



The impact of tax differentials on pre-tax income of Swiss MNEs

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Abstract

Multinational enterprises may use income shifting techniques such as strategic transfer pricing and debt shifting to reduce their global tax burden. Due to comparably low corporate taxation, Switzerland is presumably a suitable location for tax planning strategies. The thesis at hand examines income shifting among multinational enterprises headquartered in Switzerland in a quantitative manner and provides indirect evidence of income shifting. Using a large panel dataset of foreign subsidiaries of Swiss parent firms and employing a fixed-effects regression approach, the estimated semi-elasticity of pre-tax income with respect to the statutory tax rate differential between the parent firm and the subsidiary is -1.458 . This estimate is highly significant and larger than the estimates in comparable papers using European samples. Additionally, this thesis shows that income shifting activities between the parent firm and the subsidiary increase with the parent's ownership share in the subsidiary and the firm size of the subsidiary. Hence, Swiss multinational enterprises preferably shift income using large, wholly-owned subsidiaries.

Keywords: Income shifting, tax planning, Swiss multinationals, semi-elasticity, tax differential

1. Introduction

1.1. Multinational enterprises and income shifting

Firms operating in a multi-jurisdictional environment can use two main income shifting techniques to reduce their global tax burden [Bartelsman and Beetsma \(2003, 2227\)](#). First, a multinational enterprise (MNE) can make strategic use of transfer pricing (TP). To do so, a MNE may supply intermediate goods or services from an affiliate incorporated in a low-tax (high-tax) jurisdiction to an affiliate incorporated within a high-tax (low-tax) jurisdiction priced above (below) the true price. Secondly, a MNE may grant a loan from an affiliate residing in a low-tax country to an affiliate residing in a high-tax country and benefit from the tax-deductibility of interest payments in the high-tax country. In both cases, income is shifted from a high-tax affiliate to a low-tax affiliate and the global tax bill of the MNE is smaller than it is in the absence of income shifting. The effectivity of these tax planning strategies is partially dependent on the peculiarities of the legal setting. Specific national tax law, as well as international double taxation agreements (DTA) may prevent or deter income shifting of MNEs. In case tax saving potentials are available, it is widely agreed on, that MNEs respond mainly to tax differentials in statutory tax rates [Haufler and Schjelderup \(2000, 307\)](#), [Becker et al. \(2012, 1499\)](#) That is,

the MNE strategically relocates income to affiliates residing in low-tax countries by means of income shifting techniques.

Prior literature finds empirical, although mostly indirect, evidence that MNEs shift income.¹ Pre-tax income that is sensitive to changes in tax differentials between affiliates of a MNE is interpreted as indirect evidence for income shifting [Mooij and Ederveen \(2008, 684\)](#). Examples of direct evidence of income shifting are provided by [Vicard \(2015, 23-24\)](#), [Overesch \(2006, 1-2\)](#) and [Clausing \(2003, 2222\)](#). Recent research is often dedicated to finding specific opportunities to shift income or identifying tax regulations that deter income shifting. The former opportunities, also called drivers of income shifting, are usually based on basic observable firm and country characteristics. These drivers increase the sensitivity of pre-tax income to changes in tax differentials, while tax regulations decrease this sensitivity. Within Europe, especially German authors have taken up on the subject addressing German or European MNEs and the effectiveness of tax legislations. The interest in the German case could stem from the fact that Germany is characterized by high statutory corporate income tax rates (CITR) and income potentially being shifted out of the country [Weichenrieder \(2009, 284, 293\)](#).

¹See [Dharmapala \(2014\)](#) or [Heckemeyer and Overesch \(2013\)](#) for overviews on evidence of income shifting.

Huizinga and Laeven (2008, 1179) estimate that 13.6% of Germany's tax base in 1999 is lost due to income shifting. For the opposite reason, Switzerland is presumably an interesting location to study income shifting.

1.2. Objective

The objective of this thesis is to investigate whether Swiss MNEs shift income or not. Therefore, the sensitivity of pre-tax income of subsidiaries of Swiss MNEs to tax differentials is empirically examined. This sensitivity is to be quantified in terms of a semi-elasticity of the pre-tax income with respect to (w.r.t.) the tax differential. It is further to be verified if firm specific drivers of income shifting affect this semi-elasticity. The results are put in a European context and various implications are discussed. Few studies about income shifting focus on single countries in Europe. Examples are Langli and Saudagaran (2004) in the case of Norway, Weichenrieder (2009) in the case of Germany, Mura et al. (2013) in the Case of Italy and Vicard (2015) in the case of France. Up to the current knowledge of the author of this thesis, there exists no comparable research specifically addressing income shifting of Swiss MNEs.² The thesis at hand attempts to fill this gap in the empirical literature on income shifting.

1.3. Research approach

2 summarizes prior literature. This literature is used in two ways. First, drivers of income shifting based on certain firm and country characteristics suitable for the empirical analysis are identified. Secondly, tax legislation effectively deterring income shifting is analyzed. Tax legislation is not empirically studied, but used to qualitatively infer how effective Swiss tax legislation prevents income shifting. 3 provides an overview on corporate taxation in Switzerland. 4 presents a basic model to study income shifting of Swiss MNEs. This model is theoretically established by Hines and Rice (1994) and notably expanded by Huizinga and Laeven (2008). A brief description of this model can be found in Dharmapala (2014, 424-427). The basic model is then extended by incorporating the drivers of income shifting from the literature review. The extended model allows to study how the sensitivity of pre-tax income to changes in tax differentials depends on these drivers of income shifting. The earnings before interest and taxes (EBIT) is employed as a measure of pre-tax income. 5 describes the data and variables used. The empirical approach relies mainly on financial firm data retrieved from the ORBIS database. The data is collected at the subsidiary level. Tax and macroeconomic data is obtained from sources otherwise stated. Furthermore, 5 explains the sample construction process. 6 presents and summarizes the empirical results of the basic and extended model. Additionally, robustness tests are used to verify the results. 7 contains a discussion of the results and provides implications for future

²Swiss firms have been included in previous studies on income shifting within Europe. However, the number of Swiss firms being low, these studies do not allow to draw specific conclusions for Swiss firms.

research. Specific issues examined are how the income shifting behavior of Swiss MNEs developed over time, and which locations play important roles in income shifting strategies of Swiss MNEs. 8 addresses the limitations of the thesis and 9 concludes. Stata 14 StataCorp. (2015) is used for statistical computation, and \LaTeX Group (2017) and R 3.3.3 in conjunction with ggplot2 Team (2017), Wickham (2016) are used to plot figures.

2. Literature review

The subject of income shifting started to become popular in the United States (US) in the 1990's. An early pioneering work by Hines and Rice (1994) influences the literature up to the present. The authors argue that the income of a firm is partly attributable to production factors such as capital and labor, and, if income is shifted, partly to tax rates. They regress the pre-tax income on capital, labor, gross domestic product (GDP) per capita and the effective tax rate (ETR) Hines and Rice (1994, 161). This approach became popular later on and Dharmapala (2014, 423) refers to it as the "Hines and Rice approach". Hines and Rice apply a log-level specification, allowing them to interpret the coefficient estimate of the tax variable as a semielasticity. They use country-aggregated data on US majority-owned affiliates and find that a 1 percentage point increase in the ETR reduces reported income by roughly 3% Hines and Rice (1994, 161-162). Huizinga and Laeven (2008) draw upon their approach and use affiliate-level data of European firms from the AMADEUS database and a composite tax variable. The authors argue that income shifting can not only take place between the parent and the subsidiary, but also between subsidiaries of the same parent. They calculate an average tax differential considering all affiliates of a MNE and further argue that for income shifting to take place, the MNE needs an incentive and an opportunity to shift income. The incentive is given by the average tax differential, the opportunity is given by the scale of operations of the affiliate (which they proxy with sales) and the composite tax variable is a combination of the two. Hence, income shifting is large if the average tax differential and the scale of operations are large Huizinga and Laeven (2008, 1168-1169). Huizinga and Laeven regress the EBIT on production inputs and the composite tax variable in a log-level specification. Their preferred estimate is -1.766, meaning that an increase in the composite tax variable by 1 percentage point is associated with a decrease in the EBIT of 1.766%, which is in line with income shifting Huizinga and Laeven (2008, 1177).

Numerous authors use the models developed in these two papers to introduce drivers of income shifting, and to explain differences in income shifting behavior. Such studies typically argue, that the opportunities to shift income depend on some observable firm and country characteristics. A standard empirical approach to study drivers of income shifting is to create an interaction term consisting of the driver and the tax incentive variable, and integrating it within the "Hines

and Rice approach". The drivers of income shifting considered in this thesis are: the scale of operations, the amount of intangible assets, the ownership share of the parent in the subsidiary and the direction of income shifting.³ The legal environment further affects income shifting by reducing possibilities for tax savings in certain countries.

Huizinga and Laeven (2008, 1166–68) argue, that income shifting is large if the scale of operations is large because the firms books and real trade have to be adjusted less to justify transfer prices of the shifted goods (see also Haufler and Schjelderup 2000, 319). Surprisingly, the impact of the scale of operations, or equivalently firm size, is seldom studied. Relying on the "Hines and Rice approach", Beer and Loeprick (2015, 436) find that both large and small MNEs react stronger to tax differentials, implying that they shift income to a larger extent than medium sized firms. Conover and Nichols (2000, 207) use a different approach and find that the income shifting behavior of US MNEs depends somehow on the firm size. However, their results are a mere indication of a size effect in income shifting behavior (Conover and Nichols (2000), 209), leaving the effect of the firm size an interesting subject to study.

The role of intangible assets within the "Hines and Rice approach" has been studied by Grubert (2003), Beer and Loeprick (2015) and Dischinger and Riedel (2011). Because it is difficult to determine arm's length prices for intangibles, the transfer of such provides opportunities for tax savings through income shifting Bartelsman and Beetsma (2003, 2235), Beer and Loeprick (2015, 428). Grubert (2003, 229) examines the effect of intangible assets owned by the parent firm on income shifting and finds that a high intangible asset endowment of the parent firm facilitates income shifting. In contrast hereto, Beer and Loeprick (2015) use the intangible asset endowment of subsidiaries to explain differences in income shifting behavior. They find that income shifting increases with the subsidiary's amount of intangible assets Beer and Loeprick (2015, 434). Dischinger and Riedel (2011, 699-700) find the same qualitative result within a similar framework. Alternative research approaches have further confirmed the use of intangibles in income shifting strategies. Dischinger and Riedel (2008, 13) show that intangible assets within MNEs are located at affiliates facing a low statutory tax rate and Karkinsky and Riedel (2012, 182) find that the tax rate is negatively correlated with the number of patent applications. Both findings suggest intangibles are being used to shift income to low-tax jurisdictions.

Weichenrieder (2009) studies the impact of the ownership share on the income shifting behavior of German foreign direct investment (FDI). He argues that income shifting to the parent firm is additionally costly due to opposition from other shareholders with conflicting interests if the subsidiary is not wholly-owned. These additional costs do not accrue if income is shifted from the parent firm to the subsidiary Weichenrieder (2009, 285). Using the microdatabase direct

investment (MiDi), Weichenrieder finds that wholly-owned subsidiaries react stronger to tax rate changes, however, this finding turns insignificant once the capital structure of the subsidiary is accounted for Weichenrieder (2009, 295). Desai et al. (2004, 341-343) find that the profitability of non wholly-owned subsidiaries is less sensitive to tax rates than is that of wholly-owned subsidiaries. This is in line with income shifting and they conclude that a MNE's possibility to minimize taxes is dampened by shared ownership Desai et al. (2004, 341). Dischinger (2008) uses the "Hines and Rice approach" and a continuous variable to measure the ownership share and shows that subsidiaries owned with a higher ownership share shift significantly more income Dischinger (2008, 17-18). Further, Buettner and Wamser (2013, 84) find that majority-owned subsidiaries use internal debt to shift income to low-tax countries more pronounced than non majority-owned subsidiaries.

Dischinger et al. (2014) focus on the direction of income shifting. The authors distinguish income shifting towards the parent firm from income shifting towards the subsidiary. Due to a headquarter bias, it is more costly to shift income to the subsidiary. Various arguments suggest the existence of a headquarter bias. The authors mention that managers prefer having assets under direct control rather than having them in distant locations, and that funds might be located at the parent firm to avoid potential withholding taxes upon dividend repatriation Dischinger et al. (2014, 249). Their results imply that the amount of shifted income is by more than 70% smaller if the income is shifted away from the parent instead of shifted towards the parent Dischinger et al. (2014, 268).

Various authors have studied the impact of tax and TP legislation on the income shifting behavior of MNEs. Among them are Lohse and Riedel (2012), Buettner et al. (2017), Beuselink et al. (2015) and Ruf and Weichenrieder (2012). Lohse and Riedel (2012) assess the impact of TP regulations on the income shifting behavior of European MNEs. They split countries into three categories according to the strictness of TP regulations. Category 1 includes countries with no or very general regulations, but no documentation requirements. Category 2 includes countries with TP regulations including documentation requirements. Category 3 is similar to category 2, but the TP documentation regulations are required to be incorporated into national tax law Lohse and Riedel (2012, 6-7, 19-20). The authors find that income shifting among firms incorporated in countries with binding TP regulations (countries assigned to category 2 and 3) is reduced by approximately 50% Lohse and Riedel (2012, 10-11). Buettner et al. (2017) use a similar approach based on a strictness of TP legislation overview provided by Lohse et al. (2012, 21-24), but do not find a significant reduction in income shifting due to stricter TP regulations. However, they find that thin-capitalization rules reduce income shifting Buettner et al. (2017, 13-14). Beuselink et al. (2015) use a broader system to quantify the strength of tax enforcement in different countries. Factors they include are the tax audit risk, related party disclosure requirements, existence of tax favorable holding regimes, existence of thin-capitalization

³Other recently studied drivers are the firm complexity Beer and Loeprick (2015) or the legal form of the firm Beuselink et al. (2015).

rules and DTAs and the possibility to carry-forward losses [Beuselinck et al. \(2015, 715-716\)](#). They find that a weak tax enforcement environment is associated with more income shifting [Beuselinck et al. \(2015, 729-732\)](#). [Ruf and Weichenrieder \(2012\)](#) study the effect of controlled foreign corporation (CFC) rules on passive investment of German MNEs. They find that both, a higher tax rate and binding CFC rules are associated with lower passive investment. Specifically, the passive assets of a foreign subsidiary are reduced by 77% if that country is affected by the German CFC rules [Ruf and Weichenrieder \(2012, 1513-1514\)](#). The authors conclude that the German CFC rules effectively reduce tax revenue loss by preventing the outflow of passive investments to low-tax countries [Ruf and Weichenrieder \(2012, 1527\)](#).

The four drivers of income shifting are incorporated into the basic model by [Huizinga and Laeven \(2008\)](#) in 4.2. The tax legislation with a potentially dampening effect on income shifting is not studied empirically since the sample includes only subsidiaries of Swiss parent firms, which are subject to the same tax system. Nonetheless, the results of these studies give hints about how and to which extent Swiss corporate tax legislation may prevent income shifting among Swiss MNEs. Appendix A provides a structured classification of the literature reviewed here. A more comprehensive overview on empirical literature can be found for example in [Devereux and Maffini \(2007\)](#).

3. Switzerland as a location of income shifting

The purpose of this section is to evaluate whether Swiss MNEs can possibly reduce their global tax burden using income shifting techniques. To do so, relevant aspects of the corporate tax environment in Switzerland are analyzed. Corporate income taxes in Switzerland are levied on three organizational levels. On the federal level a flat rate of 8.5% applies (the same rate applies regardless of the amount of income), but differing rates apply on the cantonal level, and rates expressed as percentages of the cantonal rate are levied on the municipal level [Galletta and Redonda \(2017, 7\)](#). As a consequence, tax rates are heterogeneous in Switzerland. [Lampart et al. \(2012, 18\)](#) present ETRs for stock companies in Switzerland between 13 and 23.7% in 2010, depending on the exact location of incorporation. In a European context, statutory CITRs in Switzerland may be considered to be of low to moderate level.⁴ Considering [Haufler and Schjelderup \(2000, 307\)](#), who state that income shifting reacts mainly to statutory tax differentials, the low CITRs in Switzerland constitute an incentive to shift income to Switzerland. Two arguments favor the use of statutory tax rates over ETRs. First, previous literature used mainly statutory rates and statutory rates are easy to use, whereas it can be difficult to calculate ETRs due to differing tax favors and deductions in different locations. Secondly, statutory tax rates are determined by governments only and are therefore not under the influence

of the firm [Dharmapala \(2014, 425\)](#). A drawback of statutory tax rates is that they reflect the shifting incentive less accurate, especially in the presence of losses and loss carry-forwards [Overesch \(2006, 16\)](#), [Buettner and Wamser \(2013, 74\)](#). To comply with previous literature, statutory tax rates are used in this thesis.⁵

Low statutory CITRs are not sufficient to explain income shifting. In case the home country of the parent firm taxes income of its foreign subsidiaries, no tax saving is obtainable by shifting income among affiliates. Double taxation can occur if the country of residence of the subsidiary also levies taxes on the subsidiaries' domestic income. To counteract double taxation, Switzerland has concluded DTAs with major industrial countries. The Swiss Confederation provides and updates a list of all DTAs online, as of March 2017, Switzerland has signed 55 DTAs in accordance with the organization for economic co-operation and development (OECD) standard, of which 50 are in force [Confederation \(2017\)](#). The DTAs apply the exemption method, which excludes income of foreign subsidiaries from taxation in Switzerland [Enterprise \(2016, 121\)](#), [OECD \(2014, 36-37\)](#). Therefore, Swiss MNEs can possibly realize tax savings by shifting income to Switzerland. This reasoning is confirmed by [Heckemeyer and Overesch \(2013, 16\)](#). Further, [Markle \(2016, 8-9, 32-33\)](#) presents empirical evidence that MNEs subject to a territorial taxation system (countries that generally exempt foreign income from home taxation) shift significantly more income than MNEs subject to a worldwide taxation system. However, a taxation method with an exemption system by itself is not tantamount with income shifting being present. As mentioned in the introduction, certain tax legislations can prevent or dampen income shifting through specific channels such as debt shifting and manipulation of transfer prices. It is thin-capitalization rules in the case of debt shifting [Buettner et al. \(2017, 13-14\)](#) and TP legislation and documentation requirements in the case of income shifting through strategic TP [Lohse and Riedel \(2012, 15\)](#). The federal tax administration in Switzerland issues minimum and maximum interest rates that are tax-deductible. If the charged rate is outside this interval, it might be adjusted [PwC \(2015, 963\)](#). The safe haven debt-to-equity ratio⁶ is 6:1. This ratio is generous in comparison with other countries, meaning that the thin-capitalization rules in Switzerland are rather loose in an international context [Buettner et al. \(2012, 932\)](#).⁷ Switzerland currently does not apply specific TP legislation or documentation requirements, but follows the OECD guidelines on TP [PwC \(2015, 962, 964\)](#). Unsurprisingly, Switzerland ranked low in a worldwide overview on the strictness of national TP regulations [Lohse et al. \(2012, 23-24\)](#).

⁵Loss-making subsidiaries are excluded from the sample to mitigate this drawback (see 2).

⁶Interest payments are granted to be deductible if the debt-to-equity ratio is below the safe haven debt-to-equity ratio [Buettner et al. \(2012, 931\)](#).

⁷The comparison dates back to 2005, however, as the authors point out, it occurs seldom that a country abolishes thin-capitalization rules [Buettner et al. \(2012, 932\)](#). [PwC \(2015, 963\)](#) mention that the 6:1 ratio is still applicable in Switzerland in 2015.

⁴See 5.2 for a comparison of European and worldwide CITRs.

Thus, the low statutory CITRs within an exemption method taxation system and the absence of strict thin-capitalization rules and TP legislation allow Swiss MNEs to realize tax savings by means of income shifting. More specifically, tax savings can be realized by shifting income to Switzerland, whenever the foreign tax rate is higher than the Swiss rate. Further, according to [Gehriger \(2008, 243-244\)](#) and [Ruf and Weichenrieder \(2012, 1527-1528\)](#), the absence of CFC rules facilitates income shifting. A broader guide on corporate taxation in Switzerland can be found for example in [Feld and Kirchgässner \(2002, 131-135\)](#).

4. Theoretical considerations

4.1. Basic model

The basic model allows to study the relation between tax differentials and pre-tax income of Swiss MNEs. The basic model presented here constitutes an adaptation of the model by [Huizinga and Laeven \(2008\)](#). The model is extended in 4.2 to incorporate the drivers of income shifting. The representative MNE consists of two affiliates, the parent firm h in Switzerland and the subsidiary i in a foreign country. Due to limited access to ownership data, it is not possible to create a comprehensive MNE dataset with groups consisting of more than two affiliates, as for example in [Huizinga and Laeven \(2008, 1169\)](#) or [Beer and Loeprick \(2015, 430\)](#). It is only possible to link subsidiaries to Swiss shareholders. For the purpose of this thesis, a firm is considered a subsidiary if the Swiss parent firm owns at least 10% of the shares in the subsidiary.⁸ It is assumed that both countries exempt foreign income from taxation, but tax any income that has been shifted to the country. This assumption is necessary for income shifting to have a tax-saving effect and is standard in the literature. See for example [Haufler and Schjelderup \(2000, 312\)](#) or [Mintz and Smart \(2004, 1151\)](#).

