986 %	23,94065 %
ChangeMarketsize	27.024	977,6259	9013,624	-111485,5	185.169,4
Loss	27.024	0	0	0	0
Tax Variables					
C	27.024	-0,0069242	0,0485375	-0,3521273	0,3093299
STR	27.024	22,71158 %	0,0663815	9,0 %	44,429 %
STR Differentials within Group	27.024	2,69695 %	0,0498742	-1,31E-08	35,429 %
Other Firm Attributes					
Sales	24.715	3,65E+07	2,84E+08	0,00E+00	1,41E+10
Assets	27.024	2,27E+07	2,27E+08	948	1,72E+10
Low Sales	27.024	0,2906676	0,4540788	0	1
Stable Markets	27.024	0,2734976	0,4457623	0	1

9.3 Appendix C

Appendix C provides and overview of the descriptive statistics for the ten quantiles used in the test pertaining to the robustness test where ROA ranges from -10% to 10%.

Descriptive Statistics: Quantile 1 (-0.1, -0.08)

	n	Mean	Std.	Min	Max
Income Prediction Variables					
ROA	1.689	-8,95 %	0,0058275	-10,00 %	-8,00 %
Tax Variables					
C	1.689	-0,0011222	0,0583049	-0,2724803	0,2783953

Descriptive Statistics: Quantile 2 (-0.08, -0.06)

	n	Mean	Std.	Min	Max
Income Prediction Variables					
ROA	2.163	-6,94 %	0,0057489	-8,00 %	-6,00 %
Tax Variables					
C	2.163	-0,0025948	0,0566222	-0,2858088	0,2580224

Descriptive Statistics: Quantile 3 (-0.06, -0.04)

	n	Mean	Std.	Min	Max
Income Prediction Variables					
ROA	3.008	-4,93 %	0,0057565	-6,00 %	-4,00 %
Tax Variables					
C	3.008	3,53E-06	0,0542712	-0,3488002	0,2508079

Descriptive Statistics: Quantile 4 (-0.04, -0.02)

	n	Mean	Std.	Min	Max
Income Prediction Variables					
ROA	4.576	-2,93 %	0,0057759	-4,00 %	-2,00 %
Tax Variables					
C	4.576	0,0001173	0,0557978	-0,2756896	0,2683705

Descriptive Statistics: Quantile 5 (-0.02, 0.00)

	n	Mean	Std.	Min	Max
Income Prediction Variables					
ROA	9.683	-0,82 %	0,0057704	-2,00 %	0,00 %
Tax Variables					
C	9.683	0,0017616	0,0522958	-0,3356896	0,2536872

Descriptive Statistics: Quantile 6 (0.0, 0.02)

	n	Mean	Std.	Min	Max
Income Prediction Variables					
ROA	16.988	1,01 %	0,005898ε	0,00 %	2,00 %
Tax Variables					
C	16.988	0,0027624	0,049165:	-0,3520966	0,2937721

Descriptive Statistics: Quantile 7 (0.02, 0.04)

	n	Mean	Std.	Min	Max
Income Prediction Variables					
ROA	19.271	3,01 %	0,0057588	2,00 %	4,00 %
Tax Variables					
C	19.271	0,0022706	0,0479153	-0,3138002	0,2851985

Descriptive Statistics: Quantile 8 (0.04, 0.06)

	n	Mean	Std.	Min	Max
Income Prediction Variables					
ROA	19.977	5,00 %	0,005781	4,00 %	6,00 %
Tax Variables					
C	19.977	0,0012727	0,0458234	-0,2951599	0,2859832

Descriptive Statistics: Quantile 9 (0.06, 0.08)

	n	Mean	Std.	Min	Max
Income Prediction Variables					
ROA	18.915	6,99 %	0,0057669	6,00 %	8,00 %
Tax Variables					
C	18.915	0,0008247	0,0451032	-0,3541124	0,254238

Descriptive Statistics: Quantile 10 (0.08, 0.1)

	n	Mean	Std.	Min	Max
Income Prediction Variables					
ROA	16.886	8,98 %	0,0057904	8,00 %	10,00 %
Tax Variables					
C	16.886	-0,0001783	0,045977	-0,3182573	0,3009164

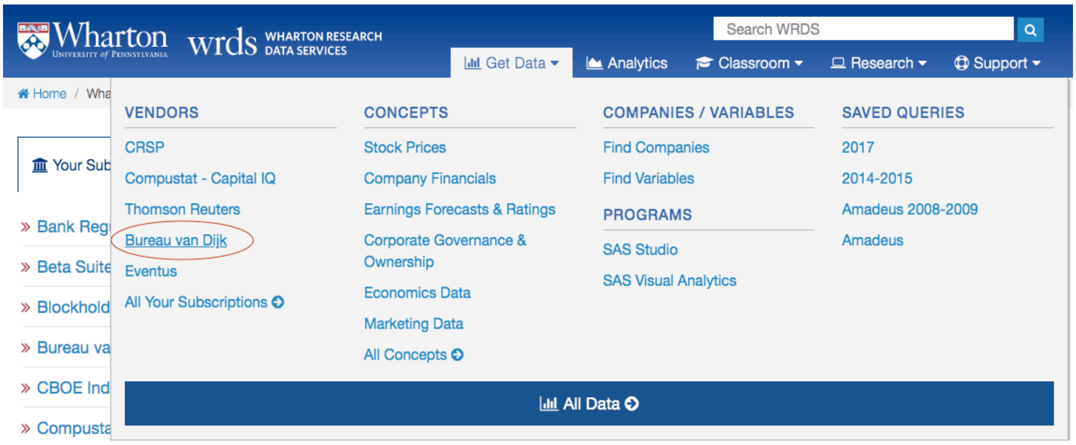
9.4 Appendix D

The table below displays the statutory corporate tax rates for the different tax jurisdictions in each year. The tax rates are retrieved from the worldwide corporate tax guide of EY (EY, 2019) and the statutory corporate income tax rates of OECD (OECD, 2019).

