A profit shifting study:
Statutory and effective tax rates, which one tells more?

Erasmus University Rotterdam
Erasmus School of Economics
MSc. Accounting, Auditing, and Control

Author **:** Dwi Afianto Budi Purnomo (456292dp)
Supervisor **:** Dr. Jochen Pierk
Co – reader **:** Dr. Jingwen Zhang

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Dwi Afianto Budi Purnomo

Abstract

Past studies synchronously suggest that the incentive to shift profits into or out of jurisdiction hinges on the tax rates gap between countries, but oppose in how to measure the country tax attractiveness level. Some apply the statutory tax rate due to simplicity and unspoiled by endogeneity, while others choose the effective tax rate as it represents tax base effects. This study performs a comparison analysis of both tax rates measuring profit shifting incentive using two stages of empirical strategy. First, I estimate the effective tax rate using the domestic-only firms to remove the endogeneity. Second, I perform a horse race for both rates and find weak evidence in favor of the effective rate. Moreover, focus on affiliates which the tax incentive variable values are contrary identified by both rates, I find that the use of the statutory tax rate may generate a contradicting regression result to the empirical prediction, especially in country-year that experiences a significant gap between statutory and effective tax rates.

Keywords: Profit shifting, transfer pricing, statutory tax rate, effective tax rate, tax incentive variable

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1. Introduction

There are two common ratios to measure tax burden levels, the statutory tax rate, and the effective tax rate. The statutory rate is the tax rate determined by the tax authority (imposed by law) and applied to firms' taxable income. Some countries apply progressive tax rates, meaning that higher tax rates charge higher income level. The effective tax rate is the relative of actual tax paid to firms' total income. In general, the effective tax rate is lower than the statutory rate due to several reductions in tax base (i.e., tax exempted profit, tax credits, or different depreciation rules).

In the empirical study, both rates have their caveat. Some researchers apply the statutory tax rate due to simplicity and untainted by endogeneity, while others choose the effective tax rate as it also represents tax base effects. Specifically, the first group argues that the effective tax rate endogenous to firm characteristics as it reflects business decisions made by the firm. Not limited to common tax avoidance research, the debate also escalates to the field of international taxation study. Acknowledge that past studies synchronously suggest that the incentive to reallocate firms profit into or out of jurisdiction depends on the tax rates gap between countries, but oppose in how to measure the tax rate, inspires me to answer the following research question:

RQ: Between statutory and effective tax rate, which one is better in measuring profit shifting incentive?

To find the answer above question, I adopt an empirical method introduced by Huizinga and Laeven (2008). The model point outs that the multinational firm affiliates reported profit depends on true income and the tax-motivated profit shifting incentive. The profit shifting incentive is defined as a function of multinational international profit structure and tax rate gap between countries where the multinationals operate. I use two stages of empirical strategy. First, I estimate the effective tax rate of each country-year using locally-domiciled-only firms where profit shifting opportunities are non-existing. This approach is necessary to hinder the effective tax rate from an endogenous relationship with reported profit. I assume that domestic-only firms behave in accordance to the multinationals in term of tax avoidance.

Second, employing country-level aggregated financial data of multinational firms domiciled in European Union countries, specifically 41,548 affiliate-year observations, I obtain corroborating results to prior studies to the extent of the relationship between reported profit, income shifting variable, production factors, and productivity level. I utilize Huizinga and Laeven

(2008) profit shifting model to perform a horse race for both tax rates in estimating tax incentive variable (C) and find weak evidence in favor of the effective tax rate. Moreover, by focusing on sub-sample which the tax incentive variable values are contrary identified by the statutory and effective rate, I find that the use of statutory tax rate may generate a contradicting regression result to the empirical prediction, especially in country-year that experienced a significant gap between statutory and effective tax rates.

This thesis contributes to the international taxation study by presenting evidence that the use of the statutory tax rate to gauge the tax-motivated profit shifting incentive has less explanatory power and may lead to a contradicted-to-empirical-model result. To my knowledge, this study is the first that compare the statutory and the effective tax rate to observe the association between reported profit and profit shifting incentive using the empirical model that accommodates the shifting possibility across multinational subsidiaries. The findings suggest that the researcher should not neglect the erroneous possibility when measuring tax incentive variable using the statutory tax rate. The multinational managers may have a better tax rate standard in their international tax policy. Finally, the tax authorities or governments may not only look at the statutory rate when comparing their current tax position relative to other nations.

The thesis goes as follows: Chapter 2 outlines prior literature constructing a theoretical framework of this study. Chapter 3 summarizes pieces of writing in the preceding section and hypotheses development used to answer the research question. Chapter 4 illustrates the research methodology and the sample selection process. Chapter 5 presents and elaborates the results of primary and additional tests. Last, Chapter 6 sum all previous sections up with focus on the findings, limitations, and idea for future research.