The statutory CITRs of the parent and the subsidiary are r_{ht} , respectively r_{it} . Following [Hines and Rice \(1994, 159\)](#), the total income of subsidiary i in year t , Π_{it} , equals the sum of true but unobserved income (income in the absence of income shifting) and shifted income. True income is denoted by Π_{it}^T and shifted income is denoted by s_{it} . If $r_{it} < r_{ht}$ ($r_{it} > r_{ht}$), then $s_{it} > 0$ ($s_{it} < 0$) and income is shifted to the subsidiary (to the parent). These are cases 1 and 2 in 1. Income shifting is costly and prior literature states a modification of the firms books and real trade and investment flows to justify the income shifting [Huizinga and Laeven \(2008, 1166\)](#), or efforts undertaken to conceal the shifting [Haufler and Schjelderup \(2000, 313\)](#) as explanation for the costs associated with income shifting. The costs of income shifting

for subsidiary i in year t are denoted c_{it} . 1 shows a graphical representation of this setup.

According to [Hines and Rice \(1994, 159\)](#) and [Huizinga and Laeven \(2008, 1168-1169\)](#), the total pre-tax income of subsidiary i in year t can be written as⁹

$$\Pi_{it} = \Pi_{it}^T + s_{it}. \quad (1)$$

In the following, the components of the total income are described, starting with the shifted income. To derive the optimal amount of income shifting s_{it} , an income function for the MNE is set up. The income of the MNE consists of the true income of both affiliates, plus the tax effects from income shifting, minus the costs of income shifting [Weichenrieder \(2009, 285\)](#), [Dischinger et al. \(2014, 250\)](#). The cost function specification is taken from [Hines and Rice \(1994, 159\)](#). The cost function reflects that the costs of income shifting are proportional with factor γ to the ratio of shifted income over true income. Hence, the costs of income shifting are lower if the true income of the subsidiary is high. This is also emphasized by [Haufler and Schjelderup \(2000, 319\)](#), who argue that income shifting to a given country is less costly when the true income or the level of investment in that country is high. The cost function specification is given by

$$c_{it}(s_{it}) = \frac{\gamma}{2} \cdot \frac{s_{it}^2}{\Pi_{it}^T}, \quad (2)$$

which is a convex function applying equally to positive and negative values of s_{it} . The costs of shifting income are assumed to be non-tax deductible [Dischinger et al. \(2014, 250\)](#). For simplicity, it is further assumed that these costs are solely borne by the parent firm in Switzerland. Using the cost function above, the total after-tax income of the representative MNE in year t can be expressed as

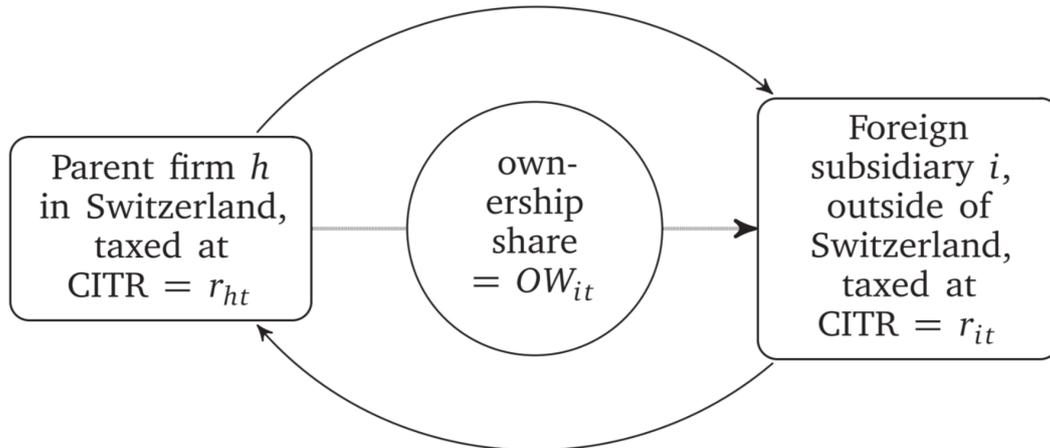
$$\begin{aligned} \Pi_{MNE,t} = & \underbrace{(1 - r_{ht})(\Pi_{ht}^T - s_{it}) - c_{it}(s_{it})}_{\text{after-tax parent income}} \\ & + \underbrace{(1 - r_{it})(\Pi_{it}^T + s_{it})}_{\text{after-tax subsidiary income}}, \end{aligned} \quad (3)$$

where Π_{ht}^T is the true income of the parent h . Note that income shifting by itself does not create additional income, since income shifted to one affiliate is equal to the income shifted away from the other affiliate [Hines and Rice \(1994, 159\)](#). Differentiating 3 w.r.t. s_{it} , substituting the cost function and solving for s_{it} yields the optimal amount of income

⁸This might not always constitute a controlling interest. However, firms with an ownership share of at least 10% are included in the sample to study the effect of the ownership share on income shifting. [Dischinger \(2008, 16\)](#) applies a minimum ownership of 25% to study the impact on income shifting. 5.1 elaborates on the issue of limited ownership information and the 10% ownership threshold.

⁹As a result of the aforementioned data restriction, only subsidiaries but not parents can be studied. The sole use of the subsidiary index i reflects this. In fact, the only known information about the parent firm is that it is located in Switzerland.

Case 1: $r_{it} < r_{ht}$, $s_{it} > 0$ income shifting to subsidiary i at costs c_{it}



Case 2: $r_{it} > r_{ht}$, $s_{it} < 0$ income shifting to parent h at costs c_{it}

Figure 1: Income shifting scenarios among Swiss multinational enterprises. Shifted income is depicted by solid arrows and ownership stakes are depicted by dotted arrows. Source: own figure.

shifting¹⁰

$$\begin{aligned} \partial \Pi_{MNE,t} / \partial s_{it} &= (r_{it} - r_{ht}) - c'_{it} = 0 \\ \Leftrightarrow (r_{it} - r_{ht}) &= -\gamma \cdot \frac{s_{it}}{\Pi_{it}^T} \\ \Leftrightarrow s_{it} &= -\frac{1}{\gamma} \cdot \Pi_{it}^T (r_{it} - r_{ht}). \end{aligned} \tag{4}$$

Substituting the third row from 4 into 1 and rearranging results in

$$\begin{aligned} \Pi_{it} &= \Pi_{it}^T - \frac{1}{\gamma} \cdot \Pi_{it}^T (r_{it} - r_{ht}) \\ &= \Pi_{it}^T \cdot \left[1 - \frac{1}{\gamma} \cdot (r_{it} - r_{ht}) \right], \end{aligned} \tag{5}$$

taking natural logarithms and approximating the second line of 5 yields¹¹

$$\ln \Pi_{it} = \ln \Pi_{it}^T - \frac{1}{\gamma} \cdot (r_{it} - r_{ht}). \tag{6}$$

¹⁰It might seem that not the straight forward solution has been chosen when solving for the optimal amount of s_{it} . This is done to ensure comparability to recent literature, which usually defines the tax differential as subsidiary tax rate minus the parent tax rate Dischinger et al. (for example 2014, 259).

¹¹The approximation used is $\ln(1+x) \approx x$, if x is close to 0 and is taken from Huizinga and Laeven (2008, 1169). Note that $\ln(a \cdot b) = \ln(a) + \ln(b)$ has been applied before using the approximation. Here x is equal to $1/\gamma \cdot (r_{it} - r_{ht})$. With moderate tax differentials, this expression is reasonably close to 0.

In line with Hines and Rice (1994, 160-161) and Huizinga and Laeven (2008, 1169), the true income is assumed to be the output Q_{it} produced according to a Cobb-Douglas production function, minus the wage costs w_{it} . The above authors propose the following specification, $Q = kA_{it}^\alpha L_{it}^\lambda K_{it}^\phi e^{u_{it}}$, where k is a constant term, A_{it} , L_{it} and K_{it} are the technology, labor and capital input of subsidiary i in year t , u_{it} is a random term and e is Euler's number. The wage costs w_{it} are equal to the partial derivative of Q_{it} w.r.t. L_{it} , which gives $w_{it} = k\lambda A_{it}^\alpha L_{it}^{\lambda-1} K_{it}^\phi e^{u_{it}}$. Subtracting the wage costs w_{it} from the true income Π_{it}^T is therefore equal to

$$\Pi_{it}^T = Q_{it} - w_{it} = k(1-\lambda)A_{it}^\alpha L_{it}^\lambda K_{it}^\phi e^{u_{it}}, \tag{7}$$

and taking natural logarithms gives

$$\begin{aligned} \ln \Pi_{it}^T &= \ln k + \ln(1-\lambda) + \alpha \cdot \ln A_{it} + \lambda \cdot \ln L_{it} \\ &\quad + \phi \cdot \ln K_{it} + u_{it}. \end{aligned} \tag{8}$$

Replacing $\ln \Pi_{it}^T$ in 6 with the expression given in 8 and introducing empirically customary notation, yields the following basic model

$$\begin{aligned} \ln \Pi_{it} &= \underbrace{\ln k + \ln(1-\lambda)}_{\equiv \beta_0} + \alpha \cdot \ln A_{it} + \lambda \cdot \ln L_{it} \\ &\quad + \phi \cdot \ln K_{it} + u_{it} - \frac{1}{\gamma} \cdot \underbrace{(r_{it} - r_{ht})}_{\equiv \tau_{it}} \\ &= \beta_0 + \beta_1 \cdot \ln A_{it} + \beta_2 \cdot \ln L_{it} \\ &\quad + \beta_3 \cdot \ln K_{it} - \beta_4 \cdot \tau_{it} + u_{it}, \end{aligned} \tag{9}$$

where $\alpha = \beta_1$, $\lambda = \beta_2$, $\phi = \beta_3$, $1/\gamma = \beta_4$ and the tax differential is depicted by τ_{it} . The model given in 9 corresponds to the estimation equation from [Huizinga and Laeven \(2008, 1169\)](#). Their composite tax variable captures the incentive to shift income among any affiliates of the MNE (the average tax differential) and the opportunity to shift income (the scale of operations, proxied by sales). In contrast thereto, the tax differential τ_{it} only captures the incentive to shift income between the subsidiary and the parent, which is a direct consequence of the earlier mentioned limited access to ownership data, which makes it impossible to calculate an average tax differential.

4.2. Extended model

The model extensions are motivated by the research presented in 2 and allow to study income shifting in greater detail. These studies identify individual opportunities to shift income based on observable firm and country characteristics. Other than [Huizinga and Laeven \(2008\)](#), who assume the scale of operations of an affiliate in a given country is the sole driver of income shifting, additional factors are considered here. Four drivers are examined. These drivers are the scale of operation [Huizinga and Laeven \(2008\)](#), the amount of intangible assets [Beer and Loeprick \(2015\)](#), [Dischinger and Riedel \(2011\)](#), the ownership share [Weichenrieder \(2009\)](#), [Dischinger \(2008\)](#) and the direction of income shifting [Dischinger et al. \(2014\)](#). These drivers extend the basic model in 9 by introducing interaction terms consisting of the drivers and the tax differential. This procedure is standard in the literature and is used by all authors mentioned above, however, an in-depth analysis of the interaction terms and corresponding marginal effects is often lacking. Therefore, the recommendations of [Brambor et al. \(2006, 64\)](#) and [Berry et al. \(2012, 660\)](#) are followed. Their main recommendations are to include all variables that constitute an interaction term, calculate marginal effects and corresponding standard errors for a substantive range of the variables involved, and present the results thereof in an informative way.¹²

[Huizinga and Laeven \(2008, 1167-1168\)](#) argue that the amount of income shifting depends on the affiliate's scale of operations in a given country. A firm with a large scale of operations finds it easier to shift income than a firm with a small scale of operations. To account for this possibility, an interaction term consisting of the scale of operations and the tax differential is added to the model in 9. Other than in [Huizinga and Laeven \(2008, 1172\)](#), the capital input K_{it} is

used instead of sales to proxy for the scale of operations. This is based on [Haufler and Schjelderup \(2000, 319\)](#) and has the advantage of presumably being a more stable measure and being less distorted by income shifting [Huizinga and Laeven \(2008, 1174\)](#). It is further convenient as no additional variable has to be included when interacting the tax differential with the capital input. The standalone terms are kept in the model. [Beer and Loeprick \(2015, 428\)](#) argue that intangible assets such as trademarks, patents and copyrights are difficult to value and provide opportunities for tax savings. Thus, a strategic transfer price of an intangible asset deviating from the arm's length price is less costly to conceal from the tax authority and income shifting increases with the amount of intangibles. This argument is followed and an interaction term consisting of the amount of intangibles, I_{it} , and the tax differential is introduced. Both, the interaction term and I_{it} as a standalone term are added to 9. A similar argument, with income shifting depending on the ownership share of the parent, is made by [Dischinger and Riedel \(2008, 5\)](#). He argues that income shifting strategies with subsidiary i are hard to implement if the ownership share of the parent in this subsidiary is small and hence, tax savings from income shifting are hard to realize. Dischinger measures the ownership with a continuous variable, whereas [Weichenrieder \(2009, 292\)](#) uses a categorical variable to distinguish wholly-owned subsidiaries from non wholly-owned subsidiaries. The later approach is followed here, and two categorical ownership variables are introduced and each interacted with τ_{it} . $OW_{51_{it}}$ is equal to 1 if the ownership share is between 51 and 99.99% and 0 otherwise, and $OW_{100_{it}}$ is equal to 1 if the subsidiary is wholly-owned and 0 otherwise. Since time-invariant variables cannot be used in a fixed effects (FE) model, solely the interaction terms are added to 9.¹³ [Dischinger et al. \(2014, 249, 251\)](#) provide several reasons why income shifting to the parent is less costly than income shifting to the subsidiary. Among them are withholding taxes upon repatriation of foreign income as dividends and managers preferring having funds under control rather than having them overseas. To implement this argument, the case distinction from 1 is applied to the model. In case 1, income is shifted to the subsidiary ($r_{it} < r_{ht}$, $s_{it} > 0$), and in case 2, income is shifted to the parent ($r_{it} > r_{ht}$, $s_{it} < 0$). The variable $Case2_{it}$ equal to 1 if the shifting direction is towards the parent (in case 2) and 0 otherwise (in case 1), is introduced and interacted with τ_{it} . Both the interaction and the standalone term are added to the model in 9. The extended model is constructed by combining the second line of 9 and the additional standalone and interaction terms mentioned above, and is given

¹²The authors come from the field of politics, however, their recommendations apply irrespective of the subject. The authors find that their main recommendations are largely ignored in a survey of political studies. The articles presented in 2 almost always include all variables constituting an interaction (an exception are [Huizinga and Laeven \(2008, 1169\)](#) who state that their composite tax variable is the product of two terms, but include only the product and not the single terms). But, interaction terms are rarely analyzed at the level of detail proposed by [Brambor et al. \(2006, 73-77\)](#) (an exception are [Beer and Loeprick \(2015, 444\)](#) who include a figure of a marginal effect of an interaction term).

¹³The ORBIS database reports the ownership for the last available year only [Dharmapala \(2014, 430\)](#). For the purpose of the empirical analysis, it is assumed that the ownership share remained unchanged as it was in the year 2015. [Dischinger and Riedel \(2008, 9\)](#) mentions that making this assumption does not constitute a serious threat to the validity of his results. But making this assumption results in having a time-invariant ownership variable. As a consequence, only the interaction terms but not the standalone terms can be added to 9. 8 elaborates and mentions that the coefficient estimates of such a procedure are possibly biased.

for subsidiary i in year t by

$$\begin{aligned} \ln \Pi_{it} = & \underbrace{\beta_0 + \beta_1 \cdot \ln A_{it} + \beta_2 \cdot \ln K_{it} + \beta_4 \cdot \tau_{it} + u_{it}}_{\text{basic model from 9}} \\ & - \underbrace{\beta_5 \cdot \tau_{it} \times \ln K_{it}}_{\text{capital interaction}} + \beta_6 \cdot \ln I_{it} - \underbrace{\beta_7 \cdot \tau_{it} \times \ln I_{it}}_{\text{intang. interact.}} \\ & - \underbrace{\beta_8 \cdot \tau_{it} \times OW_51_{it}}_{1^{st} \text{ ownership interact.}} - \underbrace{\beta_9 \cdot \tau_{it} \times OW_100_{it}}_{2^{nd} \text{ ownership interact.}} \\ & + \beta_{10} \cdot Case2_{it} - \underbrace{\beta_{11} \cdot \tau_{it} \times Case2_{it}}_{\text{direction interaction}}. \end{aligned} \tag{10}$$

10 constitutes the extended model. Note that the interaction terms enter with a negative sign. This is due to the definition of the tax differential in 4 and the deliberate coding of the categorical variables included in the interaction terms.¹⁴ The extended model allows to compute and interpret specific marginal effects, although this advantage comes at the price of increased model complexity. The subsequent subsection is intended to give an idea on model interpretation and how the extended model can be used to gain a more detailed insight into income shifting activities of Swiss MNEs.

4.3. Model interpretation and marginal effects

A negative sign of β_4 is in line with income shifting [Becker and Riedel \(2012, 447\)](#). If τ_{it} is negative (case 1, $r_{it} < r_{ht}$, $s_{it} > 0$), income is shifted to the subsidiary. As a consequence, the subsidiary's total income Π_{it} increases. A negative sign of β_4 in 9,10 reflects case 1 correctly. If τ_{it} is positive (case 2, $r_{it} > r_{ht}$, $s_{it} < 0$), income is shifted to the parent. As a consequence, the subsidiary's total income Π_{it} decreases. A negative sign of β_4 also reflects case 2 correctly. Moreover, the marginal effect of τ_{it} on Π_{it} in the basic model is given by the partial derivative $\partial \ln \Pi_{it} / \partial \tau_{it} = -\beta_4$ [Buettnner et al. \(2017, 11\)](#). Since the basic model is written in a log-level specification, the marginal effect can be interpreted as a semi-elasticity [Wooldridge \(2009, 43-46\)](#). That is the percentage change in Π_{it} associated with a 1 percentage point change in τ_{it} [Dharmapala \(2014, 429\)](#). An estimate of -1.5 translates into a 1.5% decrease in Π_{it} due to a 1 percentage point increase in τ_{it} , where the increase in τ_{it} is either a result of an increase in r_{it} or a decrease in r_{ht} .

The extended model in 10 is harder to interpret because the influence of τ_{it} depends on the drivers of income shifting. Partially differentiating 10 w.r.t. τ_{it} yields

$$\begin{aligned} \frac{\partial \ln \Pi_{it}}{\partial \tau_{it}} = & -\beta_4 - \beta_5 \times \ln K_{it} - \beta_7 \times \ln I_{it} \\ & - \beta_8 \times OW_51_{it} - \beta_9 \times OW_100_{it} \\ & - \beta_{11} \times Case2_{it}, \end{aligned} \tag{11}$$

¹⁴The categorical variables OW_51_{it} , OW_100_{it} and $Case2_{it}$ are coded in the same way as in the original papers. Doing so facilitates the comparison of the results.

which varies with the capital input, the amount of intangibles and the categorical ownership and shifting direction variables. The marginal effect in 11 still represents a semi-elasticity, and the coefficient estimates of the interaction terms from 10 depict how much the semi-elasticity changes w.r.t. the drivers of income shifting. For example, an estimate of β_5 of 0.5 results in a decrease (an absolute increase) of the marginal effect by -1.5 , given $\ln K_{it} = 3$, an ownership share between 10 and 50.99% and shifting direction to the subsidiary (the three last terms in 11 fall away). Given these characteristics, β_4 now depicts the marginal effect for a subsidiary with no capital. This example highlights two important points when it comes to interaction terms. First, marginal effects according to 11 reflect firm specific opportunities to shift income. For example, in the above setting the marginal effect for a subsidiary with capital of $\ln K_{it} = 3$ is -3 , which is twice as large as the marginal effect for a subsidiary with no capital. Thus, the extended model allows to study income shifting behavior among Swiss MNEs in greater detail. Secondly, it highlights the importance of calculating meaningful marginal effects and standard errors as proposed by [Brambor et al. \(2006, 74\)](#). A typical regression table reports coefficient estimates only. However, the estimate of β_4 is of little use in the extended model, since the sample includes no observations with zero capital. Although a regression table allows to calculate marginal effects for various combinations and levels of the regressors, there is no way of calculating correct standard errors and therefore, the significance of the marginal effect can not be assessed. Consider again the above example. The marginal effect for a subsidiary with the given characteristics is $\partial \ln \Pi_{it} / \partial \tau_{it} = \beta_4 - \beta_5 \times \ln K_{it}$, and the standard error (SE) is given by

$$\begin{aligned} SE \left(\frac{\partial \ln \Pi_{it}}{\partial \tau_{it}} \right) = & [\text{var} \beta_4 + (\ln K_{it})^2 \cdot \text{var} \beta_5 \\ & + 2 \cdot \ln K_{it} \cdot \text{cov}(\beta_4 \beta_5)]^{1/2} \end{aligned} \tag{12}$$

The formula can be found in [Brambor et al. \(2006, 70\)](#) and [Aiken and West \(1991, 16\)](#), who also provide a variety of standard errors for common interaction models.¹⁵ Typically, this quantity can not be assessed by the reader, as covariance terms are seldom reported. Therefore, a strong focus is put on meaningful marginal effects and their graphical representation in 6 when presenting the estimation results.