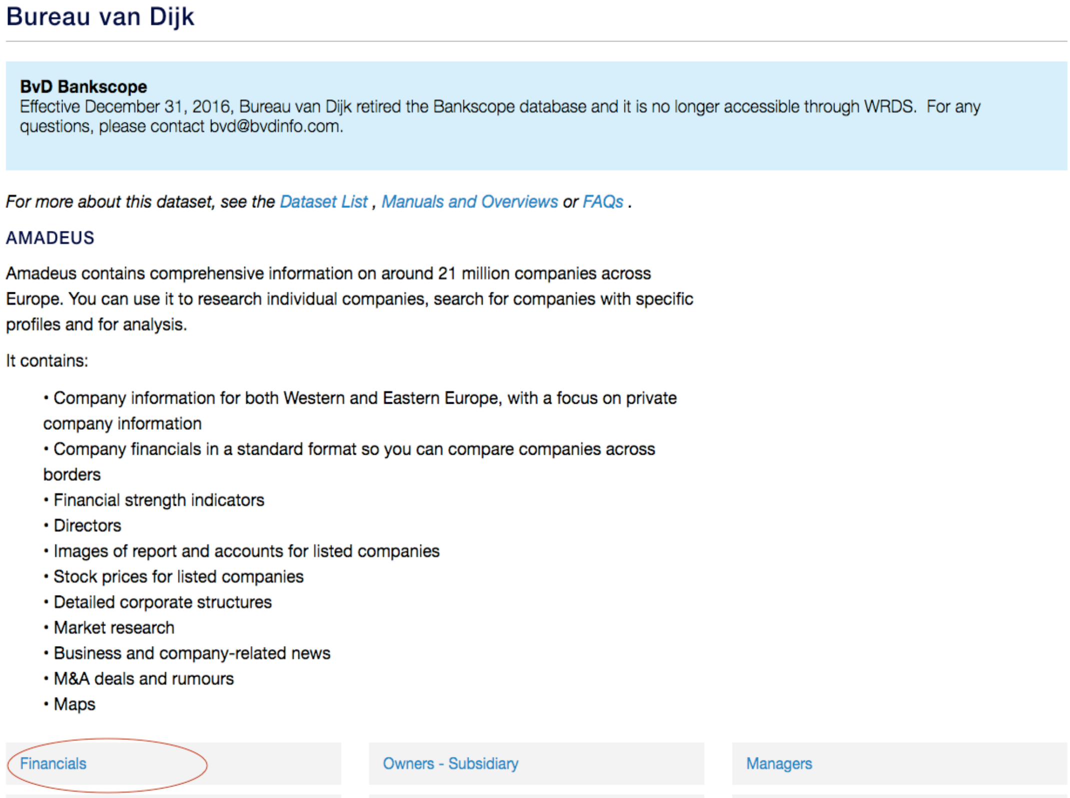
Country	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
AL	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,15	0,15	0,15
AT	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,25
BA	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10
BE	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33	0,33
CY	0,10	0,10	0,10	0,10	0,10	0,10	0,13	0,13	0,13	0,13
CZ	0,21	0,20	0,19	0,19	0,19	0,19	0,19	0,19	0,19	0,19
DK	0,25	0,25	0,25	0,25	0,25	0,25	0,25	0,24	0,22	0,22
EE	0,21	0,21	0,21	0,21	0,21	0,21	0,21	0,20	0,20	0,20
FI	0,26	0,26	0,26	0,26	0,25	0,25	0,20	0,20	0,20	0,20
FR	0,34	0,34	0,34	0,36	0,36	0,38	0,38	0,38	0,34	0,44
DE	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16
GR	0,25	0,25	0,24	0,20	0,20	0,26	0,26	0,29	0,29	0,29
HU	0,20	0,20	0,19	0,19	0,19	0,19	0,19	0,19	0,19	0,09
IS	0,25	0,15	0,18	0,20	0,20	0,20	0,20	0,20	0,20	0,20
IE	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13
IT	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,24
KV							0,10	0,10	0,10	0,10
LV	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15
LT	0,15	0,20	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15
LU	0,23	0,22	0,22	0,22	0,22	0,22	0,22	0,22	0,22	0,20
MD	0,00	0,00	0,00	0,00	0,12	0,12	0,12	0,12	0,12	0,12
ME	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,09
MK	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10
NL	0,26	0,26	0,26	0,25	0,25	0,25	0,25	0,25	0,25	0,25
NO	0,28	0,28	0,28	0,28	0,28	0,28	0,27	0,27	0,25	0,24
PL	0,19	0,19	0,19	0,19	0,19	0,19	0,19	0,19	0,19	0,19
PT	0,25	0,25	0,25	0,27	0,30	0,30	0,30	0,28	0,28	0,28
SK	0,19	0,19	0,19	0,19	0,19	0,23	0,22	0,22	0,22	0,21
SI	0,22	0,21	0,20	0,20	0,18	0,17	0,17	0,17	0,17	0,19
ES	0,30	0,30	0,30	0,30	0,30	0,30	0,30	0,28	0,25	0,25
SE	0,28	0,26	0,26	0,26	0,26	0,22	0,22	0,22	0,22	0,22
CH	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,09	0,09
TR	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20
GB	0,28	0,28	0,28	0,26	0,24	0,23	0,21	0,20	0,20	0,19
BG	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10
HR	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,18
LI	0,20	0,20	0,20	0,13	0,13	0,13	0,13	0,13	0,13	0,13
MT	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35
RO	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16
RU	0,24	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20
RS	0,10	0,10	0,10	0,10	0,10	0,15	0,15	0,15	0,15	0,15
UA	0,25	0,25	0,25	0,23	0,21	0,19	0,18	0,18	0,18	0,18

9.5 Appendix E

To obtain financial information we entered the website https://wrds-web.wharton.upenn.edu/wrds/index.cfm and logged in using our subscription from the Norwegian School of Economics. We went to ”Get Data” and chose the ”Bureau van Dijk” vendor.



Once we were on the Bureau van Dijk site, we chose “Financials”.



Bureau van Dijk

BvD Bankscope
Effective December 31, 2016, Bureau van Dijk retired the Bankscope database and it is no longer accessible through WRDS. For any questions, please contact bvd@bvdinfo.com.

For more about this dataset, see the Dataset List , Manuals and Overviews or FAQs .

AMADEUS

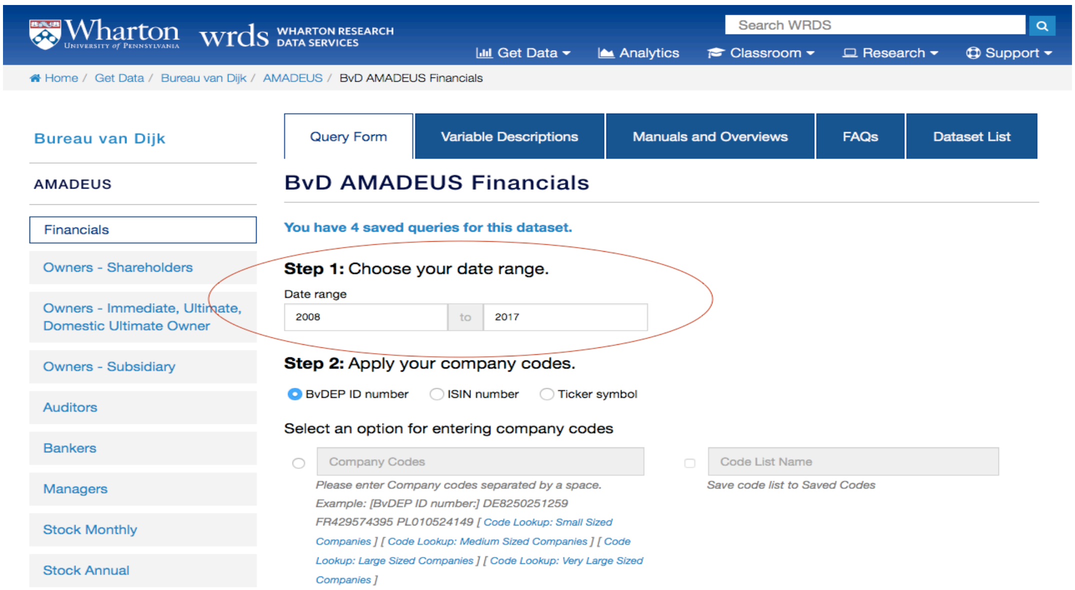
Amadeus contains comprehensive information on around 21 million companies across Europe. You can use it to research individual companies, search for companies with specific profiles and for analysis.