2. Theoretical background and literature review

This section outlines prior literature constructing a theoretical framework of this study. It begins with brief illustrations of international taxation and profit shifting theory. Next subsection elaborates some evidence on how the multinational firms manage their income internationally and benefit by reducing their tax burden via profit reallocation. Last, comparison profit shifting literature that use either statutory or effective tax rates are presented.

2.1. Fair taxation principle, tax harmonization, and profit shifting

Most countries enforce both income and consumption taxes. The income taxes are based on net income over a specified period, whereas the consumption taxes rely on good and service expenditures at the time of the transaction. Focus on the former one; there are two significant determinants of income tax, tax base and tax rate (Bartelsman and Beetsma, 2003). OECD (2014), in its guidelines, shows that majority countries formulate their tax base definition to encompass all kinds of income acquired by entities whatever their nature. Tax rate refers to the ratio set by the fiscal authorities in which a tax subject (either person or firm) is taxed. This thesis concentrates on the income taxes with the tax subject adhere to companies (corporate income tax – CIT) instead of individual income tax.

OECD (2014) determines effective and fairness as two of the principles in designing tax policy. Globalization has brought income taxation into new complexities level by introducing cross-border transactions. Country tax rules have to incorporate two cross-border conditions: the taxation of inbound foreign investments and the taxation of outbound investments from its residents. As Markle (2016) explains in his work, there are two general principles of foreign income taxes that all countries must conform to reach fairness principle. First, the country where the income is generated has the right to levy the tax. Second, it is only one tax per each dollar profit. These principles mean that countries should levy the right amount of taxes at the right time while avoiding double taxation and unintentional non-taxation at the same time.

Considering cross-border characteristics, it is not an easy task for any tax authorities to impose these two principles. Despite the ongoing economic integration, such as applying single currency Euro and increasing trading volume of intermediate goods brought by free trade policy, no consensus on single tax system brings income taxation remaining to be national issues among European Union (EU) countries (Huizinga and Laeven, 2008). Each country applies different rates

and tax base on corporate income taxation. On the other hand, companies consider taxation as an avoidable cost rather than a contribution to society on the investment of social infrastructure and social capital (Sikka and Willmott, 2010). As a result, firm managers maximize their shareholders' value by reducing the firm's tax burden. Specifically, to reduce the tax burden, the multinational firms may move their income into countries with a lower tax rate than their home country.

2.2. Profit shifting behavior

As describe before, the multinationals have opportunities to avoid paying more taxes by exploiting the differences tax rates and laws between countries. Hanlon and Heitzman (2010), in their review study of tax research, suggest that tax rates are a crucial determinant in the transfer price established. Massive studies investigate the relationship between tax rate and reported profit. Grubert and Mutti (1991) present evidence that the affiliates of U.S. multinational report more profit in low tax jurisdiction rather than those located in a country with higher tax rate. Using cross-sectional data of U.S. manufacturing subsidiaries in 33 countries for the year 1982, they show that the reported profit pattern above is consistent with income shifting behavior. They utilize two measures of income, the ratio of profit to host country (local) sales and profit to local equity, as the dependent variable in the regression on local tax rate (as the independent variable) and find a negative relationship between tax rate and profit. Harris et al. (1991) confirm this finding by reporting that U.S. multinationals with foreign affiliates domiciled in lower tax jurisdiction pay significantly low tax to U.S. government. The results show that affiliate local tax rates are a significant determinant of U.S. multinational reported profits.

Concerning on the widespread uses of tax havens that are possibly threatening domestic tax base, Hines and Rice (1994) investigate the relationship between U.S. multinational foreign affiliates and host country tax burden. Employing sample of non-bank U.S. multinational affiliates in 41 countries identified as tax havens in 1982, they show evidence of the negative relationship between foreign affiliates reported income and host country tax rates. In general, sample firms report maximum foreign profits when the local tax rates are around 5-8%. The result implies that the U.S. multinationals can reallocate a material part of their income from high tax jurisdiction country (U.S.) to their affiliates in tax haven countries (low tax rate nation). Lastly, they suggest that U.S. tax revenues are sensitive to low tax rates in tax haven countries. Taking into account the

worldwide system adopted by U.S., cheap tax rates on tax haven countries may benefit U.S. tax revenue collections thanks to fewer foreign tax credits (Hines and Rice, 1994).