4.4. Estimation approach

[Huizinga and Laeven \(2008, 1172-1173\)](#) estimate their model by ordinary least squares (OLS). This is reasonable since their data is a cross-section from 1999. The panel dataset in this thesis allows to control for unobserved heterogeneity among subsidiaries. As a consequence, FE estima-

¹⁵The formulas can be assessed on Golder's website [Golder \(2017\)](#). The formulas allow to calculate standard errors for all marginal effects presented in 6.1, 6.2, 6.3.

tion is used here.¹⁶ A vector of yearly categorical variables to model a time trend, and a vector of categorical variables depicting the industry-affiliation interacted with the yearly categorical variables are added to the model in 10. The European classification of economic activities (NACE) rev. 2 main sector codes are used to distinguish industries Commission (2008, 57). The sample is limited to firms in the manufacturing and wholesale and retail industries, where a Cobb-Douglas production function to describe output presumably seems appropriate Huizinga and Laeven (for example 2008, 1172). This restriction is relaxed in robustness tests in 6.5. The FE estimation approach is fully described below in 13. Since the basic model from 9 is nested within the extended model from 10, this is done for the extended model only.

$$\begin{aligned} \ln \Pi_{it} = & \beta_0 + \beta_1 \cdot \ln A_{it} + \beta_2 \cdot \ln K_{it} + \beta_4 \cdot \tau_{it} \\ & - \beta_5 \cdot \tau_{it} \times \ln K_{it} + \beta_6 \cdot \ln I_{it} - \beta_7 \cdot \tau_{it} \times \ln I_{it} \\ & - \beta_8 \cdot \tau_{it} \times \text{OW}_{51_{it}} - \beta_9 \cdot \tau_{it} \times \text{OW}_{100_{it}} \quad (13) \\ & + \beta_{10} \cdot \text{Case2}_{it} - \beta_{11} \cdot \tau_{it} \times \text{Case2}_{it} + \mathbf{T}_{it} \boldsymbol{\theta}_{it} \\ & + \mathbf{U}_{it} \boldsymbol{\xi}_{it} + \rho_i + u_{it}, \end{aligned}$$

where

i is the subsidiary index,
 t is the time index ranging from 2007 to 2015,
 Π_{it} is the total pre-tax income, measured as EBIT,
 A_{it} is the technology input, proxied by the GDP per capita in local currency,
 L_{it} is the labor input, measured as costs of employees,
 K_{it} is the capital input, measured as fixed assets,
 τ_{it} is the tax differential, calculated as $\tau_{it} = (r_{it} - r_{ht})$
 I_{it} are fixed intangible assets,
 $\text{OW}_{51_{it}}$ is a categorical variable equal to 1 if the subsidiary is owned by a Swiss parent firm with a share between 51 and 99.99% and 0 otherwise,
 $\text{OW}_{100_{it}}$ is a categorical variable equal to 1 if the subsidiary is wholly-owned by a Swiss parent firm and 0 otherwise,
 Case2_{it} is a categorical variable equal to 1 if the income shifting direction is from the subsidiary to the parent firm in Switzerland and 0 otherwise,
 \mathbf{T}_{it} is a vector of dimensionality (1×8) , indicating which year the observation falls into, $\mathbf{T}_{it} = (T_{08} T_{09} T_{10} T_{11} T_{12} T_{13} T_{14} T_{15})$, the year 2007 being the reference category, and each of the categorical variables T_t being equal to 1 if the observation falls into year t and 0 otherwise,
 $\boldsymbol{\theta}_{it}$ is a vector of dimensionality (8×1) , holding the coefficients for each year except 2007, $\boldsymbol{\theta}'_{it} = (\theta_{08} \theta_{09} \theta_{10} \theta_{11} \theta_{12} \theta_{13} \theta_{14} \theta_{15})$
 \mathbf{U}_{it} is a vector of dimensionality (1×8) , holding industry-year categorical variables, each being equal

to 1 if the observation falls into that industry in that year and 0 otherwise,

$\boldsymbol{\xi}_{it}$ is a vector of dimensionality (8×1) , holding the coefficients for the industry-year categorical variables¹⁷
 ρ_i is the subsidiary-fixed effect, and
 u_{it} is the error term.

Directly estimating 13 is one way of studying income shifting among Swiss MNEs. In order to get a more complete picture of the underlying income shifting patterns, various adaptations of 13 are estimated. In a first step, the basic model excluding all interaction terms is estimated. In a second step, 13 including single drivers of income shifting separately is estimated. In a third step, all drivers of income shifting are studied within the same model, which is done by directly estimating 13 as stated above. The following section describes the data used in estimation and 6 presents the empirical estimation results.

5. Data and sample

5.1. Financial data and country statistics

The sample period covers 9 years, ranging from 2007 to 2015. The financial firm data is retrieved from the ORBIS database provided by the Bureau Van Dijk (BvD), which also provides access to the AMADEUS database, the European subset of ORBIS.¹⁸ Kalemli-Ozcan et al. (2015, 14) mention that the ORBIS and AMADEUS databases do not overlap in 100% of the cases and the coverage being higher in the ORBIS database. Therefore, the ORBIS database is used. The main variables downloaded include: EBIT, profit/loss (P/L) before tax, total assets, fixed assets, tangible fixed assets, intangible fixed assets, debt, equity, the number and costs of employees, the country's international standard organization (ISO) code, the BvD identification number (ID) and the NACE rev. 2 main sectors. The GDP data is taken from the World Bank Databank world-development-indicators Bank (2017). Subsidiaries included in the sample are firms with a Swiss parent firm holding at least 10% of the shares. The sample firms are allowed to have subsidiaries themselves. The BvD ID number is used as the subsidiary identifier within the dataset. The data is downloaded through the BvD web interface and access is provided by the University of Zurich. A major advantage of the ORBIS database is the possibility to link ownership data with accounting data to create MNE-panel datasets Beer and Loeprick (for example 2015, 430). Thus, it is possible to link parent firms with all available subsidiaries. Unfortunately, the access provided by the University of Zurich does not include the ownership data. It is therefore not possible to link parent firms to subsidiaries and vice

¹⁶FE estimation is preferred over random effects (RE) estimation, based on the results of a Hausman specification test. The result of this test is provided in Appendix B.2.

¹⁷See Appendix B.1 for additional comments on matrix algebra and the NACE rev. 2 industry classification. The dimensionality of the vectors \mathbf{U}_{it} and $\boldsymbol{\xi}_{it}$ depends on the number of industries included in the analysis.

¹⁸A short overview on the ORBIS database can be found in Ribeiro et al. (2010).

Table 1: ORBIS search strategy and data restrictions

Notes. ^aLeverage is calculated as ln debt over ln total assets, therefore ratios below 1 are negative after taking natural logarithms. The maximum GDP per capita is below the maximum EBIT and P/L before tax. This seems unreasonable, but it should be kept in mind that the GDP per capita is measured in local currency units, whereas all other financial data is measured in Swiss Francs (CHF). Source: own table.

Search step / restriction	Subsidiaries	Percentage	Last step
All active companies and companies with unknown situation	177'064'116	100.000%	100.000%
Worldwide companies	174'596'526	98.606%	98.606%
Subsidiaries with a non-missing data value in at least one year between 2007 and 2015 ^a	6'968'497	3.936%	3.991%
subsidiaries owned by at least one shareholder located in Switzerland, owning between 10 and 100% of the shares	10'070	.006%	.145%
Exclusion of subsidiaries with no tax or GDP data available	10'066	.006%	99.960%
Exclusion of subsidiaries located in Switzerland	9'812	.006%	97.438%
Subsidiaries in manufacturing and wholesale and retail industry where a Cobb-Douglass production function is appropriate	5'414	.003%	55.177%
Exclusion of observations with insufficient data ^b	4'862	.003%	89.804%

versa. However, another feature of the database can be exploited to retrieve some ownership information. To compute the tax differential τ_{it} , it is not necessary to know which firm is the owner of a foreign subsidiary. It is sufficient to select subsidiaries hold by a Swiss parent firm and download the countries of residence of these subsidiaries. By downloading firms with a Swiss shareholder, a range for the ownership share can be specified, however, the dataset will not contain the specific ownership shares of the individual firms. This method is used to download firms that are owned by a Swiss parent firm by at least 10%.¹⁹ 1 summarizes the search strategy and data trimming procedures used to retrieve the data from ORBIS.

In a second step, the search strategy from 1 is reused to download subsidiaries with an ownership share between 51 and 99.99%. In a third step, firms with an ownership of 100% are downloaded. Matching the three datasets on the BvD ID numbers and the calendar year allows to distinct three categories. The first category includes subsidiaries with an ownership share between 10 and 50.99%. The second category includes subsidiaries with an ownership share between 51 and 99.99%, for which the categorical variable $OW_{51_{it}}$ equals 1. The third category includes wholly-owned subsidiaries for which the variable $OW_{100_{it}}$ equals 1. The lower bound of the ownership is chosen as low as 10% for the following reasons. First, a shareholder can reach a controlling interest with less than 51% in case different share classes with differing voting rights exist and secondly, affiliated shareholders can reach a controlling interest combining their voting rights. The low boundary ensures to detect potential income shifting in these cases. If these cases are

irrelevant, the above approach is likely to understate the extent of income shifting, which is considered less severe than overstating.

The raw dataset downloaded from ORBIS includes financial data on 10'070 subsidiaries, of which 4'862 are suitable for the empirical analysis. The average subsidiary is observed over 5.53 years, resulting in a total sample size of 26'869 observations. The data restrictions shown in 1 represent the sample that is used to estimate the basic model and most of the variations of the extended model. The sample size is reduced when intangibles are included in the model. The sample statistics provided in 2 refer to the sample described in 1. Additionally, the distributions of some of these variables are shown in Appendix C.1. The regression results in 6 state the sample size for each model specification. The continuous variables are highly skewed to the right. Natural logarithms are taken to counteract. Looking at means, medians, 25 and 75 percentiles of the continuous variables, taking natural logarithms seems to result in useful distributions. The row of intangibles in 2 shows that the sample size is reduced to 17'897 observations when intangible assets are included. The tax differential τ_{it} is mostly positive, indicating that only few observations in the dataset have a smaller CITR than Switzerland, which is tantamount with most subsidiaries being faced with an incentive to shift income to Switzerland. This is confirmed by the mean of $Case2_{it}$, which shows that 90.01% of the observations have an incentive to shift income to Switzerland. Tax rates and tax differentials are discussed in more detail in 5.2. The means of the categorical variables $OW_{51_{it}}$ and $OW_{100_{it}}$ show that 12.5% of the subsidiaries are owned with an ownership share between 51 and 99.99%, 69.9% of the subsidiaries are wholly-owned and 17.6% of the subsidiaries are owned with an ownership share between 10 and 50.99%.

3 shows the pairwise correlation coefficients among the main variables used. Continuous variables have been log-transformed before calculations. The inputs to the Cobb-

¹⁹To ensure that the subsidiaries are part of a MNE and not owned by an individual person, the following types of shareholders are selected: banks and financial companies, insurance companies, industrial companies, private equity firms, hedge funds, venture capital, mutual and pension funds, nominees, trusts, trustees, foundations, research institutes, public authorities, states and governments.

Table 2: Summary statistics

Notes: ^aLeverage is calculated as In debt over In total assets, therefore ratios below 1 are negative after taking natural logarithms. The maximum GDP per capita is below the maximum EBIT and P/L before tax. This seems unreasonable, but it should be kept in mind that the GDP per capita is measured in local currency units, whereas all other financial data is measured in Swiss Francs (CHF). Source: own table.

Variable	Minimum	25 th Perc.	Median	Mean	75 th Perc.	Maximum	Stan. dev.	No. of obs.
In EBIT, (Π_{it})	3.741	12.054	13.484	13.457	14.486	22.415	2.162	26 ^b 869
In P/L before tax	2.499	11.946	13.448	13.389	14.854	22.486	2.246	25 ^b 423
In total assets	9.218	14.831	16.085	16.121	17.305	24.417	1.918	26 ^b 869
In fixed assets, (K_{it})	1.756	12.031	13.980	13.942	15.812	24.063	2.752	26 ^b 869
In intangible fixed assets, (I_{it})	-4.560	8.853	10.890	10.921	12.915	23.233	3.171	17 ^b 897
In cost of employees, (L_{it})	0.902	13.373	14.624	14.564	15.785	22.467	1.945	26 ^b 869
In number of employees, (L_N_{it})	0	2.639	3.738	3.817	4.977	12.000	1.763	22 ^b 193
Leverage ^a , (LEV_{it})	-7.959	-0.862	-0.453	-0.615	-0.204	4.018	0.623	26 ^b 577
In GDP per capita, (A_{it})	8.481	10.204	10.359	10.833	10.549	17.618	1.362	26 ^b 869
Local tax rate, (r_{it})	0	0.220	0.294	0.268	0.314	0.550	0.064	26 ^b 869
Tax differential, (τ_{it})	-0.206	0.031	0.105	0.082	0.133	0.360	0.063	26 ^b 869
OW_51 _{it}	0	0	0	0.125	0	1	0.331	26 ^b 869
OW_100 _{it}	0	0	1	0.699	1	1	0.459	26 ^b 869
Case2 _{it}	0	1	1	0.901	1	1	0.298	26 ^b 869

Table 3: Pairwise correlations of main variables

Notes. The number of observations is given in parentheses. Source: own table.

Variable	Π_{it}	K_{it}	L_{it}	A_{it}	I_{it}	LEV_{it}
In fixed assets, (K_{it})	0.703 (26'869)					
In costs of employees, (L_{it})	0.770 (26'869)	0.736 (26'869)				
In GDP per capita, (A_{it})	0.038 (26'869)	-0.001 (26'869)	-0.011 (26'869)			
In intangible assets, (I_{it})	0.510 (17'897)	0.640 (17'897)	0.571 (17'897)	0.013 (17'897)		
Leverage, (LEV_{it})	-0.091 (26'577)	-0.059 (26'577)	0.014 (26'577)	-0.059 (17'680)	0.036 (26'577)	
Tax differential, (τ_{it})	0.047 (26'869)	0.023 (26'869)	0.166 (26'869)	-0.277 (26'869)	0.124 (17'897)	0.129 (26'577)

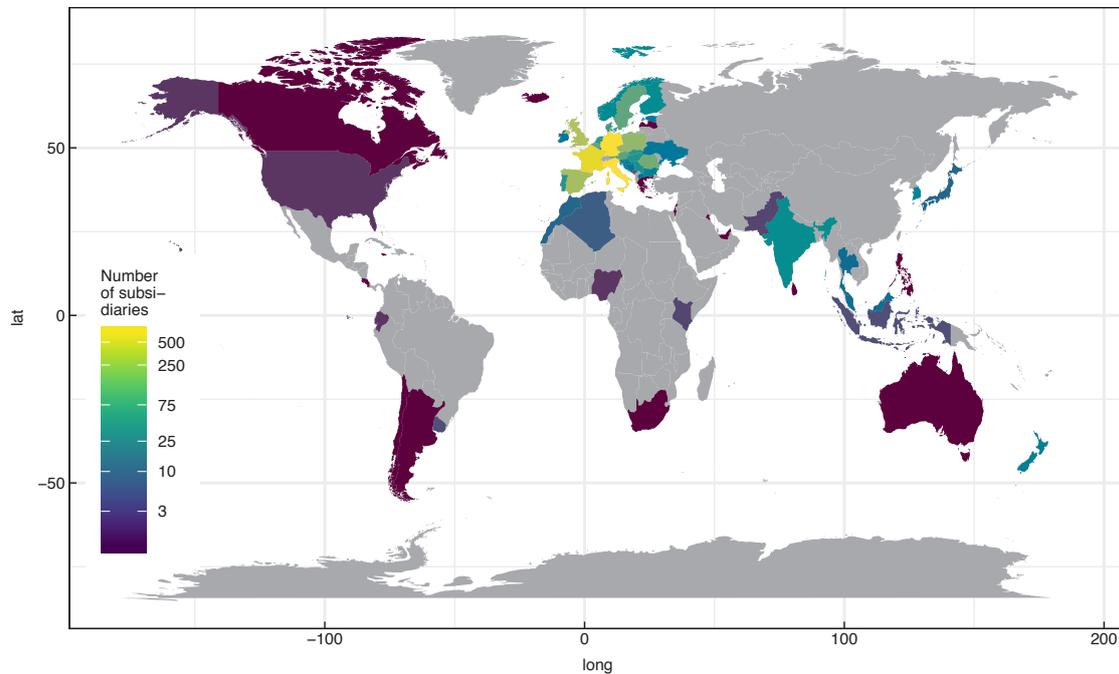


Figure 2: Spatial distribution of subsidiaries. Countries with no subsidiaries are blank. The number of subsidiaries is presented in 4. The number of subsidiaries have been log-transformed to get a meaningful color scale. A detailed map of Europe is provided in Appendix C.3. Source: own figure.

Douglas production function, namely fixed assets, costs of employees and the GDP per capita are all positively related to the EBIT. A positive coefficient is observed for the correlation between the EBIT and the tax differential. A negative coefficient is in line with income shifting. Hence, the data from 3 does not suggest income shifting being present. However, the coefficients capture only pairwise correlations, thus neglecting other, more complicated interdependencies in the dataset. A multi-variate analysis is essential.

The sample contains financial data of subsidiaries from 63 countries. 4 shows the number of subsidiaries per country. A vast majority of subsidiaries is residing in Europe. Subsidiaries from France, Germany, Italy, Spain and the United Kingdom (UK) make up roughly half of the sample size. A lot of subsidiaries furthermore reside in Eastern European countries such as the Czech Republic, Hungary, Poland and Romania. It is striking how few subsidiaries from Asia, America and Africa are included in the sample. Further, almost no observation from tax havens are included in the sample. European subsidiaries might be numerous for two reasons. First, Swiss MNEs could be less likely to have subsidiaries in distant locations, and secondly, different regions might be unequally covered in ORBIS.

Various authors, among them Cobham and Loretz (2014, 14), Clausing (2016, 908) and Fuest and Riedel (2010, 18) mention that the coverage for developing countries, especially countries in Africa, and tax havens is lower than for European countries.²⁰ However, this does not explain why there are few observations in developed countries outside of Europe, such as the US, Canada, Japan or Australia. 2 presents a spatial distribution of the subsidiaries of Swiss MNEs across the world, amplifying the insights derived from 4.

The world map suggests that the distance between Switzerland and the foreign country is correlated with the number of subsidiaries in that foreign country. Clausing (2016, 716) finds that the distance between US subsidiaries and the parent firm and the income of these subsidiaries are negatively correlated. Her results favor the first argument why the sample contains few subsidiaries outside of Europe. However, it is not possible to exclude restrictions on data availability outside Europe as the reason for this supposed correlation. The data is used for the empirical analysis as presented here.

5.2. Tax rates and tax differentials

National tax rates are available at KPMG's corporate tax rates table website KPMG (2017).²¹ KPMG provides yearly CITRs for countries worldwide. The tax rates are matched with the financial firm data using the ISO 2 country codes and the calendar year as matching variables, using the Stata

²⁰Desai et al. (2006, 529-530) find that tax havens are used by US MNEs to avoid taxes. In case Swiss MNEs do so, the results presented in 6.1, 6.2, 6.3 might be understated. 8 elaborates on this issue.

²¹KPMG does not provide an export function. Therefore the data is downloaded from Damodaran's website Damodaran (2017). According to his wish, credit is given to KPMG.

package "kountry" Raciborski (2008). Aggregated summary statistics for tax rates and tax differentials are displayed in 5. The computation of national tax rates differs among countries and might affect the empirical analysis.²² Tax rates for Switzerland are calculated as the average of the tax rates in the capital cities of the cantons KPMG (2017).

As described in 4.1, the tax differential represents the incentive to shift income. Other factors possibly affecting the shifting incentive are neglected.²³ Positive values of τ_{it} in 5 represent an incentives to shift income to Switzerland. The mean tax differentials show that the Swiss tax rate is on average below the tax rates in almost all world regions. The mean tax differentials between Switzerland and Asia, the Americas and Western Europe are particularly high, indicating large tax saving opportunities. 3,4 show mean tax rates over time. The Swiss tax rate is below the mean tax rate in the Americas, Asia, Europe and Oceania during all sample years. The mean African tax rate is below the Swiss tax rate during the first years of the sample period, but is well above the Swiss rate at the end of the sample period.

Since a vast majority of the sample subsidiaries is located in Europe, a closer comparison of European CITRs is desirable. 4 allows to compare European tax rates in greater detail. The mean tax rate in Western Europe is higher than in the other regions during all sample years. The mean tax rates in Northern and Southern Europe show a slightly decreasing trend over the sample period, whereas the mean tax rates in Eastern and Western Europe show a more stable trend. The Swiss tax rate fell continuously over the sample period. Clearly, Swiss MNEs with subsidiaries in Western Europe have an incentive to shift income to Switzerland. Mean tax rates in Southern and Northern Europe are higher than the Swiss tax rate, although the difference is not as obvious as it is between Western Europe and Switzerland. Eastern European tax rates are comparable to the Swiss tax rate, leaving the country-specific incentives to shift income small or ambiguous. Finally, 5 provides a snapshot of the tax differentials between Switzerland and European countries for the most recent year 2015. The left map shows tax differentials > 0 (shifting incentive to the parent in Switzerland), and the right map shows tax differentials < 0 (shifting incentive away from the parent). Comparing the two maps indicates that most European countries are faced with an incentive to shift income to Switzerland in 2015. 5 visually underlines the insights derived within this subsection. A complete overview on all variables and datasources used is provided in Appendix C.6.