It contains:

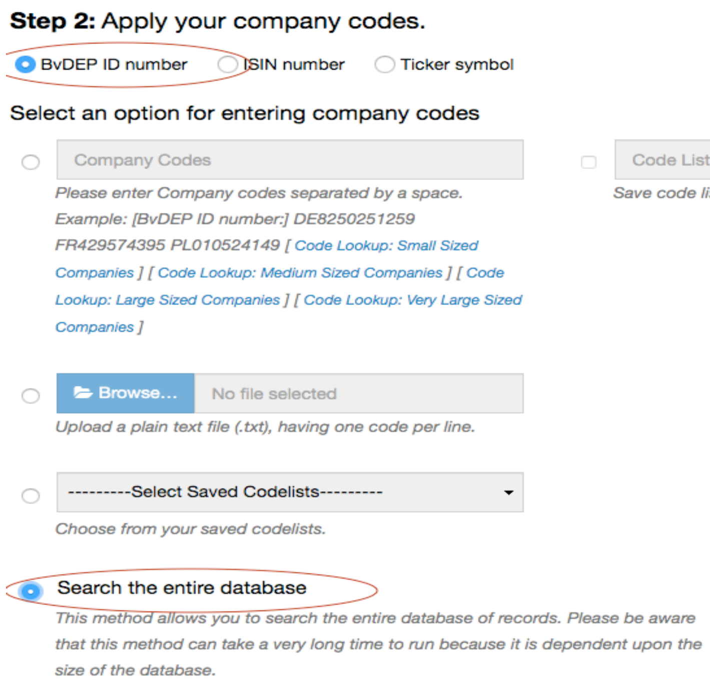
- Company information for both Western and Eastern Europe, with a focus on private company information
- Company financials in a standard format so you can compare companies across borders
- Financial strength indicators
- Directors
- Images of report and accounts for listed companies
- Stock prices for listed companies
- Detailed corporate structures
- Market research
- Business and company-related news
- M&A deals and rumours
- Maps

Financials | Owners - Subsidiary | Managers

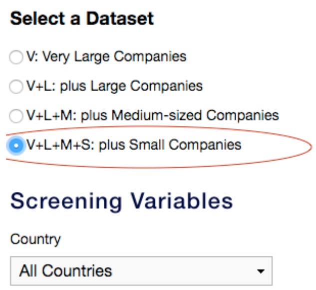
We followed a 4-step procedure to obtain the required financial information. For step 1 we chose the time period 2008-2017.



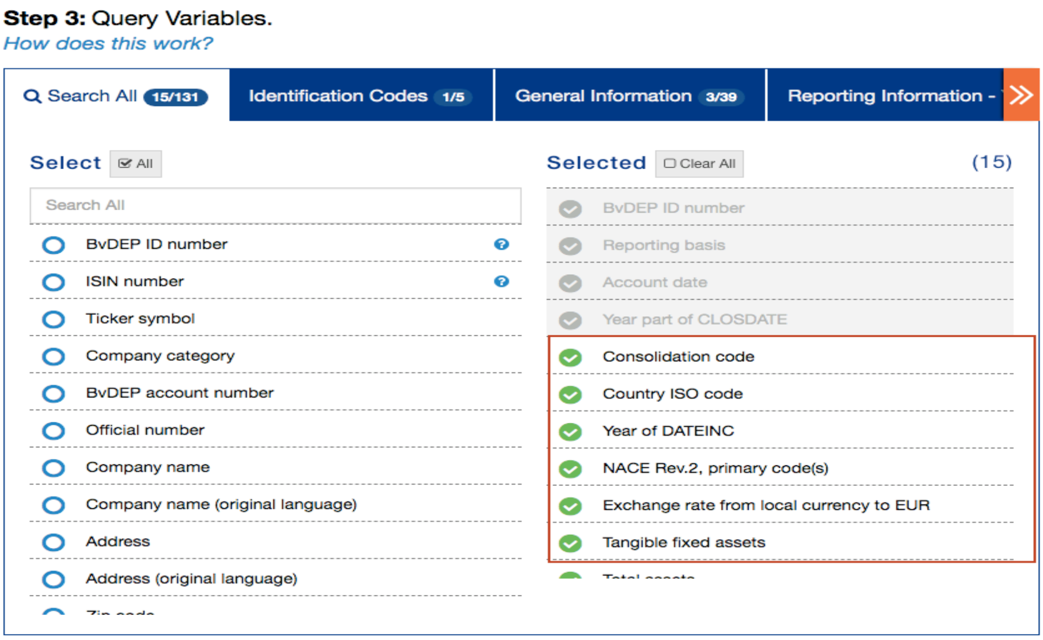
For step 2, we chose to sort on the BvDEP ID number, and to search the entire database for affiliate information.

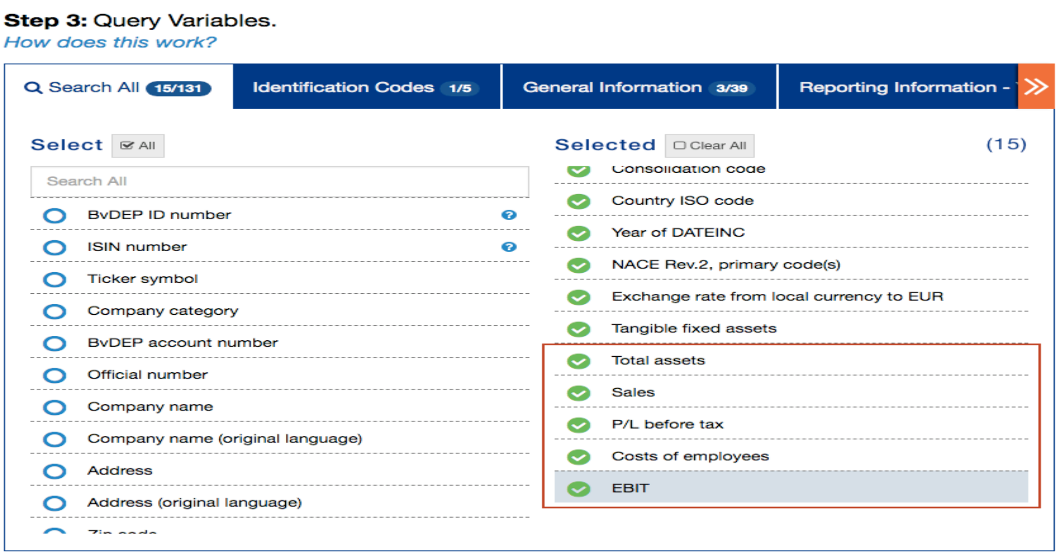


Moreover, we chose to search for Very large, large, medium and small companies in all countries.

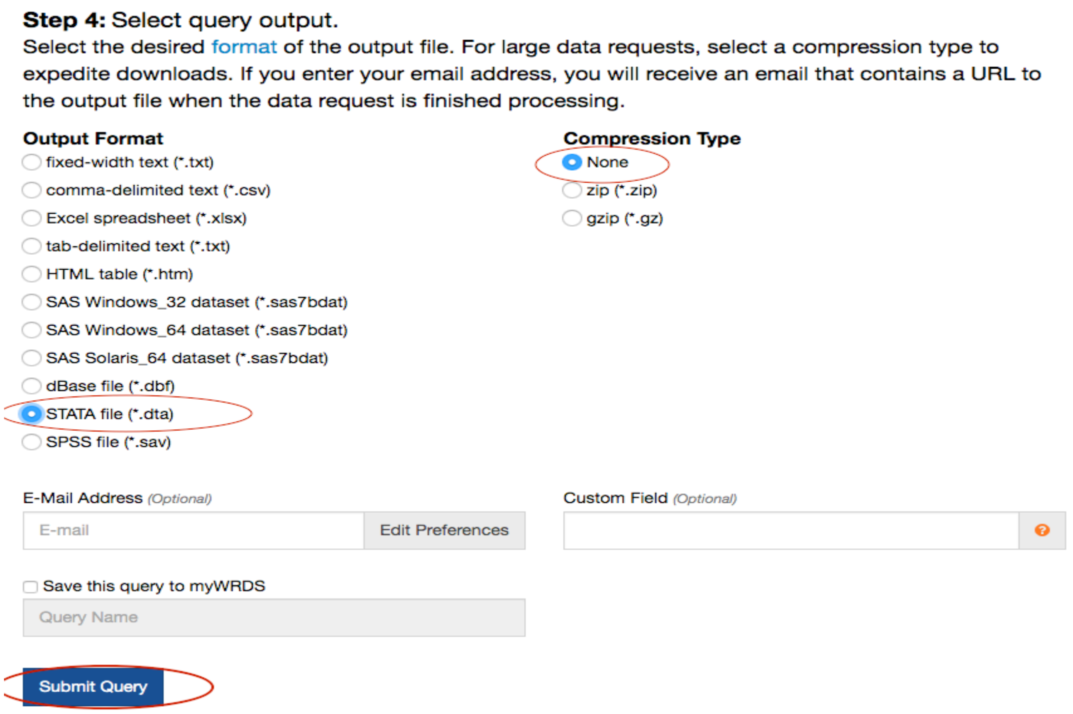


For step 3, we chose the required variables. The ID number and fiscal year are already included. We chose consolidation code to restrict our sample to unconsolidated data, country ISO code to identify foreign affiliates, year of incorporation to calculate age, NACE code to identify the industry, exchange rate due to the inherent measurement errors due to all information being in local currency. In addition, we chose financial numbers for the estimates like tangible fixed assets, total assets, sales, profit or loss before tax, cost of employees and EBIT.