Another indirect evidence comes from Bartelsman and Beetsma (2003), they point out that increasing tax rates does not improve national tax revenues; instead, it alleviates companies reported profits. Ceteris paribus in tax base (firm reported profit is unchanged), a one percent increase of statutory tax rate reduces corporate income tax revenue by three percent. They use sectoral data of OECD countries as a representation of large economies and find that the multinationals (both parent and affiliates) domiciled in high tax rate countries also conduct transfer pricing. Further, tighter enforcement level of transfer pricing rules in high tax rate country may decrease the return on investment and reported profit, implying a need for cross-border coordination when designing transfer pricing policies.

Hines and Rice (1994) argue that there are three main technique of transfer pricing: via debt contracts, strategic valuation of transfer prices, and conversion of U.S. export income into tax haven income. Grubert (2003) confirm the first by depicting evidence that allocation debt among affiliates and the income from intangible assets (R&D) together explain the all observed variance of income from differential tax rates. Dharmapala and Riedel (2013) emphasize that the strategic use of debt is the most superior driver of profit shifting effects. Heckemeyer and Overesch (2013) support the second channel by suggesting that the vital profit shifting channels are transfer pricing and licensing. Two-thirds of the shifting is driven by tax-motivated adjustments of intra-group transactions. Beer and Loeprick (2015) show that intangible asset and supply-chain complexity explain the shifting trends. In line with last channel hypothesis, Markle and Shackelford (2012) argue that domicile in tax haven countries benefits the multinationals a lower effective tax rates.

Another study about the shifting behavior is Dischinger, Knoll, Riedel (2014) that present evidence on profit shifting pattern between headquarter (HQ) and subsidiaries locations. The profit shifting out of the HQ country is unlikely to occur when the parent country has a higher tax rate. On the other hand, the shifting activities towards parent firm are massive when the parent located in a country with a lower tax rate than the affiliates. Mintz and Smart (2004) argue that domestic-firms also engage profit shifting activities exploiting tax rate differentials in sub-national or provincial level. Beuselinck and Pierk (2018) indicate that the multinationals focus more on engaging local tax avoidance in more recent years. Markle (2016) shows evidence that firms

engage profit shifting regardless of the taxation system (either territorial or worldwide) of their domicile country. However, the firms domiciled in the territorial system shift more profit than in the worldwide. De Simone (2016) argue that the multinationals face more flexibility to shift their profit upon IFRS adoption as it introduces a wider range of arm's length comparison.

Several studies focus on how to prevent the shifting behavior. Buettner et al. (2012) assert that the application of thin capitalization rules effectively shifts the use of intragroup debt (as a channel of income shifting) towards external debt. Using panel data on European multinationals, Lohse and Riedel (2013) reveal that regulating transfer pricing reduce the shifting activities significantly. Since the effect is notable in economic scale, they suggest the legislative to impose such rules, though it induces the administrative burden on firms and tax authorities. Beer and Loeprick (2015) find that two years after the introduction of transfer pricing documentation (tp-doc) requirements, the estimated profit shifting between affiliates fall by 52%. The tp-doc is powerful to reduce transfer pricing under supply-chain complexity strategy. However, it is not useful to counteract transfer pricing through intangible asset channel. Beuselinck et al. (2015) suggest that a country's tax enforcement level plays a vital part in international profit shifting. The income shifting activities are more pronounced in a country with a high tax rate and a weak tax enforcement level. The private multinationals abuse more the weak enforcement level than the public firms. It emphasizes the importance of a strong tax authority with all its instrument to hinder the profit shifting behaviour.

2.3. Statutory and effective tax rates

Prior studies use either statutory tax rates or effective tax rates to measure tax burden level. Statutory rates are the tax rates determined by the tax authorities (imposed by law) and applied to firms' taxable income. Some countries apply progressive rates, meaning that higher income level are charged by higher tax rates. Effective tax rates is the relative of actual tax paid to firms' total income. In general, the effective tax rate is lower than the statutory rate due to tax exempted profit, tax credits, or loopholes in tax rule. At the end, the statutory rate is just a starting point or a determinant in measuring tax burden.

Grubert and Mutti (1991) find that the investments in affiliates are related to host country statutory and effective tax rates. In their regressions results, the statutory rate has more explanatory power than the effective rate. However, they find equal R^2 when controlling the gross domestic

product growth in the model. Huizinga and Laeven (2008) develop an empirical model of international profit shifting incentives and opportunities induced by tax rate differential. The model captures shifting possibility, not only transfer between parent and affiliates, but also between affiliates in different host countries. They use the statutory tax rate to measure the tax gap and find a negative semi-elastic relationship between pre-tax profit to tax rate at 1.3 and shifting cost to tax base at 0.8. It implies that a one percent increase in the statutory rate, on average, is associated with 1.3% decrease in reported pre-tax profit. In their robustness test, adopting Hines and Rice (1994) model and regress pre-tax profit on the average effective tax rate, they find similar result but at lower coefficient and suspect it is due to the cross-sectional differences (country characteristics) in their sample. Relying on Grubert and Mutti (1991) finding, De Simone (2016) suggests that the effective tax rate is not a rival to the statutory rate when computing tax-motivated profit shifting incentive. She addresses the potential endogeneity introduced by the effective rate. Dharmapala (2014) adds that effective tax rate reflects business decisions made by the firm.