²²See Appendix C.4 for peculiarities in national tax rate calculations potentially affecting the analysis.

²³Another factor potentially affecting the incentive to shift income are withholding taxes. Markle (2016, 15) uses withholding taxes as part of his tax incentive variable. However, Scholes and Wolfson (1992, 289) note that the use of TP techniques typically avoids withholding taxes entirely. In this thesis, withholding taxes are potentially influential only when income is shifted out of Switzerland but is intended to be repatriated later. Since this could be the case for 10% of the sample at most (see 2), withholding taxes are neglected.

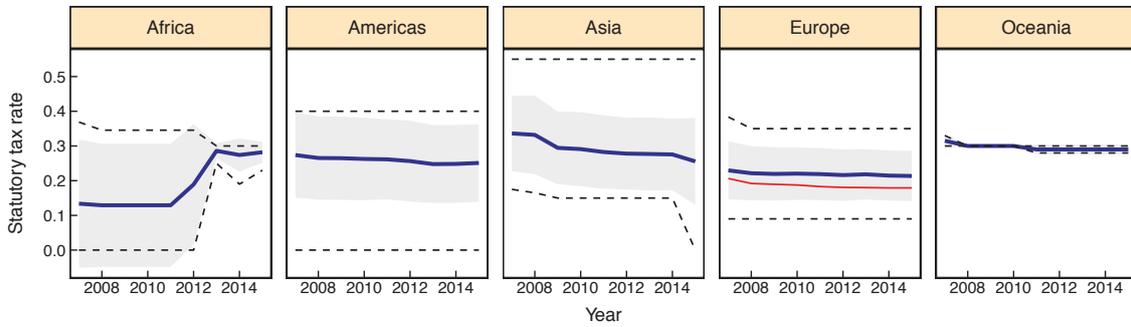


Figure 3: Corporate tax rates across the world. Solid lines represent unweighted mean tax rates, dashed lines depict minimum and maximum tax rates and the shaded area shows the mean tax rate ± 1 standard deviation. The red line depicts the Swiss tax rate. A detailed version of this figure is shown in Appendix C.5. Tax data is taken from [KPMG \(2017\)](#). Countries are assigned to geographic regions based on [Nations \(2017\)](#), see Appendix C.2. Source: own figure.

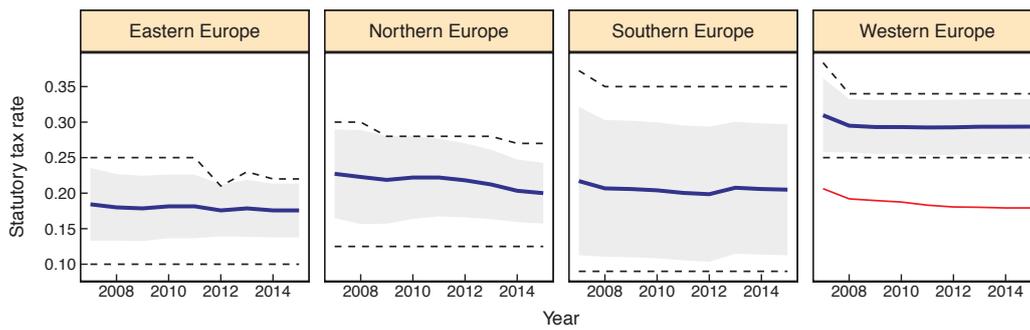


Figure 4: Corporate tax rates across Europe. Solid lines represent unweighted mean tax rates, dashed lines depict minimum and maximum tax rates and the shaded area shows the mean tax rate ± 1 standard deviation. The red line depicts the Swiss tax rate. Tax data is taken from [KPMG \(2017\)](#). Countries are assigned to geographic regions based on [Nations \(2017\)](#), see Appendix C.2. Source: own figure.

Table 4: Subsidiaries per country

Notes. Numbers in parentheses represent observations numbers and the corresponding percentages. ^aOne firm (8 observations) residing in La Reunion is treated as residing in France. ^bTwo firms (17 observations) residing on the Canary Islands are treated as residing in Spain. The United Nations (UN) region classification used to assign countries to geographic regions can be found in Appendix C.2. Source: own table.

Country	Subs.	Obs.	Subs.(%)	Obs.(%)
Algeria	7	(10)	0.14	(0.04)
Argentina	1	(3)	0.02	(0.01)
Australia	1	(2)	0.02	(0.01)
Austria	139	(790)	2.86	(2.94)
Belgium	151	(997)	3.11	(3.71)
Bermuda	2	(13)	0.04	(0.05)
Bosnia & Herzegovina	21	(110)	0.43	(0.05)
Bulgaria	48	(266)	0.99	(0.99)
Canada	1	(1)	0.02	(0.00)
Chili	1	(1)	0.02	(0.00)
Costa Rica	1	(5)	0.02	(0.02)
Croatia	30	(186)	0.62	(0.69)
Czech Republic	230	(1'419)	4.73	(5.28)
Denmark	102	(396)	2.10	(1.47)
Ecuador	2	(5)	0.04	(0.02)
Estonia	23	(132)	0.47	(0.49)
Finland	70	(427)	1.44	(1.59)
France ^a	543	(3'155)	11.17	(11.74)
Germany	703	(3'630)	14.46	(13.51)
Greece	1	(9)	0.02	(0.03)
Hong Kong	2	(15)	0.04	(0.06)
Hungary	87	(556)	1.79	(2.07)
Iceland	1	(3)	0.02	(0.01)
India	71	(207)	1.46	(0.77)
Indonesia	4	(34)	0.08	(0.13)
Ireland	24	(133)	0.49	(0.49)
Israel	1	(1)	0.02	(0.00)
Italy	741	(4'192)	15.24	(15.60)
Japan	10	(30)	0.21	(0.11)
Jamaica	1	(4)	0.02	(0.01)
Kenya	3	(18)	0.06	(0.07)
Kuwait	1	(7)	0.02	(0.03)
Latvia	1	(3)	0.02	(0.01)
Luxembourg	12	(54)	0.25	(0.20)
Macedonia	16	(34)	0.33	(0.13)
Malaysia	15	(87)	0.31	(0.32)
Malta	2	(8)	0.04	(0.03)
Montenegro	4	(14)	0.08	(0.05)
Morocco	10	(16)	0.21	(0.06)
Netherlands	101	(431)	2.08	(1.60)
New Zealand	38	(198)	0.78	(0.74)
Nigeria	2	(18)	0.04	(0.07)
Norway	64	(424)	1.32	(1.58)
Pakistan	3	(19)	0.06	(0.07)
Philippines	1	(9)	0.02	(0.03)

(Continued)

Table 4—continued

Country	Subs.	Obs.	Subs.(%)	Obs.(%)
Poland	235	(1'306)	4.83	(4.86)
Portugal	92	(551)	1.89	(2.05)
Republic of Korea	52	(350)	1.07	(1.30)
Romania	173	(948)	3.56	(3.53)
Serbia	82	(387)	1.69	(1.44)
Singapore	2	(10)	0.04	(0.04)
Slovakia	91	(517)	1.87	(1.92)
Slovenia	52	(326)	1.07	(1.21)
South Africa	1	(6)	0.02	(0.02)
Spain ^b	283	(1'612)	5.82	(6.00)
Sri Lanka	1	(9)	0.02	(0.03)
Sweden	145	(866)	2.98	(3.22)
Thailand	14	(31)	0.29	(0.12)
Ukraine	24	(112)	0.49	(0.42)
United Arab Emirates	1	(2)	0.02	(0.01)
UK	316	(1'751)	6.50	(6.52)
US	2	(8)	0.04	(0.03)
Uruguay	4	(4)	0.08	(0.01)
Africa		(68)		(0.25)
Americas		(45)		(0.17)
Asia		(811)		(3.02)
Oceania		(200)		(0.74)
Europe		(25'745)		(95.82)
World	4'862	(26'869)	100.00	(100.00)

6. Empirical results

6.1. Basic model results

6 presents the results from estimating the basic model in 9 using the sample described in 1. Regressions (1) and (2) include a set of year, respectively a set of year and a set of industry-year categorical variables. Regression (2) constitutes the benchmark regression.²⁴ Regression (3) includes frequently used control variables Weichenrieder (2009, 293), Lohse and Riedel (2012, 8). Regression (4) includes a quadratic term of the tax differential, allowing to check for a curvature in the relationship between the EBIT and the tax differential Hines and Rice (1994, 162-163). Thus, it can be verified whether the proposed model specification in 9 is appropriate or not.

The inputs of the Cobb-Douglas production function are positive and significant (with the exception of GDP per capita in regression (3)), meaning that higher inputs lead to higher output. These estimates can be interpreted as elasticities Wooldridge (2009, 45-46). Specifically in regression (1), increasing the GDP per capita, the fixed assets or the costs of employees by 1%, corresponds to an increase in the EBIT

of 0.257%, 0.064% or 0.465%, respectively. The tax differential enters significantly negative in all specifications, thus providing indirect evidence of income shifting among Swiss MNEs. The semi-elasticity of the EBIT w.r.t the tax differential in the benchmark regression (2) is -1.458 , indicating that an increase in the tax differential by 1 percentage point is associated with a decrease in the EBIT of 1.458%. It is irrelevant whether this increase in τ_{it} is due to an increase in the subsidiary's CITR or a decrease in the Swiss CITR. The semi-elasticities in regressions (1) and (3) and subsequent semi-elasticities (or marginal effects, the two terms are used interchangeably when appropriate), can be interpreted accordingly. The leverage and the GDP growth enter significantly negative, respectively significantly positive. The coefficients of leverage and GDP growth can be interpreted as semi-elasticities.

The estimate of the tax differential in regression (4) cannot be interpreted without considering the estimate of the squared tax differential simultaneously. The marginal effect of the tax differential is given by $\partial \ln \Pi_{it} / \partial \tau_{it} = -1.504 + 0.363 \times 2 \cdot \tau_{it}$.²⁵ 6 plots the marginal effect over the complete range of tax differentials. The marginal effect is significant

²⁴Regression diagnostics for the benchmark regression are presented in Appendix D.2.

²⁵Interpreting the coefficient of the tax differential as a conditional semi-elasticity when the tax differential is 0 is theoretically pointless since it corresponds to having no incentive to shift income.

Table 5: Tax rate statistics

Notes. The tax data is from KPMG (2017). Countries are assigned to geographic regions based on Nations (2017), see Appendix C.2. All calculations are unweighted. The number of observations is equal to the number of countries per region multiplied by 9, since data is downloaded for 2007-2015. Source: own table.

UN geographic region	Minimum	25 th Perc.	Median	Mean	75 th Perc.	Maximum	Stan. dev.	No. of Obs.
<i>Panel A: Local tax rates, (t_{it})</i>								
Africa	0.000	0.000	0.280	0.187	0.300	0.369	0.150	45
Americas	0.000	0.225	0.265	0.259	0.333	0.400	0.111	81
Asia	0.000	0.240	0.280	0.291	0.350	0.550	0.108	126
Europe (whole continent)	0.090	0.160	0.220	0.219	0.280	0.384	0.075	297
Eastern Europe	0.100	0.160	0.190	0.179	0.190	0.250	0.040	63
Northern Europe	0.125	0.180	0.220	0.216	0.260	0.300	0.053	81
Southern Europe	0.090	0.100	0.200	0.206	0.300	0.373	0.092	99
Western Europe	0.250	0.250	0.294	0.295	0.333	0.384	0.037	54
Oceania	0.280	0.280	0.300	0.296	0.300	0.330	0.012	18
World	0.000	0.190	0.250	0.241	0.300	0.550	0.101	567
<i>Panel B: Tax differentials, (τ_{it})</i>								
Africa	-0.206	-0.188	0.101	0.000	0.121	0.165	0.153	45
Americas	-0.206	0.044	0.086	0.073	0.146	0.221	0.111	81
Asia	-0.179	0.052	0.092	0.105	0.158	0.371	0.107	126
Europe (whole continent)	-0.116	-0.021	0.031	0.033	0.090	0.177	0.075	297
Eastern Europe	-0.106	-0.028	0.003	-0.007	0.011	0.067	0.041	63
Northern Europe	-0.081	-0.026	0.040	0.030	0.073	0.108	0.053	81
Southern Europe	-0.116	-0.081	0.019	0.019	0.111	0.171	0.092	99
Western Europe	0.044	0.070	0.109	0.109	0.148	0.177	0.037	54
Oceania	0.094	0.101	0.110	0.110	0.119	0.124	0.009	18
World	-0.206	-0.002	0.067	0.054	0.119	0.371	0.101	567

whenever the confidence intervals (CI) do not cross the zero-line. This is the case for more than 90% of the tax differentials. However, the slope of the marginal effect in 6 is close to 0, indicating that the interaction is economically meaningless. Berry et al. (2012, 662) describe such a marginal effect (with a slope close to 0) as evidence against a theory presuming an interaction effect. Hence, the model specification in 9 seems to be appropriate and a quadratic term is not included in subsequent analysis. An economic argument against the use of a quadratic term is the following. A flat tax rate implies that the tax saving for a subsidiary engaging in income shifting activities is proportional to the change in the tax differential. Whether the tax rate change happens at low or high tax differentials is irrelevant. However, Hines and Rice (1994, 163) as well as Dowd et al. (2017, 6, 8) find that a quadratic term is statistically and economically meaningful in their analysis.

6.2. Extended model results including single interactions

The results of estimating the extended model including single interaction terms are presented in 7. Each interaction term representing a driver of income shifting is analyzed separately. Regressions (1) and (2) test the theory that income shifting depends on the scale of operations, as proposed by Huizinga and Laeven (2008). Regression (1) includes an interaction term consisting of the tax differential and the capital input, measured as ln fixed assets. The interaction term in regression (2) uses the categorical variable $K_{d_{it}}$, equal

to 1 if the ln fixed assets are above mean and 0 otherwise. Regression (1) shows a significant positive coefficient of the tax differential and a significant negative coefficient of the interaction term. Since the inputs of the production function have been interpreted in the preceding section, the focus is put on the tax differential and the interaction terms. The coefficient of the tax differential represents the semi-elasticity of the EBIT w.r.t. the tax differential for subsidiaries with zero ln fixed assets, thus it is not meaningful to interpret this coefficient in isolation. The coefficient of the interaction term depicts how much the above mentioned semi-elasticity changes when ln fixed assets are increased. The marginal effect of the tax differential is given by the partial derivative and is equal to $\partial \ln \Pi_{it} / \partial \tau_{it} = 3.637 - 0.346 \times \ln K_{it}$, which is visualized in 7. Evaluation at the sample mean of ln fixed assets yields a significant effect of -1.187^{***} .²⁶

The minimum amount of ln fixed assets required for significant income shifting to be present is given by the point of intersection between the zero-line and the upper limit of the 90% CI. 7 shows that this is the case once the ln fixed assets have reached roughly 13. The slope of the marginal effect is given by the coefficient estimate of the interaction term and is equal to -0.346 . The results from regression (1) imply that income shifting increases with fixed assets once a certain threshold of ln fixed assets is reached. A possible explanation for this result are fixed costs associated with in-

²⁶See 2 in 5.1 for sample statistics.

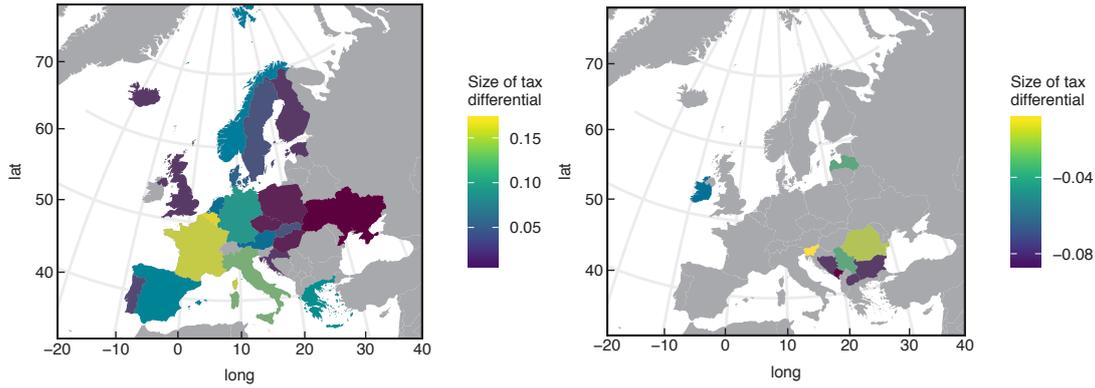


Figure 5: Differences in tax differentials in 2015 in Europe. The left map shows tax differentials for subsidiaries with incentive to shift to the parent firm ($r_{it} > r_{ht}$) and the right map shows tax differentials for subsidiaries with incentive to shift away from the parent firm ($r_{it} < r_{ht}$). Source: own figure.

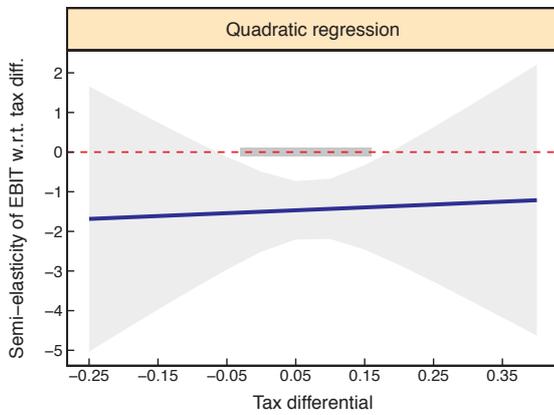


Figure 6: Marginal effect of the tax differential in the quadratic regression (4) in 6. The solid line shows the marginal effect according to the partial derivative of regression (4) in 6, and the shaded area represents the 90% confidence interval. The grey bar indicates the range of the middle 90% of the distribution of tax differentials (observations between the 5th and 95th percentile). Source: own figure, based on Berry et al. (2012, 661)

come shifting. A subsidiary shifts income only if the benefits from shifting exceed the costs. The negative coefficient of the capital interaction indicates that the opportunities to shift income, and hence the benefits from income shifting, increase with the scale of operations. The marginal effect suggests that the benefits from income shifting exceed the costs once the \ln fixed assets are larger than roughly 13. Dharmapala (2014, 423-424) mentions the possibility of fixed costs associated with income shifting and regression (1) supports this presumption. Regression (2) shows the same qualitative result as regression (1). The marginal effect of the tax differential is -0.396 (-2.086^{***}) for subsidiaries with below (above) mean \ln fixed assets and the coefficient of the interaction term is -1.690 , which is equal to the difference between the marginal effects. The marginal effect is significant

for subsidiaries with above mean \ln fixed assets only, which supports the insight regarding fixed costs derived from the results of regression (1).

Regressions (3) and (4) test whether income shifting depends on the intangible asset endowment of the subsidiary. Regression (3) includes an interaction term consisting of the tax differential and the intangible assets of the subsidiary, measured as \ln intangible fixed assets. Regression (4) includes an interaction term consisting of the tax differential and the categorical variable $I_{d_{it}}$, equal to 1 if the \ln intangible fixed assets are above mean and 0 otherwise. The right graph of 7 shows the marginal effect of the tax differential in regression (3), which is given by $\partial \ln \Pi_{it} / \partial \tau_{it} = 0.939 - 0.160 \times \ln I_{it}$. Evaluation at the sample mean of \ln intangible fixed assets results in an insignificant marginal effect of -0.808 . 7 supports the presumption that income shifting involves fixed costs, suggesting that firms with \ln intangible fixed assets larger than roughly 11.5 significantly shift income. Regression (4) conveys the same qualitative result, the marginal effect of the tax differential is -0.639 (-1.124^{**}) for subsidiaries with below (above) mean \ln intangible fixed assets. The difference between the two effects is not significant as indicated by the interaction term of -0.485 with a low t -statistic.²⁷ Regressions (3) and (4) provide moderate support for the theory that income shifting increases with the amount of intangible assets.

Regressions (5) and (6) test the theory that income shifting increases with the ownership share. Regression (5) includes the categorical ownership variable $OW_{100_{it}}$ interacted with the tax differential. This procedure is comparable to Weichenrieder (2009, 285), with the exception that it is applied to both shifting directions. Regression (6) additionally includes the ownership variable $OW_{51_{it}}$ interacted with the tax differential. Note that the ownership variables can not be included as standalone variables since they do not vary over time. The marginal effects of the tax differential in

²⁷See Appendix D.2 for additional comments on this result.

Table 6: Basic model results

Notes. Regressions (1) and (2) are the basic and benchmark regression excluding and including a set of industry-year categorical variables. Regression (3) includes leverage and GDP growth as additional control variables. Regression (4) includes a quadratic term. *, ** and *** denote significance on the 10, 5 and 1% significance level. *t*-statistics are reported in parenthesis and standard errors are clustered at the subsidiary level to control for heteroscedasticity and autocorrelation *Hoechle* (2007, 285). Source: own table.