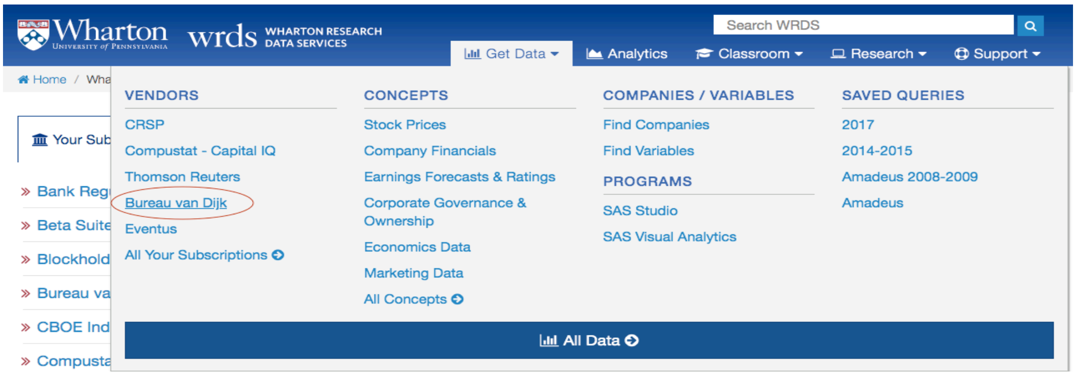


For step 4, we chose the output to be in a Stata-file, no compression and submitted the query.

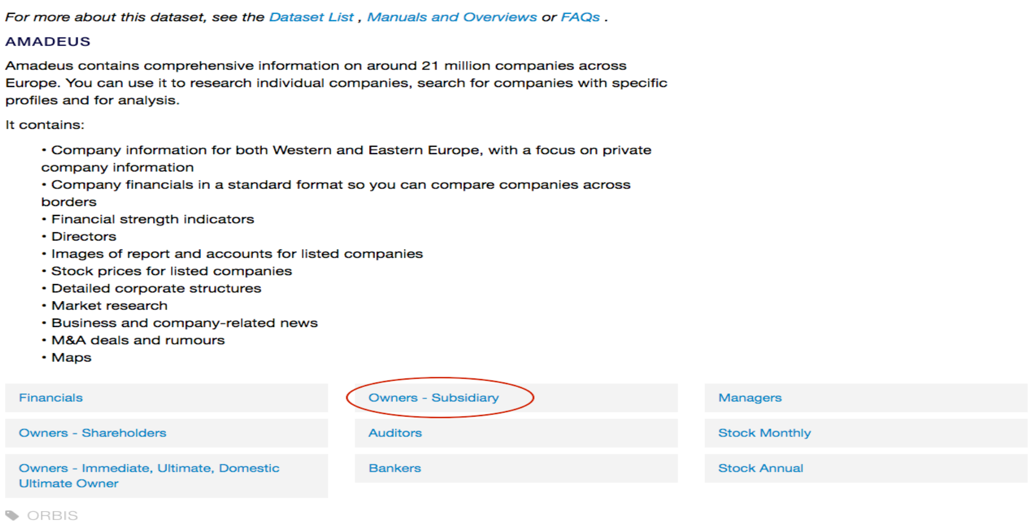

Step 4: Select query output.
Select the desired format of the output file. For large data requests, select a compression type to expedite downloads. If you enter your email address, you will receive an email that contains a URL to the output file when the data request is finished processing.
Output Format
fixed-width text (*.txt)
comma-delimited text (*.csv)
Excel spreadsheet (*.xlsx)
tab-delimited text (*.txt)
HTML table (*.htm)
SAS Windows_32 dataset (*.sas7bdat)
SAS Windows_64 dataset (*.sas7bdat)
SAS Solaris_64 dataset (*.sas7bdat)
dBase file (*.dbf)
STATA file (*.dta)
SPSS file (*.sav)
Compression Type
None
zip (*.zip)
gzip (*.gz)
E-Mail Address (Optional)
E-mail
Edit Preferences
Custom Field (Optional)
Save this query to myWRDS
Query Name
Submit Query

9.6 Appendix F

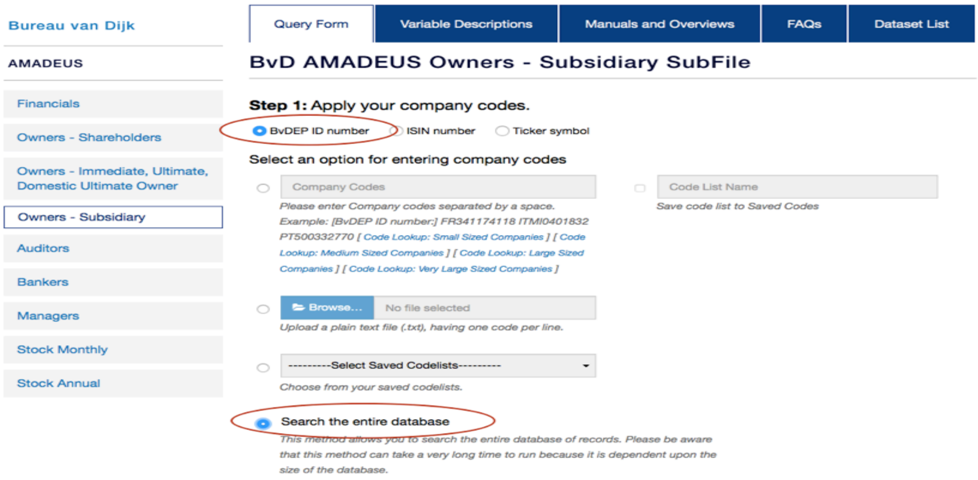
To obtain ownership information we entered the website https://wrds-web.wharton.upenn.edu/wrds/index.cfm and logged in using our subscription from the Norwegian School of Economics. We went to ”Get Data” and chose the ”Bureau van Dijk” vendor.



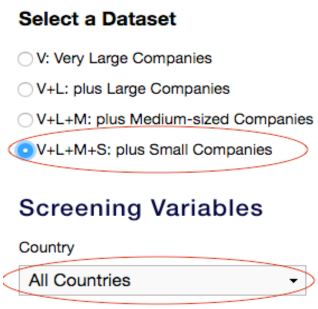
Once on the Bureau van Dijk site, we went to “Owners – Subsidiary”.