In the other side, several studies apply effective tax rate rather than the statutory for some logical justifications. Klassen et al. (1993) investigate geographic income shifting behavior in response to the changes of the tax rate. Conducting research based on 191 U.S. multinationals during 1984-1990, they find evidence that U.S. firms shift income into the U.S. from Canada following increasing Canadian tax rates. At the other period, when European countries lower their tax rates around 1985 and 1986, the U.S. multinationals shift income out to Europe. The magnitude of the income shifting, in general, is statistically and economically significant (10% to 20% of income). Klassen et al. (1993) point out two reasons why they prefer the effective rate than the statutory. First, without further explanation, they argue that the appropriate statutory rate for U.S. firm affiliates in host countries is not apparent. Second, their choice implicitly covers permanent differences caused by the difference between accounting and tax basis. However, in an untabulated result, they suggest that they find similar results when conducting a preliminary analysis using the U.S. statutory tax rate for the same sample firms.

Devereux and Griffith (1998) point out that the average effective tax rate of a host country does play a significant role for U.S. multinationals when choosing their production area in Europe. Keller and Schanz (2013) argue that the statutory tax rate is an unsuitable proxy for country tax attractiveness level as it neglects tax base effect. Constructing their tax attractiveness index with the higher values show more appealing a country is, they find a positive relationship between

statutory tax rate and tax attractiveness index, particularly in Europe, which means that higher the statutory tax rate reflects more attractive the country from the tax point of view. For example, Luxembourg, Malta, and the Netherlands have larger statutory tax rate (more than 25%), but they are more tax attractive than Bulgaria, Lithuania, and Romania (less than 17%). It is opposite to taxation concept that says a high tax rate means more tax burden.

3. Hypothesis development

Summarize pieces of literature in the prior section, profit maximization is the primary goal of firms. Maximizing profits can be done either by boosting incomes or reducing expenses. The multinationals behavior portrays the pursuit of after-tax incomes, of which tax expense minimization as one channel (Hines and Rice, 1994). Multinational firms have opportunities to maximize their profits through income shifting from high taxes country to the low taxes. Numerous literature flood evidence about tax-induced profit shifting behavior by confirming the negative correlation between reported profits (either parent or subsidiaries) and local tax rates. Grubert and Mutti (1991) find an inverse relationship between the reported profit of cross-border subsidiaries and related host countries tax rates. Hines and Rice (1994) suggest that U.S. tax revenues are sensitive to low tax rates in tax haven countries. Taking into account the worldwide system adopted by the U.S., lower tax rates on tax haven countries may benefit U.S. tax revenue collections thanks to fewer foreign tax credits. Given the many empirical evidence, the existence of profit shifting between tax jurisdictions by multinational firms is undeniable.

Likewise, prior studies provide shreds of evidence about the determinants of profit shifting behavior between countries. Heckemeyer and Overesch (2013) study supports the hypothesis that the incentive to transfer the profits into or out of a jurisdiction hinges on the tax rates gap between countries. They predict a semi-elasticity of 0.8 of reported pre-tax profit to the extent of the countries tax rate differentials. Whereas, Huizinga and Laeven (2008) suggest a higher semi-elasticity value (at 1.31) using European Union firms as a sample. Bartelsman and Beetsma (2000) suggest that increasing corporate tax rate is a backfire for country tax revenue collections as the multinational firms react by decreasing their reported profits in the related country.

However, there is no unanimous consent among researchers in their approach regarding what tax rates should be used to measure tax differentials. Some choose statutory tax rate to measure the tax-motivated transfer pricing incentive, for example, Grubert and Mutti (1991), Huizinga and Laeven (2008), De Simone (2016), and Markle (2016). The first finds that statutory rate appears a better determinant of tax-induced income shifting than the effective tax rate. Based on this finding, De Simone (2016) argues that the use of effective tax rates is worthless given the potential endogeneity related to reported profits. Similarly, Dharmapala (2014) point outs that effective tax rate reflects business decisions made by the firm.