Subsidiary-fixed effects, panel 2007-2015, dependent variable: ln EBIT, Π_{it}				
Regression	Basic	Benchmark	Add. controls	Quadratic
Explanatory variables	(1)	(2)	(3)	(4)
ln GDP per capita, (A_{it})	0.257* (1.926)	0.235* (1.762)	0.218 (1.630)	0.237 (1.770)*
ln fixed assets, (K_{it})	0.064*** (5.162)	0.063*** (5.096)	0.066*** (5.283)	0.063*** (5.096)
ln cost of employees, (L_{it})	0.465*** (13.549)	0.465*** (13.553)	0.467*** (13.453)	0.465*** (13.554)
Leverage, ln debt over ln total assets, (LEV_{it})			-0.254*** (-8.253)	
GDP growth, (GDP_G_{it})			0.018*** (4.646)	
Tax differential, (τ_{it})	-1.526*** (-3.564)	-1.458*** (-3.390)	-1.139*** (-2.671)	-1.504*** (-2.445)
Tax differential squared, ($(\tau_{it})^2$)				0.363 (0.117)
Year dummies	✓	✓	✓	✓
Industry-year dummies		✓	✓	✓
No. of observations	26'869	26'869	26'577	26'869
No. of subsidiaries	4'862	4'862	4'818	4'862
Within R^2	0.066	0.066	0.074	0.066
Overall <i>F</i> -test	51.143	31.386	32.912	29.889

regressions (5) and (6) are

$$\frac{\partial \ln \Pi_{it}}{\partial \tau_{it}} = \begin{cases} \beta_4 = 0.263, & \text{if } OW_{100it} = 0 \\ \beta_4 + \beta_9 = -2.102^{***}, & \text{if } OW_{100it} = 1 \end{cases}$$

$$\frac{\partial \ln \Pi_{it}}{\partial \tau_{it}} = \begin{cases} \beta_4 = -0.233, & \text{if } OW_{51it} = OW_{100it} = 0 \\ \beta_4 + \beta_8 = -0.318, & \text{if } OW_{51it} = 1, OW_{100it} = 0 \\ \beta_4 + \beta_9 = -2.101^{***}, & \text{if } OW_{51it} = 0, OW_{100it} = 1 \end{cases} \quad (14)$$

The coefficient estimates of the interaction term $\tau_{it} \times OW_{100it}$ in regressions (5) and (6) are significant and negative, indicating that wholly-owned subsidiaries shift more income than subsidiaries with an ownership share between 10 and 50.99%. $\tau_{it} \times OW_{51it}$ enters regression (6) insignificant. The coefficients of the interaction terms give estimates and significances for the differences in income shifting between the three ownership categories of subsidiaries. The marginal effects show that only wholly-owned subsidiaries are engaged in significant income shifting. Both marginal effects for subsidiaries with an ownership share between 10 and 50.99% and subsidiaries with an ownership share between 51 and 99.99% are not significant. Regressions (5) and (6) not only support the theory that a higher ownership share is associated with a higher amount of income

shifting, but moreover suggest that only wholly-owned subsidiaries shift income. One potential problem with the approach in regression (5) is the following. In Subsection 5.1, it is argued that subsidiaries with less than 51% ownership can possibly shift income. If this is not justified, the variable OW_{100it} is impractical since it measures the difference in the extent of income shifting between wholly-owned subsidiaries and (at least some) subsidiaries that have, other than assumed, no possibility to shift income (subsidiaries with an ownership share below 51%). Thus, the variable OW_{100it} is trivial and unsurprisingly shows a significantly negative coefficient. Regression (5) is therefore rerun on a subsample of subsidiaries with an ownership share of at least 51% (22'084 observations).²⁸ The coefficient of the interaction term $\tau_{it} \times OW_{100it}$ is equal to -2.122^* and significant on the 10% confidence level. The marginal effects are -0.012 (-2.134^{***}) for non wholly-owned (wholly-owned) subsidiaries, of which the latter is significant on the 1% confidence level. These results are similar to regression (5), confirming that the coefficient of the interaction term in regression (5) is not significant due to trivial reasons.

²⁸This variation of regression (5) in 7 is described verbally only. A results table is not shown.

Table 7: Extended model results including single interactions

Notes. Regressions (1) and (2) include the capital interaction, (1) includes a continuous specification and (2) a categorical specification. Regressions (3) and (4) include the intangibles interaction, (3) includes a continuous specification and (4) a categorical specification. Regressions (5) and (6) include the ownership interactions, (5) includes only one interaction and (6) includes both interactions. Regression (7) includes the shifting direction interaction. *, **, *** denote significance on the 10, 5, 1% significance level. *t*-statistics are reported in parenthesis and standard errors are clustered at the subsidiary level to control for heteroscedasticity and autocorrelation [Hoechle \(2007, 285\)](#). Source: own table.

Subsidiary-fixed effects, panel 2007-2015, dependent variable: $\ln \text{EBIT}, \Pi_{it}$							
Income shifting driver	Capital interaction		Intangibles interaction		Ownership interactions		Direction int.
Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\ln \text{GDP per capita}, (A_{it})$	0.220*	0.228*	0.228	0.226	0.236*	0.236*	0.226*
	(1.651)	(1.706)	(1.344)	(1.329)	(1.777)	(1.776)	(1.651)
$\ln \text{fixed assets}, (K_{it})$	0.089***		0.081***	0.079***	0.063***	0.063***	0.063***
	(5.742)		(4.028)	(3.998)	(5.087)	(5.087)	(5.094)
$\ln \text{cost of employees}, (L_{it})$	0.464***	0.489***	0.460***	0.462***	0.465***	0.465***	0.465***
	(13.601)	(14.463)	(10.720)	(10.718)	(13.552)	(13.551)	(13.553)
Tax differential, (τ_{it})	3.637*	-0.396	0.939	-0.639	-0.263	-0.233	-1.330
	(1.950)	(-0.689)	(0.804)	(-1.091)	(-0.393)	(-0.286)	(-0.961)
Capital interaction, (cont., $\tau_{it} \times K_{it}$)	-0.346***						
	(-2.816)						
$\ln \text{fixed assets}, (\text{cat.}, K_{d_{it}})$		0.221***					
		(3.750)					
Capital interaction, (cat., $\tau_{it} \times K_{d_{it}}$)		-1.690***					
		(-3.191)					
$\ln \text{intangible assets}, (I_{it})$			0.007				
			(0.645)				
Intangible interaction, (cont., $\tau_{it} \times I_{it}$)			-0.160*				
			(-1.816)				
$\ln \text{intangible assets}, (\text{cat.}, I_{d_{it}})$				-0.003			
				(-0.054)			
Intangibles interaction, (cat., $\tau_{it} \times I_{d_{it}}$)				(-0.485)			
				(-1.073)			
2 nd ownership interaction, $(\text{OW}_{100_{it}})$					-1.839**	-1.868*	
					(-2.205)	(-1.946)	
1 st ownership interaction, $(\text{OW}_{51_{it}})$						-0.085	
						(-0.058)	
Shifting direction, $(\text{Case}2_{it})$							0.007
							(0.115)
Direction interaction, $(\tau_{it} \times \text{Case}2_{it})$							-0.179
							(-0.117)
Year dummies	✓	✓	✓	✓	✓	✓	✓
Industry-year dummies	✓	✓	✓	✓	✓	✓	✓
No. of observations	26'869	26'869	17'897	17'897	26'869	26'869	26'869
No. of subsidiaries	4'862	4'862	3'698	3'698	4'862	4'862	4'862
Within R^2	0.067	0.065	0.064	0.064	0.066	0.066	0.066
Overall F -test	30.365	28.078	19.271	19.017	30.032	28.670	28.537

Regression (7) includes an interaction term consisting of the tax differential and the shifting direction, depicted by $\text{Case}2_{it}$. $\text{Case}2_{it}$ is equal to 1 if the shifting direction is to the parent ($r_{it} > r_{ht}$, $s_{it} < 0$), and 0 otherwise ($r_{it} < r_{ht}$, $s_{it} > 0$). The coefficient estimate is negative but insignificant and the marginal effects of the tax differential are given by

$$\frac{\partial \ln \Pi_{it}}{\partial \tau_{it}} = \begin{cases} \beta_4 = -1.330, & \text{if } \text{Case}2_{it} = 0 \\ \beta_4 + \beta_{11} = -1.509^{***}, & \text{if } \text{Case}2_{it} = 1 \end{cases} \quad (15)$$

indicating that income shifting to the parent firm is significant, whereas no income is shifted to the subsidiaries. It should be borne in mind that the coefficient estimate and the marginal effects test different hypotheses, and that com-

paring marginal effects does not allow to judge on the significance of the difference between them. To gain a deeper insight, regression (7) is rerun separately on the subsample of manufacturing subsidiaries and on the subsample of subsidiaries in the wholesale and retail sector. The marginal effects of the tax differential are -2.124^{***} (1.591) for manufacturing subsidiaries with shifting direction to the parent firm (to the subsidiary), and -1.026 (-7.623^{***}) for wholesale and retail subsidiaries with shifting direction to the parent firm (to the subsidiary). The coefficient of the direction interaction is significant for both industries, but with differing signs.²⁹ Hence, manufacturing subsidiaries shift

²⁹The regression results and additional comments are shown in table 20 and in Appendix D.3.

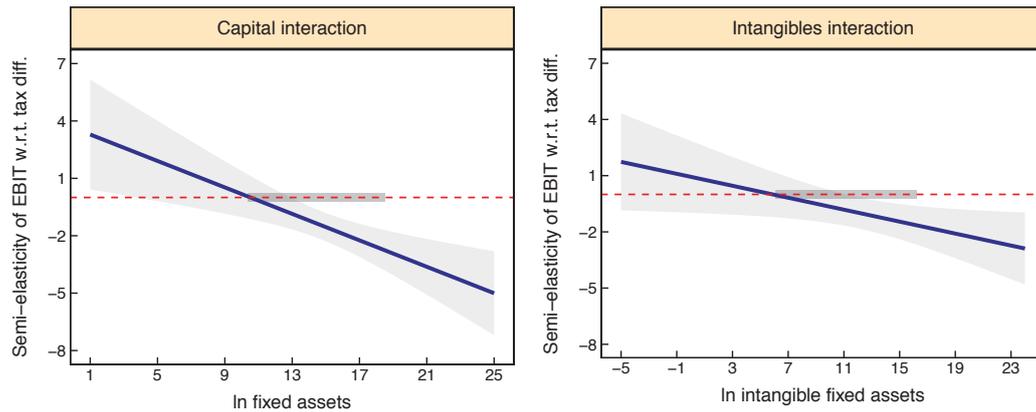


Figure 7: Marginal effect of the tax differential in regressions (1) and (3) in 7. The solid line shows the marginal effect according to the partial derivative of regression (4) in 6, and the shaded area represents the 90% confidence interval. The grey bar indicates the range of the middle 90% of the distribution of tax differentials (observations between the 5th and 95th percentile). Source: own figure, based on Berry et al. (2012, 661)

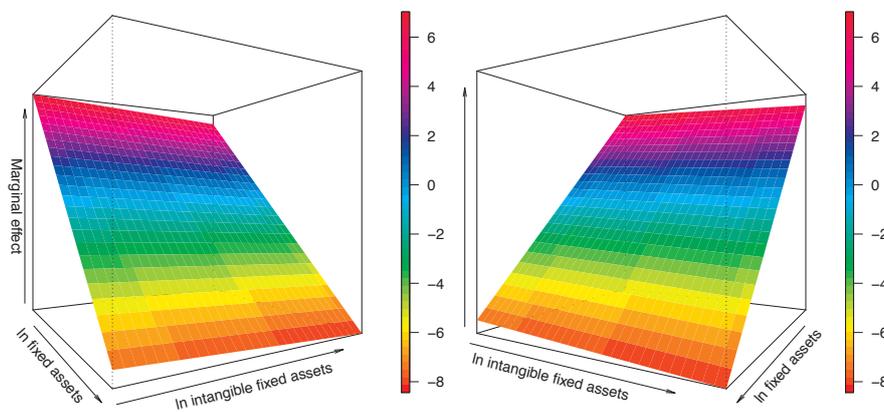


Figure 8: 3D Marginal effect of the tax differential in regression (1) in 8. The marginal effect is plotted for wholly-owned subsidiaries with shifting direction to the parent firm. The plane represents the marginal effect according to the partial derivative of regression (1) in 8. Source: own figure.

mainly income to the parent in Switzerland and wholesale and retail subsidiaries receive income shifted away from their parent firms in Switzerland. The somewhat unclear result from regression (7) in 7 might stem from offsetting industry-dependent shifting behavior.

The analysis of single drivers of income shifting allows to draw the following conclusions. Once a certain size threshold has been reached, income shifting increases with the scale of operations, suggesting that income shifting gives rise to fixed costs. The same argument applies to the amount of intangible assets. Wholly-owned subsidiaries engage in income shifting activities, but non wholly-owned subsidiaries do not. Moreover, the analysis suggests that once below 100%, the ownership share is irrelevant.³⁰ On average, Swiss

³⁰Interpretation of the results including ownership interactions are only valid under the proviso that the coefficient estimates from regression (5) and (6) in 7 are unbiased. 8 elaborates.

MNEs only shift income to the parent firm in Switzerland, but not to foreign subsidiaries, however, the detailed analysis of the shifting direction interaction suggests that there are differences in income shifting patterns across industries. The conclusions drawn so far are only valid within the respective framework of analysis. How the different interaction terms affect each other is not possible to assess with the results from 7. The following subsection is intended to shed light on how the different drivers of income shifting influence each other.

6.3. Extended model results including multiple interactions

8 shows the results of estimating the extended model including multiple interactions. Regressions (1) and (2) include the capital and intangibles interaction continuously specified, and regressions (3) and (4) include all interaction terms categorically specified. Regression (1) and (3) each include all interaction terms, whereas regressions (2) and (4)

Table 8: Extended model results including multiple interactions

Notes. Regressions (1) and (2) include continuous capital and intangibles interactions. Regression (1) includes all interactions and (2) includes only significant interactions. Regressions (3) and (4) include categorical capital and intangibles interactions. (3) includes all interactions and (4) includes only significant interactions. Regression (1) is the preferred regression. *, **, *** denote significance on the 10, 5, 1% significance level. *t*-statistics are reported in parenthesis and standard errors are clustered at the subsidiary level to control for heteroscedasticity and autocorrelation [Hoechle \(2007, 285\)](#). Source: own table.

Subsidiary-fixed effects, panel 2007-2015, dependent variable: $\ln \text{EBIT}, \Pi_{it}$				
Specification	Continuous interactions		Categorical interactions	
Explanatory variables	(1)	(2)	(3)	(4)
$\ln \text{GDP per capita}, (A_{it})$	0.219 (1.240)	0.219* (1.651)	0.238 (1.349)	0.228* (1.714)
$\ln \text{fixed assets}, (K_{it})$	0.136*** (5.159)	0.094*** (5.987)		
$\ln \text{cost of employees}, (L_{it})$	0.458*** (10.768)	0.464*** (13.605)	0.494*** (11.525)	0.489*** (14.461)
Tax differential, (τ_{it})	9.788*** (3.039)	6.318*** (2.842)	0.882 (0.564)	1.104 (1.145)
Capital interaction, (cont., $\tau_{it} \times K_{it}$)	-0.612*** (-3.228)	-0.407*** (-3.299)		
$\ln \text{fixed assets}, (\text{cat.}, K_{d_{it}})$			0.286*** (3.533)	0.227*** (3.828)
Capital interaction, (cat., $\tau_{it} \times K_{d_{it}}$)			-2.273*** (-3.336)	-1.765*** (-3.316)
$\ln \text{intangible assets}, (I_{it})$	-0.004 (-0.390)			
Intangible interaction, (cont., $\tau_{it} \times I_{it}$)	-0.027 (-0.273)			
$\ln \text{intangible assets}, (\text{cat.}, I_{d_{it}})$			0.002 (0.043)	
Intangibles interaction, (cat., $\tau_{it} \times I_{d_{it}}$)			-0.251 (-0.549)	
2 nd ownership interaction, $(\text{OW}_{100_{it}})$	-3.613*** (-3.349)	-2.639*** (-2.590)	-3.070*** (-2.885)	-2.173*** (-2.202)
1 st ownership interaction, $(\text{OW}_{51_{it}})$	0.314 (0.190)	-0.536 (-0.345)	0.425 (0.273)	-0.316 (-0.211)
Shifting direction, (Case2_{it})	0.051 (0.630)		0.063 (0.773)	
Direction interaction, $(\tau_{it} \times \text{Case2}_{it})$	1.333 (0.704)		1.980 (1.048)	
Year dummies	✓	✓	✓	✓
Industry-year dummies	✓	✓	✓	✓
No. of observations	17'897	26'869	17'897	26'869
No. of subsidiaries	3'698	4'862	3'698	4'862
Within R^2	0.066	0.067	0.064	0.065
Overall F -test	16.752	28.072	15.433	25.823

only include interaction terms that entered significantly in regressions (1) and (3), respectively. Regression (1) shows the results of estimating equation (13) on the sample from 1 and constitutes the preferred regression. The coefficient of the tax differential is significantly positive while the coefficient of the capital interaction is significantly negative. Hence, the theory of fixed costs associated with income shifting is sup-

ported. The coefficient of the intangibles interaction is not significant anymore and the significance of the coefficients of the two ownership interaction terms remains unchanged. The coefficient of the direction interaction remains insignificant. Marginal effects for this extended model can be calculated using 11. Since this model allows to calculate numerous marginal effects for subsidiaries with different character-

istics, it is mainly relied on graphics to interpret the shifting behavior of Swiss MNEs. 8 shows the marginal effect of the tax differential for wholly-owned subsidiaries with shifting direction to the parent. Note that the variables $OW_{51_{it}}$, $OW_{100_{it}}$ and $Case2_{it}$ shift the plane along the vertical axis, depending on the value they take. For example, switching $OW_{100_{it}}$ from 0 to 1 lowers the plane by 3.613 units *ceteris paribus*, which is equal to the coefficient estimate of $OW_{100_{it}}$. Thus, the marginal effect is in absolute terms by 3.613 larger for wholly-owned subsidiaries than it is for subsidiaries with an ownership share between 10 and 50.99%. 8 shows that intangible assets are less important in explaining differences in income shifting patterns than is the scale of operations. The marginal effect barely varies with the amount of intangibles, possibly because the informational value of intangibles is nested within fixed assets. This finding contradicts several recent studies examining the effect of intangibles on income shifting.³¹ Among the papers reviewed in 2, only Beer and Loeprick (2015, 436-438) take into account that a size effect potentially affects the extent of income shifting. When including an interaction of the tax differential and the logarithm of the MNE's total assets, their intangibles interaction remains significant. However, the intangible assets are measured at the subsidiary level while the size is measured at the MNE level, thus the authors lack consistency of measurement across the variables.

9 highlights how ownership and the shifting direction affect the marginal effect of the tax differential in regression (1). The top and bottom row show the marginal effect for subsidiaries with $Case2_{it} = 1$, respectively with $Case2_{it} = 0$. The intangible asset endowment is fixed at \ln intangible fixed assets = 11 (roughly the sample mean) for all effects. Significant income shifting is present whenever the upper bound of the CI is below the zero-line. The marginal effects are practically relevant over the range indicated by the grey bar Berry et al. (2012, 661). Both conditions are met only for wholly-owned subsidiaries with sufficiently large \ln fixed assets (the top and bottom left graphs). 9 suggests that the ownership share explains more variability in income shifting patterns than the direction of income shifting (the difference between semi-elasticities is larger across the columns of the graphs than it is across the rows). This is not surprising given the coefficient estimates and their significance in regression (1) in 8. The results from regression (1) in 8 support the theories that the scale of operations and the ownership share influence the extent of income shifting, but reject that intangible assets and the direction of income shifting affect the extent of income shifting significantly. Regression (2) in 8 excludes the insignificant interactions and associated standalone terms. Doing so changes the magnitude of the remaining interaction terms slightly, but does not affect signs and significances. In regression (2), the marginal effects of the tax differential for subsidiaries with mean \ln fixed assets are -1.995^{***} for wholly-owned subsidiaries, 0.108 for sub-

sidaries with an ownership share between 51 and 99.99% and 0.644 for subsidiaries with an ownership share between 10 and 50.99%.

Regressions (3) and (4) replicate the analysis from regressions (1) and (2) using categorical instead of continuous specifications for the interaction terms, analogous to the analysis in 7. All previous conclusions drawn remain valid using categorical variables for the capital and intangibles interaction. Using categorical specifications simplifies interpretation and visualization of marginal effects, at the costs of a reduced level of detail. The marginal effects from regression (3) are shown in 10. The marginal effects are significant whenever the error bar does not cross the zero-line. This is the case for wholly-owned subsidiaries with above mean \ln fixed assets, regardless of the value of the other variables. Additionally, subsidiaries with below mean \ln fixed assets, but above mean \ln intangible fixed assets and shifting direction to the parent show borderline significance. 10 confirms the insight from 8,9, that the ownership share and the scale of operations explain most variation in income shifting behavior of Swiss MNEs. Especially the amount of intangible assets is largely irrelevant for explaining differences in income shifting patterns (the difference between the marginal effects depicted by ● and ■ is minute). Further, these conclusions remain valid after excluding the insignificant interaction terms in regression (4).