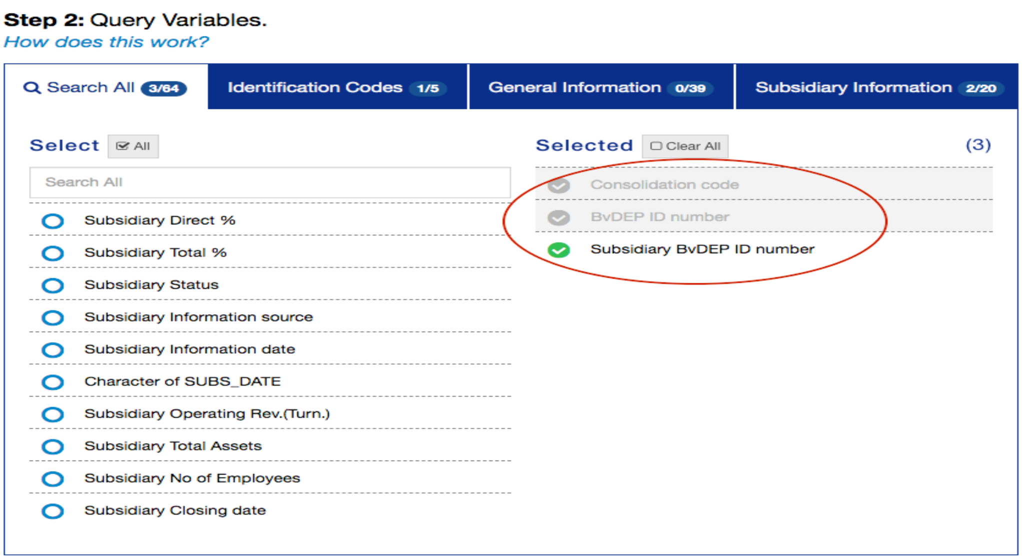
Once on the ownership database site, step 1 was to sort companies on ”BvDEP ID number” and search the entire database for companies.



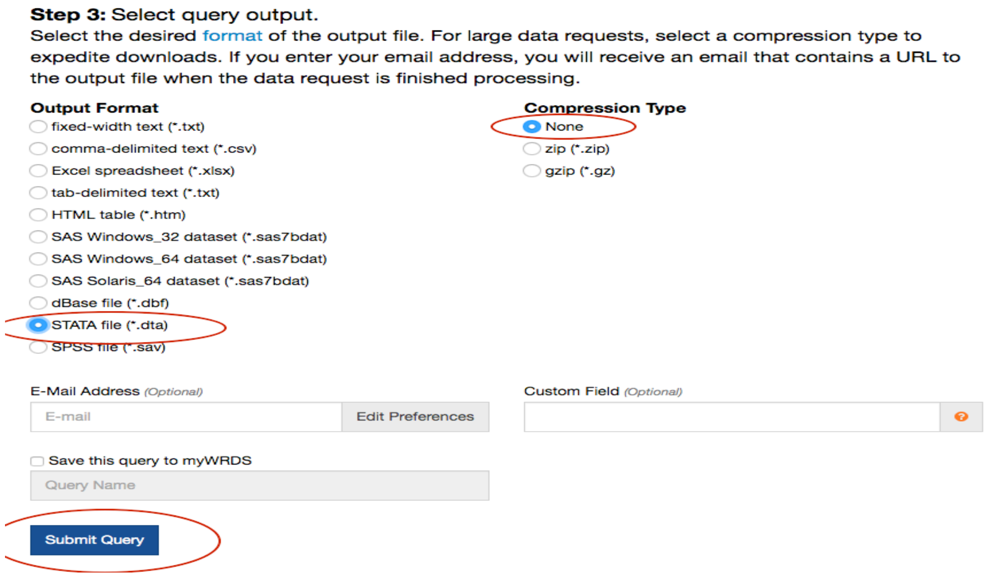
Furthermore, we chose to search for small, medium, large and very large companies in all countries.



For step 2, we chose which variables we needed. In this case, it was merely the subsidiary ID number, as the parent ID number is automatically included in the output.



Finally, we chose to get the output in a Stata-file (.dta) without compression and submitted the query.



9.7 Appendix G

```
************************************

********** DATA AGGREGATION **********

************************************

use "\\Penny\Stud$\s174776\Downloads\2008.dta"

append using "\\Penny\Stud$\s174776\Downloads\2009.dta"

append using "\\Penny\Stud$\s174776\Downloads\2010.dta"

append using "\\Penny\Stud$\s174776\Downloads\2011.dta"

append using "\\Penny\Stud$\s174776\Downloads\2012.dta"

append using "\\Penny\Stud$\s174776\Downloads\2013.dta"

append using "\\Penny\Stud$\s174776\Downloads\2014.dta"

append using "\\Penny\Stud$\s174776\Downloads\2015.dta"

append using "\\Penny\Stud$\s174776\Downloads\2016.dta"

append using "\\Penny\Stud$\s174776\Downloads\2017.dta"

append using "\\Penny\Stud$\s174776\Downloads\2007.dta"

rename idnr subs_bvdepnr


* We only want consolidated data. Therefore, we erase all else.

encode repbas, gen(num_repbas)

bysort subs_bvdepnr: drop if num_repbas==1
```

```
bysort subs_bvdepnr: drop if num_repbas==2

bysort subs_bvdepnr: drop if num_repbas==3

bysort subs_bvdepnr: drop if num_repbas==4


*We only want end-year financial information

gen month=month(closdate)

keep if month==12

gen day=day(closdate)

keep if day==31

drop month

drop day


*Identifying and dropping duplicates

sort subs_bvdepnr closdate_year

quietly by subs_bvdepnr closdate_year: gen dup = cond(_N==1,0,_n)

drop if dup>1

drop dup

save "\\Penny\Stud$\s174776\Downloads\2007-2017.dta"

****************************************************************

clear all

use "\\Penny\Stud$\s174776\System\Desktop\Data\Subsidiaries.dta"
```

* We only want majority ownership. Therefore, we erase all affiliates with minority ownership.

```
egen long numeric_subs_bvdepnr = group(subs_bvdepnr)

gen subs_total_n = real(subs_total)

gen subs_direct_n = real(subs_direct)

bysort numeric_subs_bvdepnr: keep if subs_total_n>50 | subs_direct_n>50

bysort numeric_subs_bvdepnr: drop if subs_total_n==. & subs_direct_n==.

bysort numeric_subs_bvdepnr: drop if subs_total_n==. & subs_direct_n<=50
```

* dropping consolidated data to avoid double counting

```
encode consol, gen(num_consol)

bysort numeric_subs_bvdepnr: drop if num_consol==2

bysort numeric_subs_bvdepnr: drop if num_consol==1

bysort numeric_subs_bvdepnr: drop if num_consol==4

bysort numeric_subs_bvdepnr: drop if num_consol==3

bysort numeric_subs_bvdepnr: drop if num_consol==5
```

* identifying duplicates

```
duplicates tag subs_bvdepnr, gen(dup_id)
```

*dropping subsidiaries listed with more than one majority owner as we don’t know which is correct.

```
bysort numeric_subs_bvdepnr: drop if dup_id>0

save
"\\Penny\Stud$\s174776\System\Desktop\Data\Subsidiaries_lessminority_lessconsol.dta"

************************************************************************

*we need to include affiliates of mother companies

replace subs_bvdepnr = idnr

*identifying and dropping duplicates

sort subs_bvdepnr

quietly by subs_bvdepnr: gen dup = cond(_N==1,0,_n)

drop if dup>1

save "\\Penny\Stud$\s174776\System\Desktop\Data\Motheraffiliates.dta"

************************************************************************

clear all

use
"\\Penny\Stud$\s174776\System\Desktop\Data\Subsidiaries_lessminority_lessconsol.dta"

append using "\\Penny\Stud$\s174776\System\Desktop\Data\Motheraffiliates.dta"


*identifying and dropping duplicates

drop dup

sort subs_bvdepnr

quietly by subs_bvdepnr: gen dup = cond(_N==1,0,_n)

drop if dup>1
```

*dropping variables not needed in the following process

drop dup

drop dup_id

drop num_consol

drop subs_direct_n

drop subs_total_n

drop numeric_subs_bvdepnr

drop consol

drop subs_total

drop subs_direct

drop subs_clos

*we now have ownership data for all affiliates

save "\\Penny\Stud$\s174776\System\Desktop\Data\Affiliates.dta"