On the other hand, others have a different opinion, such as Klassen et al. (1993) propose two reasons in favor of the effective rate. First, the appropriate statutory rate for U.S. firm affiliates in host countries is vague. Some countries enforce national and sub-national tax rates, whereas it is also common in practice that a country sets different tax rates on the different type of incomes. As an example, German companies are subject to two taxes, corporation tax and municipal trade tax (Huizinga and Laeven, 2008). Another example, Ireland tax authority imposes 12.5% on trading income and a double rate (25%) on non-trading income (Delloite, 2018). Second, Klassen et al. (1993) argue that effective tax rate implicitly covers permanent differences brought on by accounting and tax basis differences. Similarly, Keller and Schanz (2013) suggest that the statutory tax rate is an unsuitable proxy for country tax attractiveness level as it neglects tax base effect.

It is interesting to conduct further research as a contribution to the debate. Excellent empirical research requires valid and reliable constructs or proxy measurements. Construct validity captures the degree of a variable operationalizing the underlying theory, while reliable construct is to what extent a measurement provides a consistent estimation. Failed to choose a reliable and valid variable could bias the empirical results. Some had tried to compare both tax rates before, though they were not as the primary test, and found weak evidence or equal result. As stated above, Grubert and Mutti (1991) use both rates as regressors to foreign affiliate reported profits and find higher explanatory power in the statutory rates. However, after controlling the GDP growth in the model, the result does not hold anymore since both rates have similar explanatory power. In another comparison, when Hines and Rice (1994) replacing effective tax rates with statutory tax rates in the robustness check, they find that the changes do not significantly affect the results. Important to note, the two studies model do not consider the income shifting possibility between affiliates (Huizinga and Laeven, 2008), rather focus on the relationship between parent and affiliates only.

The dispute between statutory tax rate and effective tax rate arises from the conjecture that the former fails to capture all tax expense determinants, while an endogeneity problem is attached to the latter. If one can provide tax rates with more reasonable accuracy level or mitigate the endogeneity adhere to the effective tax rates, the debate might be allayed. Among those two alternatives, the second seems more feasible to be done. To alleviate the endogeneity issue, I propose to utilize the local firm effective tax rates instead of all firms domiciled in the country. Empirical evidences depict how taxation influences the multinationals decision in international

profit shifting. Hines and Rice (1994) point out that the multinational firm characteristics also affect the affiliates reported income (i.e., a policy of profit distribution between affiliates and or parent). As effective tax rate is a function of tax expenses over income, this relationship reflects an endogeneity. However, one may look at domestic-only firms as there is no possibility to shift income into or out of tax jurisdictions as a solution.

Theoretically, the multinationals income shifting behavior does not associate with the domestic-only firm's effective tax rate as both refer to different entities. However, this concept assumes that the multinationals behave similarly with the domestic firms regarding tax avoidance. Markle and Shackelford (2012) find a small difference between the multinationals effective tax rate and the domestic-only. Nevertheless, the difference is not consistent and the magnitude is narrow. Another evidence comes from Dyreng et al. (2017) that observing changes in corporate effective tax rates over the last 25 years. Utilizing U.S. firms as research objects, they fail to reject their second hypothesis and find out that the effective tax rates of multinationals and purely domestic firms are decreasing over time at similar rates. The inconsistency shows that MNCs do not always pay less or more taxes than domestic firms. Therefore, one may assume similar behavior in tax avoidance between the multinationals and the local firms in term of effective rate.

Before observing which profits-shifting incentive number that is more suitable, it is necessary to identify whether the two tax rates generate different results for the tax incentive value or not. It is worthless to compare the two arguments when both tax rates estimate similar numbers. Therefore, I propose my first hypothesis as:

H_1: *In general, tax incentives computed by the statutory tax rates differs from the one generated by the domestic-only firms effective tax rates.*

The first hypothesis will be the foundation to answer the research question through the final hypothesis. After understanding that tax incentive variables generated by those two tax rates are different, a comparison between two variables may answer the research question. Nevertheless, due to competing arguments and inconsistent result in prior literature, I make no preference prediction on which rate better is and state the final hypothesis in null form as below:

H_{2o}: *The tax incentive variable computed by the statutory rate has equal explanatory power in reported income compared to one generated by the domestic-only firm effective tax rates.*

4. Research methodology

The objective of this study is to compare effective and statutory tax rate in measuring tax incentive and opportunity between countries. Different from common research model which observing the association between the independent and the dependent variable, this study focuses on variable selection test to obtain the fittest proxy. This section briefly describes the empirical model, specific assumptions, and statistical method to test both hypotheses; variables description and calculation; and finally sample selection process.

4.1. Tax rates input

Theoretically, foreign income is a subject of three tax components: affiliate domicile (host country) income tax, host country withholding tax, and parent domicile (home country) income tax. The affiliates pay host country income tax for their reported income and withholding tax when shifting part of their income (i.e., as a dividend, interest, or royalty) to their parent in a different jurisdiction. In general, the withholding is a subject of tax credit against the home country income tax. The parent pays home country income tax for the foreign income received if there is a residual income after deducting the tax credit. When the foreign tax credit exceeds the parent local tax liabilities, it is likely to avoid the home country income tax.