The main results are equal across all regressions in 8. Particularly, using continuous and categorical specifications for the interaction terms does not lead to differing conclusions. The scale of operations and the ownership share play a dominant role in explaining differences in income shifting behavior of Swiss MNEs.³² Specifically, the results from the preferred regression (1) indicate that the marginal effect changes by -0.612 when \ln fixed assets are increased by 1, and that the marginal effect is by -3.613 larger (in absolute terms) for wholly-owned subsidiaries compared to subsidiaries with an ownership share between 10 and 50.99%. The corresponding semi-elasticity from regression (1) for wholly-owned subsidiaries with mean \ln fixed and intangible fixed assets and shifting direction to the parent is -1.322^* . Evaluating the marginal effect from regression (2) at the sample mean of \ln fixed assets yields -1.995^{***} for wholly-owned subsidiaries. All regressions support the idea of fixed costs and suggest that the amount of intangible assets is of minor importance once the scale of operations is considered. Almost only wholly-owned subsidiaries shift income. The impact of the shifting direction is modest as suggested by 9,10, however, the result from 6.2 concerning the shifting direction and industry-specific shifting behavior should be kept in mind.

³¹Additional comments on the implications of the intangibles interaction in 8 are deferred to 7.3

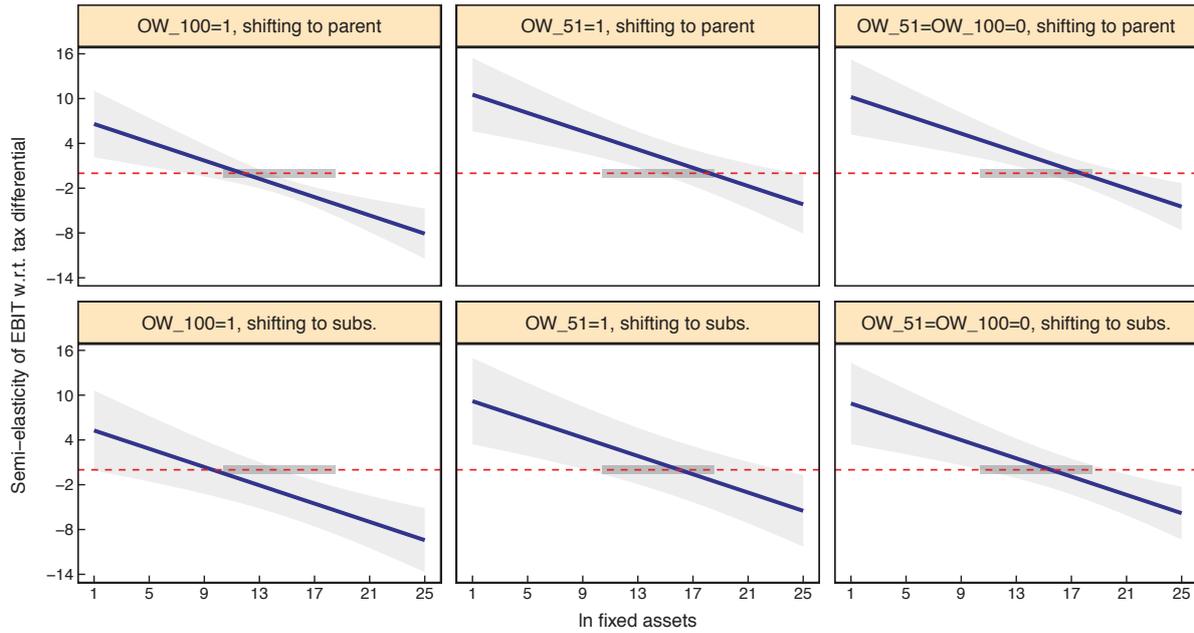


Figure 9: 2D Marginal effect of the tax differential in regression (1) in 8. In intangible fixed assets are fixed at 11. The solid line shows the marginal effect according to the partial derivative of regression (1) from 8, and the shaded area represents the 90% confidence interval. The grey bar indicates the range of the middle 90% of the distribution of ln fixed assets (observations between the 5th and 95th percentile). Source: own figure, based on Berry et al. (2012, 661).

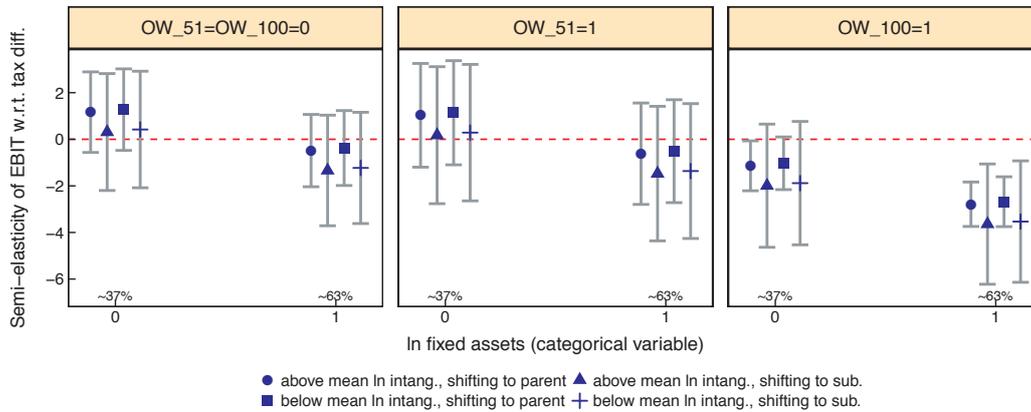


Figure 10: Marginal effect of the tax differential in regression (3) in 8. The symbols ●, ▲, ■ and + represent the marginal effect according to the partial derivative of regression (3) in Table 8, and the grey error bars represent 90% confidence intervals. Percentages indicate the approximate fraction of the sample belonging to each category. Source: own figure.

6.4. Summary of marginal effects

9 presents an overview of semi-elasticities from the different models presented throughout 6, 7, 8. Panel A shows the semi-elasticities estimated using different variations of the basic model. Panels B and C show the semi-elasticities estimated using the extended model including single and

multiple interactions, and Panel D shows semi-elasticities from related studies presented in the literature review. The benchmark estimate A.1 is smaller than the comparison from Hines and Rice (1994), which is not surprising since various authors mention that using affiliate-level data rather than aggregated data results in lower estimates of the semi-elasticity Heckemeyer and Overesch (2013, 15, 18), Dharmapala (2014, 431). Other than in Hines and Rice (1994, 163), the quadratic tax term is economically irrelevant here (the estimates A.2-A.4 are similar). The semi-elasticity estimated by Huizinga and Laeven (2008) is larger than the estimate

³²The same comments as in footnote 31 apply. Interpreting the ownership interactions is only valid given that the estimates in 8 are not biased because of the exclusion of the ownership variables as standalone terms. See 8 for additional comments.

Table 9: Summary of semi-elasticities from 6.1,6.2, 6.3

Notes. The semi-elasticities are calculated according to the partial derivative of the regression outputs in 6, 7, 8, respectively the mentioned papers. ^aThe significance can not be assessed. Sample statistics can be found in 2. *, **, *** denote significance on the 10, 5, 1% significance level. Source: own table.

Number	Subsidiary characteristics	τ_{it}	$K_{it}/K_{d_{it}}$	I_{it}	OW_51 _{it}	OW_100 _{it}	Case2 _{it}	Estimate
<i>Panel A: Basic model, 6</i>								
(A.1)	Regression (2), benchmark	-	-	-	-	-	-	-1.458***
(A.2)	Regression (4)	25 th perc.	-	-	-	-	-	-1.481***
(A.3)	Regression (4)	Mean	-	-	-	-	-	-1.444***
(A.4)	Regression (4)	75 th perc.	-	-	-	-	-	-1.407*
<i>Panel B: Extended model including single drivers of income shifting, 7</i>								
(B.1)	Regression (1)	-	25 th perc.	-	-	-	-	-0.525
(B.2)	Regression (1)	-	Mean	-	-	-	-	-1.187***
(B.3)	Regression (1)	-	75 th perc.	-	-	-	-	-1.834***
(B.4)	Regression (3)	-	-	25 th perc.	-	-	-	-0.477
(B.5)	Regression (3)	-	-	Mean	-	-	-	-0.808
(B.6)	Regression (3)	-	-	75 th perc.	-	-	-	-1.127**
(B.7)	Regression (6)	-	-	-	0	0	-	-0.233
(B.8)	Regression (6)	-	-	-	1	0	-	-0.318
(B.9)	Regression (6)	-	-	-	0	1	-	-2.101***
(B.10)	Regression (7)	-	-	-	-	-	0	-1.330
(B.11)	Regression (7)	-	-	-	-	-	1	-1.509***
<i>Panel C: Extended model including multiple drivers of income shifting, 8</i>								
(C.1)	Regression (1), preferred	-	Mean	Mean	0	1	1	-1.322*
(C.2)	Regression (2)	-	Mean	-	0	0	-	0.645
(C.3)	Regression (2)	-	Mean	-	1	0	-	0.108
(C.4)	Regression (2)	-	Mean	-	0	1	-	-1.995***
(C.5)	Regression (4)	-	1	-	0	0	-	-0.661
(C.6)	Regression (4)	-	1	-	1	0	-	-0.977
(C.7)	Regression (4)	-	1	-	0	1	-	-2.834***
(C.8)	Regression (4)	-	0	-	0	0	-	1.104
(C.9)	Regression (4)	-	0	-	1	0	-	-0.788
(C.10)	Regression (4)	-	0	-	0	1	-	-1.069*
<i>Panel D: Comparison with prior literature from 2 and consensus estimate, 8</i>								
(A.1)	Hines and Rice (1994, 163), Table 2, column (2), OLS cross-section 1982							-2.250***
(A.1)	Heckemeyer and Overesch (2013, 22-23), consensus estimate							-0.820 ^a
(B.2)	Huizinga and Laeven (2008, 1177), Table 6, column (1), OLS cross-section 1999							-1.766
(B.5)	Beer and Loeprick (2015, 435), Table 2, column (2), mean intangibles, FE panel 2003-2011							-0.980***
(B.9)	Dischinger (2008, 26), Table 6, column (5), wholly-owned subsidiaries, OLS cross-section 2004							-1.551 ^a
(B.11)	Dischinger et al. (2014, 258), Table 3, column (2), shifting to parent, FE panel 1995-2007							-1.148

B.2, however, the tax incentive variable they use is a product of two terms, and hence the difference in the estimates could stem from different model specifications. Heckemeyer and Overesch (2013, 18) find that the semi-elasticities decrease over time, possibly as a result of the introduction of specific tax law deterring income shifting. Accordingly, the time difference in the datasets could be responsible for the lower estimate. Beer and Loeprick (2015) find a slightly larger semi-elasticity than the estimate B.5, but their approach raises concerns about variable measurement.³³ Dischinger (2008) finds a lower semi-elasticity for wholly-owned firms than the estimate B.9. Different estimation methods might give rise to this difference. Dischinger et al. (2014) present a smaller semi-elasticity than B.11 using a sample of Euro-

³³The concerns about the intangibles interaction in this thesis are discussed in 7.3.

pean MNEs. Their approach is largely identical to the one applied here, hence the larger estimate probably indicates a larger extent of income shifting among Swiss MNEs. The semi-elasticities from 9, specifically the benchmark estimate of -1.458*** and the preferred estimate of -1.322* are large compared to the discussion in Dharmapala (2014, 431-432) and the consensus estimate of -0.82 provided by Heckemeyer and Overesch (2013, 22-23), possibly because Swiss MNEs face more tax saving opportunities than otherwise similar European MNEs, and thus shift more income.

6.5. Robustness

The results presented in 6.1,6.2,6.3 are verified in a series of robustness tests. 10 provides robustness tests for the basic model, using the benchmark regression (2) from 6 as a reference point. 11 provides robustness tests for the extended model including single interaction terms, and 12 presents

Table 10: Robustness tests for the basic model

Notes. All regressions are based on regression (2) from 6 with the following modifications. Regression (1) uses P/L before tax as the dependent variable. Regression (2) uses different production inputs. Regression (3) expands the sample to NACE industries A-I (see Appendix B.1). Regression (4) includes only majority-owned subsidiaries. Regression (5) uses the local tax rate instead of the tax differential. *, **, *** denote significance on the 10, 5, 1% significance level. t -statistics are reported in parenthesis and standard errors are clustered at the subsidiary level to control for heteroscedasticity and autocorrelation Hoehle (2007, 285). Source: own table.

Subsidiary-fixed effects, panel 2007-2015, dependent variable: ln EBIT, Π_{it} , except (1): P/L before tax					
Variation	P/L before tax	Prod. inputs	Industries	Majority	Tax Rate
Explanatory variables	(1)	(2)	(3)	(4)	(5)
ln GDP per capita, (A_{it})	0.279* (1.907)	0.596*** (4.025)	0.250** (1.981)	0.360** (2.401)	0.235* (1.762)
ln fixed assets, (K_{it})	0.067*** (4.863)		0.067*** (5.747)	0.061*** (4.663)	0.063*** (5.096)
ln cost of employees, (L_{it})	0.465*** (12.876)		0.419*** (14.198)	0.456*** (11.840)	0.465*** (13.553)
ln tangible fixed assets, (TK_{it})		0.097*** (5.912)			
ln number of employees, ($L_{N_{it}}$)		0.406 (11.146)			
Tax differential, (τ_{it})	-1.267*** (-2.612)	-1.782*** (-3.778)	-1.263*** (-3.132)	-1.797*** (-3.626)	
Local tax rate, (r_{it})					-1.458*** (-3.390)
Year dummies	✓	✓	✓	✓	✓
Industry-year dummies	✓	✓	✓	✓	✓
No. of observations	25'919	22'188	31'164	22'084	26'869
No. of subsidiaries	4'813	4'327	5'749	4'044	40862
Within R^2	0.057	0.057	0.063	0.066	0.066
Overall F -test	29.639	29.050	10.822	25.714	31.386

robustness tests for the extended model including multiple interaction terms. In regression (1) of 10 the EBIT is replaced by P/L before tax as the dependent variable. The coefficient of the tax differential is lower than in regression (1) of 6, which is against expectations based on Heckemeyer and Overesch (2013, 10), who state that the EBIT is affected by income shifting through transfer pricing and royalty payments but not financial shifting techniques. Marques and Pinho (2016, 720-721) are confronted with a similar case but do not provide an explanation.³⁴

The result from regression (1) suggests that not all shifting techniques are used to shift income in the same direction, and that the underlying shifting incentive might be more complex than the mere tax differential between countries. The production factors fixed assets and costs of employees are replaced with tangible fixed assets and the number of employees in regression (2), resulting in a larger coefficient estimate of the tax differential of -1.782 . Expanding the industries to the NACE sectors A-I in regression (3) yields a lower coefficient of -1.263 . The reduced estimate could be a fur-

ther indication of industry-specific shifting behavior. Regression (4) considers only subsidiaries with an ownership share of 51% or more. Unsurprisingly, the coefficient estimate of the tax differential is larger, reflecting that majority-owned subsidiaries engage in income shifting activities to a larger extent than non majority-owned subsidiaries. Regression (5) replaces the tax differential with the local tax rate at the subsidiary's location, showing that with all parent firms facing the same tax rate, it is computationally irrelevant whether the tax differential or the local tax rate of the subsidiary is used. The coefficient estimates and corresponding t -statistics are identical to the numbers presented in regression (2) of 6.³⁵ However, the interpretation of a change in the tax incentive variable is slightly different. In case a tax differential is used, a change in the shifting incentive can be attributed to either a change in the tax rate of the subsidiary, the parent firm or both. By using the local tax rate of the subsidiary only, a

³⁴ Compare columns (1) and (4) as well as column (3) and (6) in Table 9 on page 720.

³⁵ Calculating the tax differential as $\tau_{it} = (r_{it} - r_{ht})$ constitutes a variable transformation which does not affect the coefficient estimates. This is the case because the parent tax rate r_{ht} is the same for all observations for any given year. This argument does not apply to studies using samples with parent firms from multiple countries.

Table 11: Robustness tests for the extended model including single interactions

Notes. Regressions (1), (2), (3) and (4) correspond to regressions (1), (3), (6) and (7) from 7 and add leverage and GDP growth as additional control variables. *, **, *** denote significance on the 10, 5, 1% significance level. *t*-statistics are reported in parenthesis and standard errors are clustered at the subsidiary level to control for heteroscedasticity and autocorrelation [Hoechle \(2007, 285\)](#). Source: own table.

Subsidiary-fixed effects, panel 2007-2015, dependent variable: ln EBIT, Π_{it}				
Income shifting driver	Capital (cont.)	Intang. (cont.)	Ownership	Direction
Explanatory variables	(1)	(2)	(3)	(4)
ln GDP per capita, (A_{it})	0.202 (1.506)	0.241 (1.417)	0.219 (1.639)	0.207 (1.506)
ln fixed assets, (K_{it})	0.094*** (6.069)	0.086*** (4.331)	0.066*** (5.276)	0.066*** (5.281)
ln cost of employees, (L_{it})	0.466*** (13.511)	0.454*** (10.630)	0.466*** (13.453)	0.466*** (13.454)
Leverage, ln debt over ln total assets, (LEV_{it})	-0.257*** (-8.350)	-0.365*** (-9.378)	-0.253*** (-8.224)	-0.254*** (-8.251)
GDP growth, (GDP_G_{it})	0.019*** (4.707)	0.023*** (4.689)	0.018*** (4.578)	0.018*** (4.634)
Tax differential, (τ_{it})	4.418** (2.382)	1.475 (1.283)	-0.076 (-0.095)	-0.909 (-0.687)
Capital interaction, (cont., $\tau_{it} \times K_{it}$)	-0.377*** (-3.098)			
ln intangible assets, (I_{it})		0.012 (1.246)		
Intangible interaction, (cont., $\tau_{it} \times I_{it}$)		-0.177 (-2.050)		
2 nd ownership interaction, (OW_100_{it})			-1.583* (-1.670)	
1 st ownership interaction, (OW_51_{it})			-0.329 (-0.225)	
Shifting direction, ($Case2_{it}$)				0.006 (0.100)
Direction interaction, ($\tau_{it} \times Case2_{it}$)				-0.301 (-0.203)
Year dummies	✓	✓	✓	✓
Industry-year dummies	✓	✓	✓	✓
No. of observations	26'577	17'680	26'577	26'577
No. of subsidiaries	4'818	3'659	4'818	4'818
Within R^2	0.074	0.076	0.074	0.074
Overall F -test	32.160	22.331	30.233	30.171

change in the tax rate of the parent firm is irrelevant for interpretation, thus using the tax rate instead of the tax differential probably reflects reality less accurate. The robustness tests in 10 show that the conclusions from the basic model of income shifting remain unchanged for various modifications of the estimation approach.

11 takes up the regressions (1), (3), (6) and (7) from 7 and adds frequently used control variables. The additional variables are the leverage of the subsidiary, measured as ln debt over ln total assets, and GDP growth. The leverage enters significantly negative in all regressions, suggesting that a higher leverage is associated with a lower EBIT. This is not

intuitive, since the EBIT is independent of interest payments. [Huizinga and Laeven \(2008, 1174\)](#) find the same result and argue that leverage could make profitable investments more difficult to finance. They also find that leverage has a more pronounced influence when the P/L before tax is used instead of the EBIT, which is a more intuitive result [Huizinga and Laeven \(2008, 1174\)](#). The GDP growth enters significantly positive in all regressions, indicating that higher GDP growth is associated with a higher EBIT. The robustness tests in 11 do not lead to changes of signs and significances of the coefficient estimates of the tax differential and interaction terms. Hence, all conclusions drawn from the extended model us-

Table 12: Robustness tests for the extended model including multiple interactions

Notes. All regressions are based on regression (2) from 8 with the following modifications. Regression (1) includes leverage and GDP growth as additional control variables. Regression (2) uses P/L before tax as the dependent variable. Regression (3) uses different production inputs. Regression (4) expands the sample to NACE industries A-I (see Appendix B.1). *, **, *** denote significance on the 10, 5, 1% significance level. *t*-statistics are reported in parenthesis and standard errors are clustered at the subsidiary level to control for heteroscedasticity and autocorrelation [Hoechle \(2007, 285\)](#). Source: own table.

Subsidiary-fixed effects, panel 2007-2015, dependent variable: ln EBIT, Π_{it} , except (2): P/L before tax				
Variation	Add. controls	P/L before tax	Prod. inputs	Industries
Explanatory variables	(1)	(2)	(3)	(4)
ln GDP per capita, (A_{it})	0.200 (1.501)	0.263* (1.812)	0.595*** (4.053)	0.236* (1.873)
ln fixed assets, (K_{it})	0.099*** (6.276)	0.101*** (5.958)		0.098*** (6.605)
ln cost of employees, (L_{it})	0.465*** (13.517)	0.463*** (12.908)		0.417*** (14.207)
Leverage, ln debt over ln total assets, (LEV_{it})	-0.256*** (-8.326)			
GDP growth, (GDP_G_{it})	0.018 (4.624)			
ln tangible fixed assets, (TK_{it})			0.120*** (6.011)	
ln number of employees, (L_N_{it})			0.406*** (11.217)	
Tax differential, (τ_{it})	6.923*** (3.119)	6.221** (2.537)	4.384* (1.727)	6.156** (2.885)
Capital interaction, (cont., $\tau_{it} \times K_{it}$)	-4.34*** (3.522)	-0.451*** (-3.245)		-0.414*** (-3.543)
2 nd ownership interaction, (OW_100_{it})	-2.422** (-2.407)	-1.132 (-1.003)	-2.531* (-2.213)	-2.040** (-2.092)
1 st ownership interaction, (OW_51_{it})	-0.800 (-0.518)	-1.070 (-0.553)	0.414 (0.245)	-0.238 (-0.178)
Capital interaction, (cont., $\tau_{it} \times TK_{it}$)			-0.313** (-2.239)	
Year dummies	✓	✓	✓	✓
Industry-year dummies	✓	✓	✓	✓
No. of observations	26'577	25'919	22'188	31'164
No. of subsidiaries	4'818	4'813	4'327	5'749
Within R^2	0.075	0.057	0.058	0.064
Overall F -test	29.814	26.358	25.770	10.613

ing single interactions in 6.2 remain valid after controlling for leverage and GDP growth. However, including the additional controls reduces the marginal effect of the tax differential. The semi-elasticity in regression (1) of 11 is -0.838^* for subsidiaries with mean ln fixed assets, whereas the same marginal effect is -1.187^{***} in regression (1) of 7. This is in line with [Heckemeyer and Overesch \(2013, 18\)](#), who find in a meta-study of 25 income shifting papers, that controlling for leverage reduces the impact of the tax differential.