****

*we need to include the parent company

clear all

use "\\Penny\Stud$\s174776\Downloads\2007-2017.dta"

merge m:1 subs_bvdepnr using "\\Penny\Stud$\s174776\System\Desktop\Data\Motheraffiliates.dta"

drop if _merge==1

drop if _merge==2

*drop variable not needed for the following process

```
drop tfas

drop toas

drop turn

drop staf

drop ebit

drop dateinc_year

drop consol

drop subs_bvdepnr

drop subs_clos

drop nace_prim_code

drop repbas

drop closdate

drop closdate_year

drop _merge

drop dup

drop dup_id

drop num_consol

drop subs_direct_n

drop subs_total_n

drop numeric_subs_bvdepnr
```

```
drop unit

drop exchrate2

drop plbt

drop num_repbas

drop subs_cntry

drop subs_direct

drop subs_total

rename cntrycde parent_country



*identifying and dropping duplicates

duplicates tag idnr, gen(dup_id)

duplicates drop

drop dup_id

save "\\Penny\Stud$\s174776\System\Desktop\Data\Parentcountry.dta"



clear all

use "\\Penny\Stud$\s174776\System\Desktop\Data\Affiliates.dta"

merge m:1 idnr using "\\Penny\Stud$\s174776\System\Desktop\Data\Parentcountry.dta"

drop if _merge==1

drop if _merge==2

drop _merge
```

```
save "\\Penny\Stud$\s174776\System\Desktop\Data\Affiliates.dta", replace

************************************************************************

* merging fiancial data with ownership data

clear all

use "\\Penny\Stud$\s174776\Downloads\2007-2017.dta"

merge m:1 subs_bvdepnr using "\\Penny\Stud$\s174776\System\Desktop\Data\Affiliates.dta"

drop if _merge==1

drop if _merge==2

drop _merge

save "\\Penny\Stud$\s174776\System\Desktop\Data\Affiliates_2007-2017.dta"

************************************************************************

/* we need tax rates for affiliates and parent companies

 we don't drop merge==1 because then we drop all of 2007*/

merge m:1 parent_country closdate_year using "\\Penny\Stud$\s174776\System\Desktop\Data\Parent_Taxrates.dta"

drop _merge

merge m:1 cntrycde closdate_year using "\\Penny\Stud$\s174776\System\Desktop\Data\Affiliates_Taxrates.dta"

drop if _merge==2

drop _merge

save "\\Penny\Stud$\s174776\System\Desktop\Data\Affiliates_2007-2017.dta", replace

************************************************************************
```

```
* we need information regarding change in GDP for each country

merge m:1 cntrycde closdate_year using "\\Penny\Stud$\s174776\System\Desktop\Data\GDP.dta"

drop if _merge==2

drop _merge

*Setting changeGDP to decimals instead of percentage

replace changeGDP= changeGDP/100

save "\\Penny\Stud$\s174776\System\Desktop\Data\Affiliates_2007-2017.dta", replace

***********************************

******** DATA ADJUSTMENT********

***********************************

egen long numeric_idnr = group(idnr)

*Adjusting for local currency

bysort numeric_idnr closdate_year: replace tfas= tfas*exchrate

bysort numeric_idnr closdate_year: replace toas= toas*exchrate

bysort numeric_idnr closdate_year: replace turn= turn*exchrate

bysort numeric_idnr closdate_year: replace plbt= plbt*exchrate

bysort numeric_idnr closdate_year: replace staf= staf*exchrate

bysort numeric_idnr closdate_year: replace ebit= ebit*exchrate


*Adjusting 4 digit nace code to 2 digit to sort on main industries

gen nacecode = real(nace_prim_code)
```

```
replace nacecode=01 if nacecode>=0100 & nacecode<0200

replace nacecode=02 if nacecode>=0200 & nacecode<0300

replace nacecode=05 if nacecode>=0500 & nacecode<0600

replace nacecode=10 if nacecode>=1000 & nacecode<1100

replace nacecode=11 if nacecode>=1100 & nacecode<1200

replace nacecode=12 if nacecode>=1200 & nacecode<1300

replace nacecode=13 if nacecode>=1300 & nacecode<1400

replace nacecode=14 if nacecode>=1400 & nacecode<1500

replace nacecode=15 if nacecode>=1500 & nacecode<1600

replace nacecode=16 if nacecode>=1600 & nacecode<1700

replace nacecode=17 if nacecode>=1700 & nacecode<1800

replace nacecode=18 if nacecode>=1800 & nacecode<1900

replace nacecode=19 if nacecode>=1900 & nacecode<2000

replace nacecode=20 if nacecode>=2000 & nacecode<2100

replace nacecode=21 if nacecode>=2100 & nacecode<2200

replace nacecode=22 if nacecode>=2200 & nacecode<2300

replace nacecode=23 if nacecode>=2300 & nacecode<2400

replace nacecode=24 if nacecode>=2400 & nacecode<2500

replace nacecode=25 if nacecode>=2500 & nacecode<2600

replace nacecode=26 if nacecode>=2600 & nacecode<2700

replace nacecode=27 if nacecode>=2700 & nacecode<2800
```

```
replace nacecode=28 if nacecode>=2800 & nacecode<2900

replace nacecode=29 if nacecode>=2900 & nacecode<3000

replace nacecode=30 if nacecode>=3000 & nacecode<3100

replace nacecode=31 if nacecode>=3100 & nacecode<3200

replace nacecode=32 if nacecode>=3200 & nacecode<3300

replace nacecode=33 if nacecode>=3300 & nacecode<3400

replace nacecode=34 if nacecode>=3400 & nacecode<3500

replace nacecode=35 if nacecode>=3500 & nacecode<3600

replace nacecode=36 if nacecode>=3600 & nacecode<3700

replace nacecode=37 if nacecode>=3700 & nacecode<3800

replace nacecode=38 if nacecode>=3800 & nacecode<3900

replace nacecode=39 if nacecode>=3900 & nacecode<4000

replace nacecode=40 if nacecode>=4000 & nacecode<4100

replace nacecode=41 if nacecode>=4100 & nacecode<4200

replace nacecode=42 if nacecode>=4200 & nacecode<4300

replace nacecode=43 if nacecode>=4300 & nacecode<4400

replace nacecode=45 if nacecode>=4500 & nacecode<4600

replace nacecode=46 if nacecode>=4600 & nacecode<4700

replace nacecode=47 if nacecode>=4700 & nacecode<4800

replace nacecode=49 if nacecode>=4900 & nacecode<5000

replace nacecode=50 if nacecode>=5000 & nacecode<5100
```

```
replace nacecode=51 if nacecode>=5100 & nacecode<5200

replace nacecode=52 if nacecode>=5200 & nacecode<5300

replace nacecode=53 if nacecode>=5300 & nacecode<5400

replace nacecode=55 if nacecode>=5500 & nacecode<5600

replace nacecode=56 if nacecode>=5600 & nacecode<5700

replace nacecode=58 if nacecode>=5800 & nacecode<5900

replace nacecode=59 if nacecode>=5900 & nacecode<6000

replace nacecode=60 if nacecode>=6000 & nacecode<6100

replace nacecode=61 if nacecode>=6100 & nacecode<6200

replace nacecode=62 if nacecode>=6200 & nacecode<6300

replace nacecode=63 if nacecode>=6300 & nacecode<6400

replace nacecode=64 if nacecode>=6400 & nacecode<6500

replace nacecode=65 if nacecode>=6500 & nacecode<6600

replace nacecode=66 if nacecode>=6600 & nacecode<6700

replace nacecode=67 if nacecode>=6700 & nacecode<6800

replace nacecode=68 if nacecode>=6800 & nacecode<6900

replace nacecode=69 if nacecode>=6900 & nacecode<7000

replace nacecode=70 if nacecode>=7000 & nacecode<7100

replace nacecode=71 if nacecode>=7100 & nacecode<7200

replace nacecode=72 if nacecode>=7200 & nacecode<7300

replace nacecode=73 if nacecode>=7300 & nacecode<7400
```

```
replace nacecode=74 if nacecode>=7400 & nacecode<7500

replace nacecode=75 if nacecode>=7500 & nacecode<7600

replace nacecode=77 if nacecode>=7700 & nacecode<7800

replace nacecode=78 if nacecode>=7800 & nacecode<7900

replace nacecode=79 if nacecode>=7900 & nacecode<8000

replace nacecode=80 if nacecode>=8000 & nacecode<8100

replace nacecode=81 if nacecode>=8100 & nacecode<8200

replace nacecode=82 if nacecode>=8200 & nacecode<8300

replace nacecode=84 if nacecode>=8400 & nacecode<8500

replace nacecode=85 if nacecode>=8500 & nacecode<8600

replace nacecode=86 if nacecode>=8600 & nacecode<8700

replace nacecode=87 if nacecode>=8700 & nacecode<8800

replace nacecode=88 if nacecode>=8800 & nacecode<8900

replace nacecode=90 if nacecode>=9000 & nacecode<9100

replace nacecode=91 if nacecode>=9100 & nacecode<9200

replace nacecode=92 if nacecode>=9200 & nacecode<9300

replace nacecode=93 if nacecode>=9300 & nacecode<9400

replace nacecode=94 if nacecode>=9400 & nacecode<9500

replace nacecode=95 if nacecode>=9500 & nacecode<9600

replace nacecode=96 if nacecode>=9600 & nacecode<9700

replace nacecode=97 if nacecode>=9700 & nacecode<9800
```

```
replace nacecode=98 if nacecode>=9800 & nacecode<9900