The three components imply the importance of identifying the repatriation plan for each multinational. Due to the data limitation, it is impossible to identify the repatriation plans. Therefore, I adopt a prior literature assumption that all repatriations are deferred indefinitely rather than immediate plan. After reviewing securities filings from 307 firms, Bloomberg News estimates that, until 2013, the U.S. multinationals have accumulated almost $2 trillion outside the U.S. (Rubin, 2014). Based on this remarkable data, Markle (2016) suggests that immediate repatriation assumption might be unreasonable. The indefinite deferral assumption implies that only host country tax rate is relevant because without dividend payment to the parent means no withholding tax in the host country and foreign income tax from residual income in the home country.

As stated in the prior section, some countries apply more than one tax rates either imposing a national and a sub-national tax rate or charging different tax rates based on the type of income or industry. To accommodate this fact, I follow Huizinga and Laeven (2008), De Simone (2016), and Markle (2016) by employing "the adjusted top statutory tax rate." Since the adjusted tax rate

incorporates both national and sub-national tax rates, Huizinga and Laeven (2008) argue that the adjusted tax rate reflects the various level of taxation in a country.

I adopt the definition of the effective tax rate from Klassen et al. (1993) and Markle and Shackelford (2012) that define the effective tax rate is a function of tax expense divided by pre-tax income (ETR = tax expense / pre-tax income). Specifically, as described in the prior section, I utilize the local-firm-only effective tax rate instead of the tax rate from all firms domiciled in a country. Considering fact that some observation countries apply dual level of tax rates (national and sub-national) and the evidence from Mintz and Smart (2004) that shows profit shifting behavior occurs within a country, I aggregate all establishments (parent and affiliates) tax expense and reported profit in the same group and country before calculating the effective tax rate. Next, I estimate the average value of the effective tax rate from the aggregated data and adopt Markle and Shackelford (2012) approach by limiting the sample to observations with effective tax rate from zero to maximum rate at 70%.[1] The sample selection process for calculating effective tax rate is depicted in Table 1, Panel A. Panel B contains the sample distribution of effective tax rate calculation. Appendix I shows statutory and effective tax rates per country-year used in this study.

I do not follow prior researches that use marginal tax rate such as Fullerton (1984) or Devereux and Griffith (1998), because this study investigates the profit shifting incentive. While the marginal tax rate is related to investment decisions study, such as production location choice of the multinationals, and does not capture incentive to accommodate new capital (Markle and Shackelford, 2012).

Table 1. Composition of observations to calculate effective tax rate

Panel A: Sample selection process

	Observations
Parent or subsidiaries without foreign affiliates	418,242
Less:	
financial, insurance, and public service firms	28,222
observations with consolidated reporting basis	59
missing or negative aggregate profit and tax expense	119,079
aggregated to national level	160,636
observations with ETR other than 0% - 70%	5,368
Total sample	104,878

[1] Markle and Shackelford (2012) use the effective tax range of 0 – 0.7 in the worldwide firm sample. Klassen et al. (1993) use tax range of 0.2 – 0.75 in the U.S. sample. Langli and Saudagaran (2004) use 0.1 – 0.6 tax range in the Norway sample. I follow Markle and Shackelford (2012) because part of our samples share similar location (overlapping in European countries).

Panel B: Affiliate-year sample distribution of effective tax rate (ETR)

Country	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Austria	5	23	67	96	105	114	118	131	146	48	853
Belgium	102	99	99	112	126	128	142	169	195	49	1,221
Bulgaria	-	-	-	-	-	-	-	2	2	-	4
Czech Republic	4	5	2	4	6	4	7	8	8	2	50
Germany	555	611	663	813	848	902	969	901	818	123	7,203
Denmark	-	-	-	-	-	251	255	309	345	347	1507
Spain	412	445	490	572	592	579	689	757	847	395	5,778
Finland	697	861	790	897	1,209	1,366	1,545	1,640	1,630	901	11,536
France	629	679	683	776	936	1,074	1,224	1,277	1,186	584	9,048
United Kingdom	1,407	1,646	2,341	3,087	3,426	3,764	4,325	4,877	5,159	4,490	34,522
Hungary	10	7	5	9	4	9	7	10	12	10	83
Ireland	15	21	22	26	21	27	34	44	38	13	261
Italy	561	599	639	778	834	796	888	1,025	1,171	183	7,474
Luxembourg	-	-	-	1	2	2	4	5	4	-	18
Latvia	2	3	14	44	56	68	79	84	75	11	436
Malta	-	9	11	11	14	13	17	11	5	-	91
Netherlands	116	153	200	226	254	266	294	355	335	173	2372
Poland	253	255	299	350	383	394	461	470	386	154	3,405
Portugal	-	-	-	117	95	100	165	177	203	7	864
Sweden	1,608	1,583	1,772	1,982	2,056	2,070	2,280	2,322	-	2,454	18,127
Slovakia	-	-	1	1	1	-	4	7	5	6	25
Total	6,376	6,999	8,098	9,902	10,968	11,927	13,507	14,581	12,570	9,950	104,878