12 provides results from robustness tests of the extended model including multiple interactions. All four regressions are based on regression (2) in 8. The same variations as in 10 are estimated. Regression (1) includes the additional con-

trol variables leverage and GDP growth, regression (2) uses the P/L before tax as the dependent variable instead of the EBIT, in regression (3) the fixed assets and the costs of employees are replaced by tangible fixed assets and the number of employees, and finally regression (4) expands the sample to the NACE main sectors A-I. Including the additional control variables does not alter the significance of the tax differential or the interaction terms, but renders the coefficient of the GDP per capita insignificant. This might be the result of collinearity between GDP per capita and GDP growth, in which case it would be sufficient to include one of the two variables. The marginal effect for wholly-owned subsidiaries at the sample mean of ln fixed assets is -1.550^{***} . Replacing

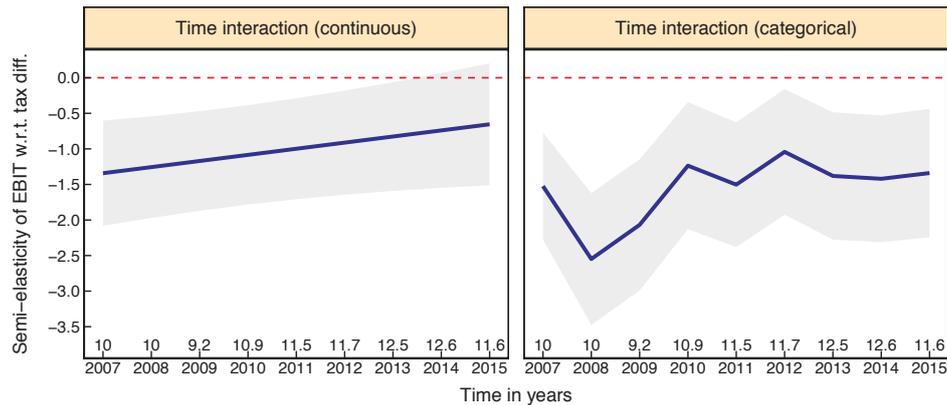


Figure 11: Income shifting patterns over time. The left and right graphs show the marginal effect of the tax differential using a continuous and a categorical specification. The solid line shows the marginal effect according to the partial derivatives of regressions (1) and (2) in 13, and the shaded area represents the 90% confidence interval. Percentages indicate the approximate fraction of observations that fall into each year. Source: own figure.

the EBIT with P/L before tax in regression (2) renders the coefficient of $OW_{100,t}$ insignificant. The marginal effect for subsidiaries with the characteristics described above is -1.199^{**} , and both effects for non wholly-owned subsidiaries are not significant. This pattern of results is also observed in regressions (4) and (7) of 7, and the comments in Appendix D.2 apply equivalently. Replacing the production function inputs in regression (3) does not lead to changes in signs or significances of the interaction terms. The marginal effect for subsidiaries with the characteristics above is -2.366^{***} . Expanding the industries in regression (4) results in a marginal effect of -1.656^{***} for wholly-owned subsidiaries with mean \ln fixed assets. As proposed earlier in this subsection and in 6.2, the lower marginal effect in regression (4) could indicate that the income shifting behavior of Swiss MNEs depends on the industry-affiliation. These four semi-elasticities correspond to the marginal effect in regression (2) from 8, which is equal to -1.995^{***} for subsidiaries with the same characteristics. The extended model using multiple income shifting drivers is robust to the estimation variations applied in 12.

7 contains a discussion about how the income shifting behavior of Swiss MNEs developed over time and which locations play important roles within income shifting strategies of Swiss MNEs. As mentioned in the introduction, recent research is often concerned with the effectiveness of various tax legislations [Beuselinck et al. \(2015\)](#). [Lohse and Riedel \(2012, 1\)](#) mention that various countries have recently introduced TP legislation aimed at reducing income shifting among MNEs. Against this background, it seems fruitful to address the above mentioned issues for the following reasons. First, examining how income shifting patterns developed over time could provide insights on the effectiveness of tax legislations, and secondly, examining locations involved in income shifting strategies might provide guidance in designing new tax legislation aimed at deterring the extent of

income shifting. For simplicity, the discussion is based on the basic model in the benchmark regression (2) of 6. Additionally, 7.3 summarizes implications for future research.

7. Discussion

7.1. Did income shifting decrease over time?

[Lohse and Riedel \(2012, 10, 23\)](#) use a linear time trend to assess changes in income shifting behavior and find that income shifting decreased over their sample period, suggesting that TP regulations indeed reduce the extent of income shifting among European MNEs. However, since negative and positive changes offset each other, modeling a linear time trend provides only limited insights into changes in income shifting patterns. Therefore, an alternative approach using interaction terms consisting of the tax differential and yearly categorical variables is additionally applied. The results of both approaches are presented in 13 and the corresponding marginal effects are plotted in 11. Regression (1) includes a linear time trend using calendar years as a continuous variable. The negative coefficient of the time trend implies that the EBIT decreased significantly over the sample period. The marginal effect of the tax differential in the left graph of 11 suggests that income shifting decreased slightly over time, moreover, it indicates that Swiss MNEs did not shift income during the last sample years 2014 and 2015. Other than in [Lohse and Riedel \(2012, 10\)](#), the coefficient estimate of the interaction term in regression (1) is not significant. Regression (2) provides a more detailed insight into how income shifting among Swiss MNEs has changed over time.

In regression (2), the coefficient of the tax differential depicts the marginal effect for all observations in the year 2007. An isolated interpretation is therefore useful. During the year 2007, an increase in the tax differential by 1 percentage point is associated with a decrease in the EBIT of 1.524%. The right graph in 11 shows how the semi-elasticity

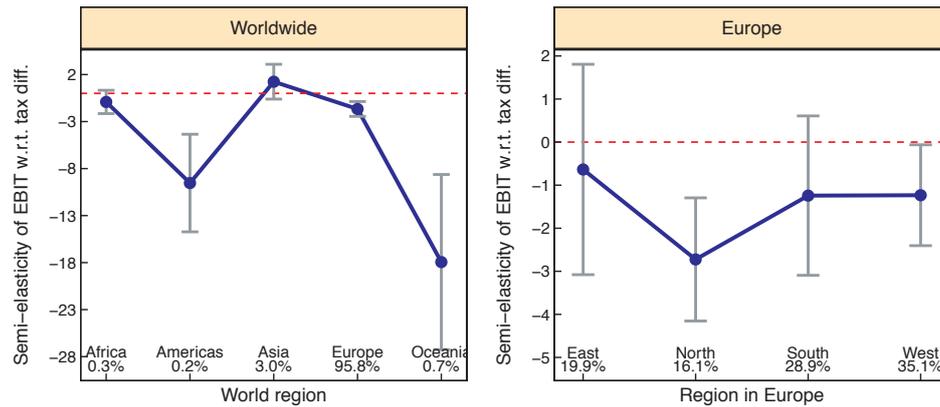


Figure 12: income shifting across geographic regions. Marginal effects of the tax differential across different regions in the world and Europe. Black dots represent the marginal effects according to the partial derivative of regression (1) and (2) in 14, and grey error bars represent 90% confidence intervals. Percentages indicate the approximate fraction of observations that falls into each region. Source: own figure.

developed over time. It dropped significantly to -2.549^{***} in 2008, but is not significantly different from the level in 2007 in later years. Further, the right graph in 11 does not suggest that income shifting disappeared in the latest sample years. A possible explanation for the large extent of income shifting in 2008 is the following. Many companies experienced losses during the financial crisis. Income shifted to a loss-making affiliate is taxed at 0% up to the extent of the losses of that affiliate, and hence the tax incentive to shift income is larger than the tax differential because the ETR of at least part of the shifted income is smaller than the statutory CITR. This argument further implies that loss carry-forwards change the shifting incentive Overesch (2009, 9-10) (8 elaborates). To conclude, income shifting among Swiss MNEs did not decrease over time, but rather remained constant in the last sample years.

7.2. Are income shifting patterns different across the globe?

Huizinga and Laeven (2008, 1173) include an interaction term consisting of the weighted tax differential and a categorical variable equal to 1 for firms located in Eastern Europe. Doing so allows the semi-elasticity of the EBIT to vary across geographic regions. This method is adopted in regressions (1) and (2) in 14. Regression (1) includes four categorical variables depicting the world region the subsidiary falls into (Africa, Americas, Asia, Europe, and Oceania). Each categorical variable being equal to 1 if the subsidiary is located in that region and Africa being the reference category. The same approach is used in regression (2) with more detailed regions within Europe (Northern, Southern, Western and Eastern Europe as the reference category). The sample is therefore restricted to European subsidiaries of Swiss MNEs. The results from regression (1) are visualized in 12 on the left, suggesting that significant income shifting occurs between the parent firm in Switzerland and subsidiaries located in the Americas, Europe and Oceania. The marginal effects of the tax differential are -9.537^{***} for subsidiaries located in the Americas,

-1.661^{***} for European subsidiaries and -17.941^{***} for subsidiaries in Oceania. However, due to the low number of observations in the Americas and Oceania, the estimates are inaccurate (indicated by the wide CIs). Using only observations of European subsidiaries favors the use of smaller geographic regions.

The marginal effect of the tax differential from regression (2) is plotted in the right graph of 12. The semi-elasticities for Northern and Western Europe are -2.728^{***} respectively -1.234^* , and both significant. In other words, an increase of 1 percentage point in the tax differential is associated with a decrease in the EBIT of 2.728% for subsidiaries in northern Europe and 1.234% for subsidiaries in Western Europe. No income shifting occurs between the Swiss parent firm and subsidiaries located in Eastern or Southern Europe. This is not surprising since the tax rates in Eastern and Southern Europe are lower than in Northern and Western Europe, but very similar to the Swiss CITR (see 4 in 5.2).

7.3. Implications for future research

Besides bringing up results to address the thesis objectives in 1.2, the empirical analysis has brought forward several implications relevant to future research and tax policy. Most important among these is the threshold of fixed assets, that needs to be reached in order for a MNE to benefit from income shifting. 7 illustrates this point well. Dharmapala (2014, 445) mentions very generally, that heterogeneity in MNEs' corporate structure, and hence in shifting behavior, can be viewed as consistent with fixed costs associated with income shifting. The results presented in 6.2, 6.3 strongly suggest that Swiss MNEs face fixed costs when shifting income and there is no obvious a priori reason to assume this is not the case for other MNEs. However, the results here provide a mere indication of fixed costs, the size and the cause thereof are to be studied in future research efforts.

An unexpected result is the low impact of intangible assets on income shifting behavior. While Beer and Loeprick

Table 13: Income shifting patterns over time

Notes. Regression (1) includes a time interaction with a continuous time variable. Regression (2) includes time interactions with yearly categorical variables. *, **, *** denote significance on the 10, 5, 1% significance level. t -statistics are reported in parenthesis and standard errors are clustered at the subsidiary level to control for heteroscedasticity and autocorrelation [Hoechle \(2007, 285\)](#). ^aThe coefficient of the tax differential is much larger than in previous specification. This is the result of including the time trend as calendar years instead of using integers 1-9 as done in [Lohse and Riedel \(2012\)](#). Since this a linear variable transformation, the marginal effect is unaffected. Source: own table.

Subsidiary-fixed effects, panel 2007-2015, dep. var.: $\ln \text{EBIT}, \Pi_{it}$		
Time trend	Continuous	Categorical
Explanatory variables	(1)	(2)
Year, (cont., $T_{CY_{it}}$)	-0.033*** (-4.035)	
\ln GDP per capita, (A_{it})	0.519*** (3.606)	0.320** (2.178)
\ln fixed assets, (K_{it})	0.064*** (5.218)	0.062*** (5.071)
\ln cost of employees, (L_{it})	0.486*** (14.255)	0.467*** (13.564)
Tax differential, (τ_{it})	-173.913 ^a (1.530)	-1.524*** (3.330)
Time interaction (cont., $\tau_{it} \times \text{Year}$)	0.086 (1.520)	
$\tau_{it} \times 2008$		-1.025*** (-2.858)
$\tau_{it} \times 2009$		-0.544 (-1.318)
$\tau_{it} \times 2010$		0.287 (0.675)
$\tau_{it} \times 2011$		0.020 (0.049)
$\tau_{it} \times 2012$		0.481 (1.098)
$\tau_{it} \times 2013$		0.143 (0.313)
$\tau_{it} \times 2014$		0.103 (0.225)
$\tau_{it} \times 2015$		0.184 (0.383)
Year dummies		✓
Industry-year dummies	✓	✓
No. of observations	26'869	26'869
No. of subsidiaries	4'862	4'862
Within R^2	0.057	0.067
Overall F -test	56.095	23.121

(2015, 435) and [Dischinger and Riedel \(2011, 706\)](#) find that the intangible assets of the subsidiary significantly impact income shifting, the results in 6.3 suggest that intangible assets are unrelated to the extent of income shifting once the capital interaction is included in the model. This is especially surprising considering the large empirical evidence on the relation between tax rates and intangibles, including recent evidence stemming from very different research approaches (for example [Karkinsky and Riedel \(2012, 185\)](#), who find that MNEs preferably locate patents in low-tax affiliates). Hence, it is unwise to conclude that the results shown here nullify previous research. It is rather stressed to choose a sensible

approach when studying how intangible assets and firm size affect income shifting. One such approach is to use the ratio of intangible fixed assets over fixed assets. Since the variable fixed assets used here includes intangible fixed assets, at least part of the significant effect of the capital interaction can be traced back to intangible assets.

The analysis of the shifting direction in 6.2 suggests, that the income shifting behavior of Swiss MNEs depends on the industry-affiliation. The evidence provided here is of anecdotal nature only and the detailed study of industry-related income shifting behavior is left to future research. Further, the discussion in 7.1 indicates that against expectations, income shifting among Swiss MNEs did not decrease over time. This is surprising since many authors describe a general trend of intensification of tax laws within Europe and as a consequence, report significant reductions in income shifting ac-

Table 14: Income shifting across geographic regions

Notes. Regression (1) includes geographic interactions with four categorical variables. Americas d_{it} , Asia d_{it} , Europe d_{it} and Oceania d_{it} , each being equal to 1, if the observation falls into that region and 0 otherwise. Regression (2) includes geographic interactions with three categorical variables Northern_Europe d_{it} , Southern_Europe d_{it} , and Western_Europe d_{it} , each being equal to 1 if the observation falls into that region and 0 otherwise. The United Nations region classification used to assign countries to geographic regions can be found in Appendix C.2. *, **, *** denote significance on the 10, 5, 1% significance level. t -statistics are reported in parenthesis and standard errors are clustered at the subsidiary level to control for heteroscedasticity and autocorrelation [Hoechle \(2007, 285\)](#). Source: own table.

Subsidiary-fixed effects, panel 2007-2015, dep. var.: $\ln \text{EBIT}, \Pi_{it}$		
Geographic regions	Worldwide	Europe
Explanatory variables	(1)	(2)
\ln GDP per capita, (A_{it})	0.244* (1.794)	0.230 (1.381)
\ln fixed assets. (K_{it})	0.063*** (5.086)	0.061*** (4.915)
\ln cost of employees, (L_{it})	0.466*** (13.553)	0.465*** (13.235)
Tax differential, (τ_{it})	-0.913 (-1.211)	-0.636 (-0.428)
$\tau_{it} \times \text{Americas}_{d_{it}}$	-8.624*** (-2.649)	
$\tau_{it} \times \text{Asia}_{d_{it}}$	2.152 (1.524)	
$\tau_{it} \times \text{Europe}_{d_{it}}$	-0.748 (-0.842)	
$\tau_{it} \times \text{Oceania}_{d_{it}}$	-17.028*** (-2.976)	
$\tau_{it} \times \text{Northern_Europe}_{d_{it}}$		-2.089 (-1.180)
$\tau_{it} \times \text{Southern_Europe}_{d_{it}}$		-0.606 (-0.328)
$\tau_{it} \times \text{Western_Europe}_{d_{it}}$		-0.598 (-0.364)
Year dummies	✓	✓
Industry-year dummies	✓	✓
No. of observations	26'869	25'745
No. of subsidiaries	4'862	4'607
Within R^2	0.066	0.067
Overall F -test	26.453	26.949

tivities Lohse et al. (for example 2012, 23-24), Marques and Pinho (2016, 729). The income shifting activities of Swiss MNEs would have been expected to decrease since a large fraction of subsidiaries is located within Europe, and thus affected by stricter tax law. This seemingly contradictory finding leads one to assume, that income shifting is most effectively deterred by tightening tax law in the host country of the parent firm. Hence, relevant tax law in Switzerland needs to be adjusted to effectively deter income shifting among Swiss MNEs. This finding in conjuncture with industry- and country-specific shifting behavior might provide useful in designing specific tax legislation aimed at preventing income shifting of Swiss MNEs.

Since the number of subsidiaries is low outside of Europe, the CIs in Figure 12 are wide and conclusions based thereon are inherently inaccurate. Therefore, future research on income shifting of Swiss MNEs using the ORBIS database is advised to use a European sample, unless intercontinental data is explicitly needed.

8. Limitations

The data and methodology applied in this thesis come with several deficiencies. The limited access to ownership data has far reaching economic and statistical consequences. Parent firms of subsidiaries can not be identified and hence, affiliates of a MNE cannot be linked to each other to form a corporate group consisting of several affiliates. Thus, calculation of an average tax differential is impossible. Several authors find that MNEs significantly shift income between subsidiaries of the same parent firm Huizinga and Laeven (2008, 1174), Dischinger and Riedel (2008, 18-19). The thesis at hand missed this potential part of income shifting among Swiss MNEs. Further, parent firms cannot be analyzed as for example in Dischinger et al. (2014, 260-261). However, this aspect of the ownership issue is outside the influence of the author of this thesis, and by using subsidiaries with a Swiss parent holding a specified ownership share, a satisfactory second-best solution was chosen.

The ownership data from ORBIS is reported for the last available year only (2015 in most cases), and the ownership categorization based on the variables $OW_{51_{it}}$ and $OW_{100_{it}}$ is a snapshot thereof Dharmapala (2014, 430). By assuming the ownership structure did not change over the sample period, the sample potentially includes subsidiaries with a smaller ownership share than 10% in earlier years. While Budd et al. (2005, 76) argue that this measurement error distorts the effect of the tax differential towards 0, other approaches to this problem exist. Dischinger (2008, 15, 26) uses an OLS cross-section of the last available year to qualitatively verify his results obtained from FE regressions using the whole panel sample. This approach further allows to include the ownership variable as a standalone term and thus avoids possible bias introduced by leaving out terms constituting an interaction term Brambor et al. (2006, 66-68). Another solution is to use more sophisticated statistical methods, such as the estimator proposed by Hausman and

Taylor (1981). This approach allows to consistently estimate both time-variant and time-invariant regressors, while still controlling for unobserved heterogeneity among subsidiaries Wooldridge (2009, 325-326). Within this thesis, the estimates of regressions including ownership share interactions should be treated with care since they are possibly biased.

The unequal coverage of different countries and the low coverage of tax havens in the ORBIS database has been mentioned often Fuest and Riedel (2010, 18), Clausing (2016, 906). Desai et al. (2006, 529-530) find that tax havens are important elements in tax avoidance strategies of US MNEs, and Clausing (2016, 906) mentions that research using the ORBIS database misses key observations from tax haven countries that drive income shifting behavior.³⁶ While this limitation can be crucial to the validity of the research in these papers, it is presumably of second-order importance for the analysis presented here. Switzerland is defined a tax haven by Desai et al. (2006, 517), hence every subsidiary in the sample has the possibility to benefit from tax haven operations (shifting income to the parent firm in Switzerland) as defined by the aforementioned authors. Given the comparably low CITRs in Switzerland, the tax benefits from establishing and shifting income to affiliates in other tax havens is lower for Swiss MNEs than it is for other MNEs facing a higher CITER. Thus, it is assumed that Swiss MNEs are unlikely to have numerous affiliates incorporated in other tax havens.