replace nacecode=99 if nacecode>=9900 & nacecode<10000

replace nacecode=31 if nacecode>=310 & nacecode<320

replace nacecode=32 if nacecode>=320 & nacecode<330

replace nacecode=60 if nacecode>=600 & nacecode<610

replace nacecode=61 if nacecode>=610 & nacecode<620

replace nacecode=62 if nacecode>=620 & nacecode<630

replace nacecode=71 if nacecode>=710 & nacecode<720

replace nacecode=72 if nacecode>=720 & nacecode<730

replace nacecode=81 if nacecode>=810 & nacecode<820

replace nacecode=89 if nacecode>=890 & nacecode<900

replace nacecode=91 if nacecode>=910 & nacecode<920

replace nacecode=99 if nacecode>=990 & nacecode<1000


* Generating numeric id and setting to panel

egen long numeric_subs_bvdepnr = group(subs_bvdepnr)

xtset numeric_subs_bvdepnr closdate_year

sort numeric_subs_bvdepnr closdate_year


* generating variable for change in marketsize

egen marketsize= total(turn), by(nacecode closdate_year cntrycde)
```

```
gen real_marketsize= marketsize

gen change_marketsize= (real_marketsize-L.real_marketsize - 1)/(1000000)

drop marketsize

drop real_marketsize


*generating dummy for foreign affiliate and dummy to identify at least one foreign affiliate

gen Foreign_affiliate=0

bysort numeric_idnr: replace Foreign_affiliate=1 if parent_country!=cntrycde

bysort numeric_idnr closdate_year: egen MNC=max(Foreign_affiliate)


*generating industryROA (before dropping domestics)

gen ROA= ebit/toas

sort nacecode closdate_year cntrycde

egen industryROA= median(ROA), by(nacecode closdate_year cntrycde)


*generating variable for absolute change in industryROA to identify stable markets

sort numeric_subs_bvdepnr closdate_year

gen change_industryROA= industryROA-L1.industryROA

replace change_industryROA= change_industryROA*(-1) if change_industryROA<0


*Dropping observations from 2007 as they are not needed any more
```

```
drop if closdate_year==2007

*Dropping domestic companies

bysort numeric_idnr closdate_year: drop if MNC==0

*dropping affiliates missing ebit

bysort numeric_idnr: drop if ebit==.

save "\\Penny\Stud$\s174776\System\Desktop\Data\Affiliates_2007-2017.dta", replace


***********************************

******* SAMPLE RESTRICTIONS******

***********************************

* dropping if NACE code is missing

drop if nacecode==.


* dropping companies in bank and insurance sector

drop if nacecode==65 | nacecode==66 | nacecode==67


* generating variables for PLBT/REV measure and dropping if consolidated group <3%

egen total_plbt= total(plbt), by(numeric_idnr closdate_year)

egen total_turn= total(turn), by(numeric_idnr closdate_year)

bysort numeric_idnr closdate_year: gen total_plbt_rev= total_plbt/total_turn

bysort numeric_idnr closdate_year: drop if total_plbt_rev<0.03 | total_plbt_rev==.
```

```
*dropping if assets <= 0 or .

bysort numeric_subs_bvdepnr closdate_year: drop if toas<=0 | toas==.

bysort numeric_subs_bvdepnr closdate_year: drop if tfas<=0 | tfas==.


* dropping if compensastion expense <=0 or .

bysort numeric_subs_bvdepnr closdate_year: drop if staf<=0 | staf==.


* generating variable for age and dropping missing values

gen age=closdate_year-dateinc_year

drop if age==.


* dropping if change in marketsize is missing

drop if change_marketsize==.


* dropping if change in GDP is missing

drop if changeGDP==.


*  generating variable for ROA and ROA+1 and dropping

gen ROAplus1= ROA+1

drop if ROAplus1<=0

save "\\Penny\Stud$\s174776\System\Desktop\Data\Affiliates_2007-2017_ready.dta"
```

```
**********************************
********** Control Variables **********
**********************************
*mean centering STR Variables
bysort numeric_idnr closdate_year: egen mean_STR= mean(STR)
bysort numeric_subs_bvdepnr closdate_year: gen centered_STR= STR-mean_STR


* creating variable C (capital weighted tax difference)
egen MNC_total_capital= total(tfas), by (numeric_idnr closdate_year)
generate share= tfas/MNC_total_capital
sort numeric_idnr closdate_year
set more off
local i=1
bysort numeric_idnr closdate_year: egen Sb=count(numeric_subs_bvdepnr)
egen MaxSb = max(Sb)
while(STR[_n+`i']!=.)&`i'<=MaxSb{
bysort numeric_idnr closdate_year: gen wdiff`i'=(centered_STR-centered_STR[_n+`i'])*(share[_n+`i'])
replace wdiff`i'=0 if wdiff`i'==.
bysort numeric_idnr closdate_year: gen wdiff_`i'=(centered_STR-centered_STR[_n-`i'])*(share[_n-`i'])
replace wdiff_`i'=0 if wdiff_`i'==.
```

```
local ++i

}

egen weighted_tax_diff=rowtotal(wdiff*)

drop wdiff*

label variable weighted_tax_diff "Weighted tax difference"


*generating dummy variable to identify unprofitable affiliates

gen Loss=0

replace Loss=1 if ebit<0


*generating log variables

gen lntfas= ln(tfas)

gen lncompexp= ln(staf)

gen lnROAplus1= ln(ROAplus1)

gen lnage= ln(age)

gen C_loss= weighted_tax_diff*Loss

gen lnebit= ln(ebit)

gen lnroa= ln(ROA)


*generating variable for income shifting constraints

bysort closdate_year: egen quartile_sales= xtile(turn), n(4)
```

```
gen LowSales=0

replace LowSales=1 if  quartile_sales==1

gen LowSales_C= LowSales*weighted_tax_diff


*generating variable for stable markets

bysort closdate_year nacecode: egen quartile_stablemarkets= xtile(change_industryROA), n(4)

gen Stable_markets=0

replace Stable_markets=1 if  quartile_stablemarkets==1

gen Stablemarkets_C= Stable_markets*weighted_tax_diff


* generating variable for groups' lowest STR

bysort numeric_idnr closdate_year: egen MNC_lowest_STR= min(STR)

gen Difference_STR= STR-MNC_lowest_STR


gen Lowsales_DiffSTR= LowSales*Difference_STR

gen Stablemarkets_DiffSTR= Stable_markets*Difference_STR


* Labeling variables

label variable nacecode "Two-digit NACE code"

label variable change_marketsize "Change in marketsize"

label variable Foreign_affiliate "Foreign affiliate"
```

```
label variable MNC "MNC"

label variable ROA "Return on Assets"

label variable industryROA "IndustryROA"

label variable age "Age"

label variable ROAplus1 "ROA+1"

label variable centered_STR "Centered Statutory Tax Rate"

label variable weighted_tax_diff "Tax Incentive"

label variable Loss "Loss affiliate"

label variable HighSTR "High Statutory Tax Rate"

label variable lntfas "Natural Log of Tangible Fixed Assets"

label variable lncompexp "Natural Log of Compensation Expense"

label variable lnROAplus1 "Natural Log of ROA+1"

label variable lnage "Natural Log of Age"

label variable lnebit "Natural Log of EBIT"

label variable lnroa "Natural Log of ROA"

save "\\Penny\Stud$\s174776\System\Desktop\Data\Affiliates_2007-2017_ready.dta", replace
```

```
*****************************

********** Replication **********

*****************************

*setting to panel

xtset numeric_subs_bvdepnr closdate_year

* Table 5 panel B: Test the effect on Loss on tax motivated income shifting

* coloumn 1

xtreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff, cluster(numeric_idnr)

outreg2 using table5B.doc

*coloumn 2

xtreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff Loss, cluster(numeric_idnr)

outreg2 using table5B.doc

*coloumn 3

xtreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff Loss C_loss, cluster(numeric_idnr)

outreg2 using table5B.doc
```

```
**************************************************
************* Quantile Regression ****************
**************************************************

* Checking for Heteroskedasticity

reg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff

outreg2 using OLS.doc

estat hettest


*Checking how many quantiles we need

xtile quantiles= lnROAplus1, nq(8)

*Table 6 Quantile Regression q=8

sqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff, q(0.125 0.25 0.375 0.5 0.625 0.75 0.875) reps(100)

outreg2 using Quantile.doc


*Table 7Interquantile range q=8

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff, q(0.000001 0.125) reps(100)

outreg2 using Interquantile.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff, q(0.125 0.25) reps(100)

outreg2 using Interquantile.doc
```