Limitations arise when calculating the effective tax rate. First, to the extent of validity level, cash taxes paid is the supreme numerator. In general, actual cash taxes paid data are confidential, and companies are only mandated to disclose total tax expense in the financial statement. Markle and Shackelford (2012) argue that none of the prior studies has more advanced measure than total tax expense. Further, they point out that they end up in a similar qualitative conclusion when using total tax expense as numerator compared to cash taxes paid. Thus, I rely on this suggestion to use total income tax expense as the numerator in effective tax rate calculation.

Second, the available data do not spread evenly among observation countries. There are no financial statement data in some countries, for example, Cyprus, Estonia, Greece, Lithuania, Romania, and Slovenia. While, other countries, such as Czech Republic, Latvia, and Malta have only a few observations per year. The uneven data spread could skew the sample distribution and bias the mean effective tax rate per country-year. To reduce the risk, I decide to include median of the effective tax rate as an alternative proxy of the effective tax rate.

4.2. Model to test hypothesis 1

Following Huizinga and Laeven (2008), De Simone (2016), Markle (2016), I measure the tax incentive variable for each affiliate using the following formula:

$$C_{it} = \frac{1}{(1-\tau_{it})} \frac{\sum_{k \neq i}^{n} \frac{B_{kt}(\tau_{it}-\tau_{kt})}{1-\tau_{kt}}}{\sum_{k=1}^{n} \frac{B_{kt}}{1-\tau_{kt}}} \quad (1)$$

where

C_{it} the tax incentive and opportunity variable of parent or affiliate *i* in year *t*

τ_{it} the statutory or effective tax rate of parent or affiliate *i* in year *t*

τ_{kt} the statutory or effective tax rate of parent or affiliate *k* in year *t*, where *k* start from 1 to *n*, where *n* is the number of affilates controlled by the parent

B_{kt} the true income (using aggregated operating revenue ~item *opre*~ as a proxy) of parent or affiliate *i* in year *t*

Huizinga and Laeven (2008) develop an index that measure cross-country incentive and opportunity to reallocate income between members of a multinationals. Distinguished from old model (i.e., Hines and Rice, 1994) that covers only tax gap between parent and subsidiaries, the index takes into consideration the revenue-weighted differential tax rate of all group members. Appendix II presents example calculations of the tax index (*C*). They explain in their work that the *C* model is derived based on three assumptions: the multinationals maximize their global after-tax profits; to the extent less true profits in a country, shifting cost increases in proportion to the scale of shifted income to true profits; and the shifting cost is tax deductible. A positive value of C_{it} implies that the multinational is expected to understate reported profit as it has an incentive to shift income out of country *i*, whereas a negative value of C_{it} represents an incentive to shift income into country *i*. Past studies find conformable evidences that there is a negative correlation between *C* and reported pre-tax income, in line with Huizinga and Laeven (2008) prediction.

Markle (2016) suggests that true income and *C* measure may contain an error caused by the difference of accounting standard (i.e., local GAAP or IFRS). It is possible that a country's local GAAP recognizes common income shifting channels such as royalties, management fees, or interest as part of operating revenue, while IFRS excludes them. The different treatment may reduce the proxy's accurate level. Nevertheless, De Simone (2016) suggests that a majority firm

in Europe start to use IFRS since 2005 on their unconsolidated report. Therefore, I choose to limit the sample observations on European Union firms to get benefit from the harmonization of accounting standard in alleviating the potential measurement error. Important to note, this sample choice does not entirely mitigate the possibility that the cross-country variation in revenue classification may impair the measurement accuracy.

Recall that the first hypothesis aims to investigate whether there are value differences in estimated tax incentive variable from statutory tax rates (*Cstr*) and effective tax rates (*Cetr*), I employ paired-samples t-test to compare those two values. Since t-test sensitives to outliers and requires an approximately normally distributed assumption, I winsorize the sample at 5% on both higher and lower percentiles. The paired t-test demands only an approximately normal data because it is quite "robust" to the violation of normality distribution. It means that the test still generates valid results even though there is little violation of the normality assumption.