Overesch (2006, 19) finds that firms with loss carry-forwards have a reversed incentive to shift income. Neglecting loss carry-forwards might lead to distorted coefficient estimates. In consequence, it is sensible to exclude subsidiaries with loss carry-forwards, or offer a differing analysis for such firms. Overesch (2009, 9-10) mentions that firms incorporated in high-tax jurisdictions with loss carry-forwards constitute a suitable control group when studying income shifting. Such firms are faced with a highly positive tax differential, but can offset any profits with former losses. Thus, the shifting incentive is mitigated and applying the basic model from this thesis on a sample of firms with these characteristics should result in an insignificant estimate of the tax differential. Such an analysis could pronounce the indirect evidence of income shifting found in this thesis. Being able to identify a suitable control group further allows to use potentially fruitful approaches, such as difference-in-difference analysis. Alternatively, loss carry-forwards could be used as an explanatory variable, as done for example by Buettner and Wamser (2013, 74).

9. Conclusion

The main objectives of this thesis were to investigate whether Swiss MNEs shift income or not, and to verify if the

³⁶However, Clausing (2016, 917) finds in the same study, that 4 out of 8 (including the top 3) key locations for income shifting of US MNEs in 2012 are industrialized countries in Europe, namely the Netherlands, Ireland, Luxembourg and Switzerland. The coverage in these countries is higher Kalemli-Ozcan et al. (2015, 7), and the criticism is partially mitigated.

income shifting behavior of Swiss MNEs depends on certain firm and country characteristics. The drivers studied in this thesis are the scale of operations, the amount of intangible assets, the ownership share and the direction of shifting. A large body of empirical literature has shown that specific tax law effectively deters income shifting. The absence of such tax law in Switzerland in combination with comparably low statutory tax rates gave rise to the suspicion, that income shifting of Swiss MNEs is large.

The thesis at hand provides indirect evidence of income shifting among Swiss MNEs. The benchmark regression has shown, that a 1 percentage point increase in the tax differential is associated with a decrease of the subsidiary's EBIT by 1.458%. Moreover, this semi-elasticity is larger than recent results from comparable studies using samples of European firms, possibly because Swiss MNEs face larger income shifting opportunities than otherwise similar European firms. Additionally, this thesis identified the scale of operations and the ownership share as significant determinants of income shifting behavior of Swiss MNEs. The sensitivity of the EBIT to changes in the tax differential increases with the scale of operations and the ownership share. Quantitatively, the preferred regression shows that increasing the \ln fixed assets by 1 leads to a decrease (absolute increase) in the semi-elasticity of the EBIT w.r.t. the tax differential of -0.612 . The difference in semi-elasticities between wholly-owned subsidiaries and subsidiaries with an ownership share between 10 and 50.99%, is estimated at -3.613 . Hence, Swiss MNEs shift income using large, wholly-owned subsidiaries. The preferred regression implies that a 1 percentage point increase in the tax differential translates into a 1.322% decrease in the EBIT of wholly-owned subsidiaries with mean \ln fixed assets, mean \ln intangible fixed assets and shifting direction to the parent. Intangible assets and the direction of shifting are less important drivers of income shifting of Swiss MNEs.

It was further shown, that income shifting activities of Swiss MNEs are probably different across industries. Against expectations, the extent of income shifting of Swiss MNEs did not decrease over time, but remained stable in recent years. Swiss MNEs shift income mainly from high-tax countries in Northern and Western Europe to Switzerland. It is again stressed, that all results should be considered with respect to the mentioned limitations.

References

- Aiken, L. S. and West, S. G. *Multiple Regression: Testing and Interpreting Interactions*. SAGE Publications, Inc, Milton Keynes, January 1991. ISBN 978-0-7619-0712-1.
- Bank, W. DataBank - World Development Indicators, March 2017. URL <http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators>.
- Bartelsman, E. J. and Beetsma, R. M. W. J. Why pay more? Corporate tax avoidance through transfer pricing in OECD countries. *Journal of Public Economics*, 87(9):2225–2252, September 2003. ISSN 0047-2727. URL <http://www.sciencedirect.com/science/article/pii/S004727270200018X>.
- Becker, J. and Riedel, N. Cross-border tax effects on affiliate investment - Evidence from European multinationals. *European Economic Review*, 56(3):436–450, April 2012. ISSN 0014-2921. URL <http://www.sciencedirect.com/science/article/pii/S0014292111001115>.
- Becker, J., Fuest, C., and Riedel, N. Corporate tax effects on the quality and quantity of FDI. *European Economic Review*, 56(8):1495–1511, November 2012. ISSN 0014-2921. URL <http://www.sciencedirect.com/science/article/pii/S0014292112000888>.
- Beer, S. and Loeprick, J. Profit shifting: drivers of transfer (mis)pricing and the potential of countermeasures. *International Tax and Public Finance*, 22(3):426–451, June 2015. ISSN 0927-5940, 1573-6970. URL <https://link.springer.com/article/10.1007/s10797-014-9323-2>.
- Berry, W. D., Golder, M., and Milton, D. Improving Tests of Theories Positing Interaction. *The Journal of Politics*, 74(3):653–671, July 2012. ISSN 0022-3816. URL <http://www.journals.uchicago.edu/doi/abs/10.1017/S0022381612000199>.
- Beuselinck, C., Deloof, M., and Vanstraelen, A. Cross-jurisdictional income shifting and tax enforcement: evidence from public versus private multinationals. *Review of Accounting Studies*, 20(2):710–746, June 2015. ISSN 1380-6653, 1573-7136. URL <https://link.springer.com/article/10.1007/s11142-014-9310-y>.
- Brambor, T., Clark, W. R., and Golder, M. Understanding Interaction Models: Improving Empirical Analyses. *Political Analysis*, 14(1):63–82, January 2006. ISSN 1047-1987, 1476-4989. URL <https://www.cambridge.org/core/journals/political-analysis/article/div-classtitl-understanding-interaction-models-improving-empirical-analyses/div/9BA57B3720A303C61EBEC6DDFA40744B>.
- Budd, J., Konings, J., and Slaughter, M. J. Wages and International Rent Sharing in Multinational Firms. *The Review of Economics and Statistics*, 87(1):73–84, 2005. URL http://econpapers.repec.org/article/tprrestat/v_3a87_3ay_3a2005_3ai_3a1_3ap_3a73-84.htm.
- Buettner, T. and Wamser, G. Internal Debt and Multinational Profit Shifting: Empirical Evidence from Firm-Level Panel Data. *National Tax Journal*, 66(1):63–95, March 2013. ISSN 00280283. URL <http://search.proquest.com/docview/1346647982?pq-origsite=gscholar>.
- Buettner, T., Overesch, M., Schreiber, U., and Wamser, G. The impact of thin-capitalization rules on the capital structure of multinational firms. *Journal of Public Economics*, 96(11):930–938, December 2012. ISSN 0047-2727. URL <http://www.sciencedirect.com/science/article/pii/S0047272712000710>.
- Buettner, T., Overesch, M., and Wamser, G. Anti profit-shifting rules and foreign direct investment. *International Tax and Public Finance*, pages 1–28, June 2017. ISSN 0927-5940, 1573-6970. URL <https://link.springer.com/article/10.1007/s10797-017-9457-0>.
- Clausing, K. A. Tax-motivated transfer pricing and US intrafirm trade prices. *Journal of Public Economics*, 87(9):2207–2223, September 2003. ISSN 0047-2727. URL <http://www.sciencedirect.com/science/article/pii/S0047272702000154>.
- Clausing, K. A. The Effect of Profit Shifting on the Corporate Tax Base in the United States and Beyond. *National Tax Journal*, 69(4):905–934, 2016. URL http://econpapers.repec.org/article/ntjjournal/v_3a69_3ay_3a2016_3ai_3a4_3ap_3a905-934.htm.
- Cobham, A. and Loretz, S. International Distribution of the Corporate Tax Base: Implications of Different Apportionment Factors Under Unitary Taxation. SSRN Scholarly Paper ID 2587839, Social Science Research Network, Rochester, NY, November 2014. URL <https://papers.ssrn.com/abstract=2587839>.
- Commission, E. NACE Rev. 2 - Statistical classification of economic activities in the European Community. Technical report, 2008. URL <http://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF>.
- Confederation, S. Double taxation and administrative assistance, March 2017. URL <https://www.sif.admin.ch/sif/en/home/themen/internationale-steuerpolitik/doppelbesteuerung-und-amtshilfe.html>.
- Conover, T. L. and Nichols, N. B. A Further Examination of Income Shifting Through Transfer Pricing Considering Firm Size and/or Distress. *The International Journal of Accounting*, 35(2):189–211, July 2000. ISSN 0020-7063. URL <http://www.sciencedirect.com/science/article/pii/S0020706300000455>.
- Damodaran, A. Corporate marginal tax rates - by country, March 2017. URL http://people.stern.nyu.edu/adamodar/New_Home_Page/datafile/countrytaxrate.htm.
- Desai, M. A., Foley, C. F., and Hines, J. R. The costs of shared ownership: Evidence from international joint ventures. *Journal of Financial Economics*, 73(2):323–374, August 2004. ISSN 0304-405X. URL <http://www.sciencedirect.com/science/article/pii/S0304405X04000121>.
- Desai, M. A., Foley, C. F., and Hines, J. R. The demand for tax haven operations. *Journal of Public Economics*, 90(3):513–531, February 2006. ISSN 0047-2727. URL <http://www.sciencedirect.com/science/article/pii/S0047272705001350>.
- Devereux, M. and Maffini, G. The Impact of Taxation on the Location of Capital, Firms and Profit: a Survey of Empirical Evidence. Working Paper 0702, Oxford University Centre for Business Taxation, 2007. URL <http://econpapers.repec.org/paper/btxwpaper/0702.htm>.
- Dharmapala, D. What Do We Know about Base Erosion and Profit Shifting? A Review of the Empirical Literature. *Fiscal Studies*, 35(4):421–448, December 2014. ISSN 1475-5890. URL <http://onlinelibrary.wiley.com/doi/10.1111/j.1475-5890.2014.12037.x/abstract>.
- Dischinger, M. Profit Shifting by Multinationals and the Ownership Share: Evidence from European Micro Data. Working Paper 2008-17, Munich Discussion Paper, 2008. URL <https://www.econstor.eu/handle/10419/104255>.
- Dischinger, M. and Riedel, N. Corporate Taxes, Profit Shifting and the Location of Intangibles within Multinational Firms. Discussion Paper, Münchener Wirtschaftswissenschaftliche Beiträge, June 2008. URL <https://epub.uni-muenchen.de/4450/>.
- Dischinger, M. and Riedel, N. Corporate taxes and the location of intangible assets within multinational firms. *Journal of Public Economics*, 95(7):691–707, August 2011. ISSN 0047-2727. URL <http://www.sciencedirect.com/science/article/pii/S0047272710002045>.
- Dischinger, M., Knoll, B., and Riedel, N. The role of headquarters in multinational profit shifting strategies. *International Tax and Public Finance*, 21(2):248–271, April 2014. ISSN 0927-5940, 1573-6970. URL <https://link.springer.com/article/10.1007/s10797-012-9265-5>.
- Dowd, T., Landefeld, P., and Moore, A. Profit shifting of U.S. multinationals. *Journal of Public Economics*, 148:1–13, April 2017. ISSN 0047-2727. URL <http://www.sciencedirect.com/science/article/pii/S004727271730018X>.
- Enterprise, S. G. Handbook for Investors - Switzerland as a Business Location. Technical report, 2016. URL <https://www.s-ge.com/sites/default/files/cserver/publication/free/handbook-for-investors-s-ge.pdf>.
- Feld, L. P. and Kirchgässner, G. The impact of corporate and personal income taxes on the location of firms and on employment: some panel evidence for the Swiss cantons. *Journal of Public Economics*, 87(1):129–155, January 2002. ISSN 0047-2727. URL <http://www.sciencedirect.com/science/article/pii/S004727270100175X>.
- Fuest, C. and Riedel, N. Tax Evasion and Tax Avoidance in Developing Countries: The Role of International Profit Shifting. Working Paper, Oxford University Centre for Business Taxation, 2010. URL <http://eureka.sbs.ox.ac.uk/4300/>.
- Galletta, S. and Redonda, A. Corporate flat tax reforms and businesses' investment decisions: evidence from Switzerland. *International Tax and Public Finance*, pages 1–35, April 2017. ISSN 0927-5940, 1573-6970. URL <https://link.springer.com/article/10.1007/s10797-017-9446-3>.
- Gehrig, P.-O. Konzernfinanzierungsgesellschaften - Quo Vadis Standort Schweiz? Neupositionierung gegenüber dem Ausland notwendig - hausgemachte Probleme lösen. *Der Schweizer Treuhänder*, (4):242–255, 2008.

- Golder, M. Interactions - Standard Errors, May 2017. URL <http://mattgolder.com/interactions>.
- Group, T. T. U. The MacTeX-2017 Distribution, 2017. URL <http://www.tug.org/mactex/index.html>.
- Grubert, H. Intangible Income, Intercompany Transactions, Income Shifting, and the Choice of Location. *National Tax Journal*, 56(1):221–242, 2003. ISSN 0028-0283. URL <http://www.jstor.org/stable/41789665>.
- Haufler, A. and Schjelderup, G. Corporate tax systems and cross country profit shifting. *Oxford Economic Papers*, 52(2):306–325, April 2000. ISSN 0030-7653. URL <https://academic.oup.com/oep/article-abstract/52/2/306/2361757/Corporate-tax-systems-and-cross-country-profit>.
- Hausman, J. A. and Taylor, W. E. Panel Data and Unobservable Individual Effects. *Econometrica*, 49(6):1377–1398, 1981. ISSN 0012-9682. URL <http://www.jstor.org/stable/1911406>.
- Heckemeyer, J. and Overesch, M. Multinationals' Profit Response to Tax Differentials: Effect Size and Shifting Channels. SSRN Scholarly Paper ID 2303679, Social Science Research Network, Rochester, NY, July 2013. URL <https://papers.ssrn.com/abstract=2303679>.
- Hines, J. R. and Rice, E. M. Fiscal Paradise: Foreign Tax Havens and American Business. *The Quarterly Journal of Economics*, 109(1):149–182, February 1994. ISSN 0033-5533. URL <https://academic.oup.com/qje/article-abstract/109/1/149/1850027/Fiscal-Paradise-Foreign-Tax-Havens-and-American>.
- Hoechle, D. Robust standard errors for panel regressions with cross-sectional dependence. *The Stata Journal*, 7(3):281–312, 2007.
- Huizinga, H. and Laeven, L. International profit shifting within multinationals: A multi-country perspective. *Journal of Public Economics*, 92(5): 1164–1182, June 2008. ISSN 0047-2727. URL <http://www.sciencedirect.com/science/article/pii/S004727270700182X>.
- Kalemli-Ozcan, S., Sorensen, B., Villegas-Sanchez, C., Volosovych, V., and Yelsitas, S. How to Construct Nationally Representative Firm Level data from the ORBIS Global Database. Working Paper, National Bureau of Economic Research, September 2015. URL <http://www.nber.org/papers/w21558>.
- Karkinsky, T. and Riedel, N. Corporate taxation and the choice of patent location within multinational firms. *Journal of International Economics*, 88(1):176–185, September 2012. ISSN 0022-1996. URL <http://www.sciencedirect.com/science/article/pii/S002219961200061X>.
- KPMG. Corporate Tax Rates Table, March 2017. URL <https://home.kpmg.com/xx/en/home/services/tax/tax-tools-and-resources/tax-rates-online/corporate-tax-rates-table.html>.
- Lampart, D., Aepli, M., and Tanner, A. Unternehmen müssen Steuern zahlen - Steuergeschenke für Firmen sind volkswirtschaftlich falsch. Technical report, SGB Dossier Nr. 91, 2012. URL http://www.sgb.ch/fileadmin/user_upload/Dokumente/Dossier/91df_DL_MA_AT_Unternehmensbesteuerung.pdf.
- Langli, J. C. and Saudagaran, S. M. Taxable income differences between foreign and domestic controlled corporations in Norway. *European Accounting Review*, 13(4):713–741, December 2004. ISSN 0963-8180. URL <http://dx.doi.org/10.1080/0963818042000237115>.
- Lohse, T. and Riedel, N. The impact of transfer pricing regulations on profit shifting within European multinationals. FZID Discussion Paper 61-2012, University of Hohenheim, Center for Research on Innovation and Services (FZID), 2012. URL <http://econpapers.repec.org/paper/zbwfidp/612012.htm>.
- Lohse, T., Riedel, N., and Spengel, C. The Increasing Importance of Transfer Pricing Regulations – a Worldwide Overview. Working Paper 1227, Oxford University Centre for Business Taxation, 2012. URL <http://econpapers.repec.org/paper/btxwpaper/1227.htm>.
- Markle, K. A Comparison of the Tax-Motivated Income Shifting of Multinationals in Territorial and Worldwide Countries. *Contemporary Accounting Research*, 33(1):7–43, March 2016. ISSN 1911-3846. URL <http://onlinelibrary.wiley.com/doi/10.1111/1911-3846.12148/abstract>.
- Marques, M. and Pinho, C. Is transfer pricing strictness deterring profit shifting within multinationals? Empirical evidence from Europe. *Accounting and Business Research*, 46(7):703–730, November 2016. ISSN 0001-4788. URL <http://dx.doi.org/10.1080/00014788.2015.1135782>.
- Mintz, J. and Smart, M. Income shifting, investment, and tax competition: theory and evidence from provincial taxation in Canada. *Journal of Public Economics*, 88(6):1149–1168, June 2004. ISSN 0047-2727. URL <http://www.sciencedirect.com/science/article/pii/S0047272703000604>.
- Mooij, R. A. d. and Ederveen, S. Corporate tax elasticities: a reader's guide to empirical findings. *Oxford Review of Economic Policy*, 24(4):680–697, December 2008. ISSN 0266-903X. URL <https://academic.oup.com/oxrep/article-abstract/24/4/680/547862/Corporate-tax-elasticities-a-reader-s-guide-to-comparables-under-profit-based-transfer-pricing-methods>.
- Mura, A., Emmanuel, C., and Vallascas, F. Challenging the reliability of comparables under profit-based transfer pricing methods. *Accounting and Business Research*, 43(5):483–505, October 2013. ISSN 0001-4788. URL <http://dx.doi.org/10.1080/00014788.2013.798581>.
- Nations, U. Methodology - Standard country or area codes for statistical use (M49), April 2017. URL <https://unstats.un.org/unsd/methodology/m49/>.
- OECD. Model Convention with Respect to Taxes on Income and on Capital. In *Model Tax Convention on Income and on Capital: Condensed Version 2014*, pages 19–44. 2014. URL http://www.keepeek.com/Digital-Asset-Management/oecd/taxation/model-tax-convention-on-income-and-on-capital-condensed-version-2014_mtc_cond-2014-en#.WWUKo9x_uuU.
- Overesch, M. Transfer Pricing of Intrafirm Sales as a Profit Shifting Channel - Evidence from German Firm Data. SSRN Scholarly Paper ID 955758, Social Science Research Network, Rochester, NY, 2006. URL <https://papers.ssrn.com/abstract=955758>.
- Overesch, M. The Effects of Multinationals' Profit Shifting Activities on Real Investments. *National Tax Journal*, 62(1):5–23, 2009. ISSN 0028-0283. URL <http://www.jstor.org/stable/41790627>.
- PwC. International Transfer Pricing 2015/16. Technical report, 2015. URL <http://www.pwc.com/gx/en/international-transfer-pricing/assets/itp-2015-2016-final.pdf>.
- Raciborski, R. Kountry: A Stata utility for merging cross-country data from multiple sources. *The Stata Journal*, 8(3):390–400, 2008. URL https://www.researchgate.net/publication/24096809_Kountry_A_Stata_utility_for_merging_cross-country_data_from_multiple_sources.
- Ribeiro, S. P., Menghinello, S., and De Backer, K. The OECD ORBIS Database. OECD Statistics Working Papers, Organisation for Economic Co-operation and Development, Paris, March 2010. URL <http://www.oecd-ilibrary.org/content/workingpaper/5kmhds3mzj8w-en>.
- Ruf, M. and Weichenrieder, A. J. The taxation of passive foreign investment: lessons from German experience. *Canadian Journal of Economics*, 45(4):1504–1528, November 2012. ISSN 1540-5982. URL <http://onlinelibrary.wiley.com/doi/10.1111/j.1540-5982.2012.01737.x/abstract>.
- Scholes, M. and Wolfson, M. *Taxes and Business Strategy: A Planning Approach*. Prentice Hall College Div, Englewood Cliffs, N.J., 1992. ISBN 978-0-13-885740-0.
- StataCorp. Stata Statistical Software: Release 14, 2015. URL <http://www.stata.com/products/#>.
- Team, R. C. R: A language and environment for statistical computing, 2017. URL <http://www.R-project.org/>.
- Vicard, V. Profit Shifting Through Transfer Pricing: Evidence from French Firm Level Trade Data. SSRN Scholarly Paper ID 2614864, Social Science Research Network, Rochester, NY, May 2015. URL <https://papers.ssrn.com/abstract=2614864>.
- Weichenrieder, A. J. Profit shifting in the EU: evidence from Germany. *International Tax and Public Finance*, 16(3):281–297, June 2009. ISSN 0927-5940, 1573-6970. URL <https://link.springer.com/article/10.1007/s10797-008-9068-x>.
- Wickham, H. *ggplot2: Elegant Graphics for Data Analysis*. Springer, New York, NY, 2nd edition edition, June 2016. ISBN 978-3-319-24275-0.
- Wooldridge, J. M. *Introductory Econometrics: A Modern Approach*. South-Western, Mason, OH, 4th edition edition, 2009. ISBN 978-0-324-66054-8.