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff, q(0.25 0.375) reps(100)

outreg2 using Interquantile.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff, q(0.375 0.5) reps(100)

outreg2 using Interquantile.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff, q(0.5 0.625) reps(100)

outreg2 using Interquantile.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff, q(0.625 0.75) reps(100)

outreg2 using Interquantile.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff, q(0.75 0.875) reps(100)

outreg2 using Interquantile.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff, q(0.875 0.9999999) reps(100)

outreg2 using Interquantile.doc

*Table 9 Interquantile range with income shifting constraintsq=8

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff LowSales LowSales_C, q(0.000001 0.125) reps(100)

outreg2 using Interquantile_lowsales.doc iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff LowSales LowSales_C, q(0.125 0.25) reps(100)

outreg2 using Interquantile_lowsales.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff LowSales LowSales_C, q(0.25 0.375) reps(100)

outreg2 using Interquantile_lowsales.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff LowSales LowSales_C, q(0.375 0.5) reps(100)

outreg2 using Interquantile_lowsales.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff LowSales LowSales_C, q(0.5 0.625) reps(100)

outreg2 using Interquantile_lowsales.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff LowSales LowSales_C, q(0.625 0.75) reps(100)

outreg2 using Interquantile_lowsales.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff LowSales LowSales_C, q(0.75 0.875) reps(100)

outreg2 using Interquantile_lowsales.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff LowSales LowSales_C, q(0.875 0.9999999) reps(100)

outreg2 using Interquantile_lowsales.doc

*Table 8 OLS with low sales

xtreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff LowSales LowSales_C

outreg2 using Fulldistribution_lowsales.doc

*Table 11 Interquantile range Stable markets q=8

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff Stable_markets Stablemarkets_C, q(0.000001 0.125) reps(100)

outreg2 using Interquantile_stablemarkets.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff Stable_markets Stablemarkets_C, q(0.125 0.25) reps(100)

outreg2 using Interquantile_stablemarkets.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff Stable_markets Stablemarkets_C, q(0.25 0.375) reps(100)

outreg2 using Interquantile_stablemarkets.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff Stable_markets Stablemarkets_C, q(0.375 0.5) reps(100)

outreg2 using Interquantile_stablemarkets.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff Stable_markets Stablemarkets_C, q(0.5 0.625) reps(100)

outreg2 using Interquantile_stablemarkets.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff Stable_markets Stablemarkets_C, q(0.625 0.75) reps(100)

outreg2 using Interquantile_stablemarkets.doc iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff Stable_markets Stablemarkets_C, q(0.75 0.875) reps(100)

outreg2 using Interquantile_stablemarkets.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff Stable_markets Stablemarkets_C, q(0.875 0.9999999) reps(100)

outreg2 using Interquantile_stablemarkets.doc

*Table 10 OLS with StableMarkets

xtreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff Stable_markets Stablemarkets_C

outreg2 using Fulldistribution_stablemarkets.doc

****

*************** ROBUSTNESS ***************

****

* Table 12 Interquantile range q=8 using the Difference in STR

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize Difference_STR, q(0.000001 0.125) reps(100)

outreg2 using InterquantileSTR.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize Difference_STR, q(0.125 0.25) reps(100)

outreg2 using InterquantileSTR.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize Difference_STR, q(0.25 0.375) reps(100) outreg2 using InterquantileSTR.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize Difference_STR, q(0.375 0.5) reps(100)

outreg2 using InterquantileSTR.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize Difference_STR, q(0.5 0.625) reps(100)

outreg2 using InterquantileSTR.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize Difference_STR, q(0.625 0.75) reps(100)

outreg2 using InterquantileSTR.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize Difference_STR, q(0.75 0.875) reps(100)

outreg2 using InterquantileSTR.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize Difference_STR, q(0.875 0.9999999) reps(100)

outreg2 using InterquantileSTR.doc

*Table 13 robustness test using sample ranging from -10 < ROA < 10 and new quantiles based on ROA not frequency q=10

drop if ROA<-0.1

drop if ROA>0.1

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff, q(0.000001 0.0149197039) reps(100)

outreg2 using ROAquantiles.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff, q(0.0149197039 0.034026465) reps(100)

outreg2 using ROAquantiles.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff, q(0.034026465 0.065974948) reps(100)

outreg2 using ROAquantiles.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff, q(0.065974948 0.1010193806) reps(100)

outreg2 using ROAquantiles.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff, q(0.1010193806 0.1865537162) reps(100)

outreg2 using ROAquantiles.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff, q(0.1865537162 0.3370581065) reps(100)

outreg2 using ROAquantiles.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff, q(0.3370581065 0.5072875996) reps(100)

outreg2 using ROAquantiles.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff, q(0.5072875996 0.6837535113) reps(100)

outreg2 using ROAquantiles.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff, q(0.6837535113 0.8508382948) reps(100)

outreg2 using ROAquantiles.doc

iqreg lnROAplus1 lntfas lncompexp industryROA lnage changeGDP change_marketsize weighted_tax_diff, q(0.8508382948 0.99999999999) reps(100)

outreg2 using ROAquantiles.doc

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