Further, to support the outlier assumption, I perform the Wilcoxon matched-pairs signed-ranks test. The Wilcoxon signed-ranks test does not sensitive to outliers as it tests the median difference rather than the mean difference. Both tests state the null hypothesis that both sample group distributions are equal; therefore a *p-value* lower than 5% will reject the null and give evidence that the two *C* values are different.

4.3. Model to test hypothesis 2

To compare those two rates, I utilize a model developed by Huizinga and Laeven (2008). Most literature before Huizinga and Laeven (2008) use the tax rate differences between parent and affiliate country to capture the income shifting incentive. Thus, Markle (2016) argues that the prior models neglect the opportunities to shift profit among affiliates within the group. The empirical model from Huizinga and Laeven (2008) is a modified Cobb-Douglas production function and estimates that the reported profit as a function of capital inputs (assets), labor, general productivity item (gross domestic product), and tax incentive variables. Below is the regression equation:

$$\text{LnPLBT}_{it} = \beta_0 + \beta_1 C_{it} + \beta_2 \text{LnASSETS}_{it} + \beta_3 \text{LnLABOR}_{it} + \beta_4 \text{LnGDP} + \Sigma\ \text{FixedEffects} + \varepsilon_{it} \quad (2)$$

where

Ln PLBT_{it} natural logarithm of profit before taxes (item *plbt*) on the unconsolidated level of affiliate *i* in year *t*

C_{it} tax incentive variable as calculated in prior hypothesis using statutory tax rate (*Cstr*) and effective tax rate (*Cetr*)

Ln $ASSETS_{it}$ natural logarithm of tangible fixed assets (item *tfas*) on the unconsolidated level of affiliate *i* in year *t*

Ln $LABOR_{it}$ natural logarithm of compensation expenses (item *staf*) on the unconsolidated level of affiliate *i* in year *t*

Ln GDP_{it} natural logarithm of million U.S. dollar value of country's per capita GDP (gross domestic product) for affiliate *i* in year *t*

All variables other than *C* and fixed effects are transformed into natural logarithm value to mitigate abnormal distribution in the sample. Consistent with De Simone (2016) and Markle (2016), I include parent country fixed effects in the model to control the possibility of systematic differences in reported profits between groups. Inaccurate estimation of a country taxation level may occur due to the imperfection adhere to the effective tax rate calculation method as described before. For example, given that the mining sector has the lowest taxes compared to other sectors, a country with disproportionately great observations in such sector might appear to have low tax rate when industry mix drives it. To control such potential distortion, I include industry fixed effects. Time fixed effects are added to control for any differences between observation periods.

The coefficient β_1 represents the estimated main effect of the tax incentive variable C_{it} to reported profit. Consistent with prior literature as described in the preceding subsection, I expect a negative coefficient of β_1. *Ln ASSETS*, *Ln LABOR*, and *Ln GDP* control for production factors to predict reported income. I expect the coefficients of the first two production variables to be positive, in line with the economic theory that point out a higher input of production generates greater profit. However, there is no prediction for *Ln GDP* as past studies show mixed evidences. Huizinga and Laeven (2008), and Markle (2016) find a negative relationship between productivity and pre-tax income, whilst Beuselinck et al. (2015) and De Simone (2016) obtain a positive relationship.

As mentioned before, this study focuses on variable selection test to obtain the fittest proxy. To do so, I compare the explanatory power of the regression equation above using *Cstr* and *Cetr*. R-squared (R^2) is a statistic that measures the ratio of variations explained by the model to the total variations of the dependent variable (Y). Note that R^2 value ranges between 0 and 1, $R^2 = 1$ indicates that model perfectly fit to explain all variability of Y, while the lowest extreme $R^2 = 0$

implies that model explains nothing about the variability in Y. Acknowledging that it is imperfect and subject to manipulation (i.e., inflating the R^2 by adding many unjustified predictors), I use adjusted R^2 instead. The adjusted R^2 is increased only if the new variable improves the model more than just by chance and decreased when the additional variable improves less than the expectation.

R^2 is seemingly an intuitive measure of how fit the model explains variation in the data, but a higher R^2 or adjusted R^2 does not necessarily indicate the model's goodness level. Thus, I adopt Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC). AIC and BIC are often used to perform model comparison. Although originated from different assumptions (AIC is based on information theory and BIC is based on large sample asymptotic), both share similar purpose to examine whether the empirical model adequately explains the essential features of the data. Burnham and Anderson (2002) explain that the chosen model is the one with the smallest variance of its probability distribution from the true distribution (the Kullback-Leibler distance). A lower AIC and BIC score indicates a better fit model.

The predictive validity framework ("Libby boxes") shown in Appendix III presents the operational model for second hypothesis (H_2).

4.4. Data source and sample selection

The financial data are obtained from the Amadeus database managed by Bureau van Dijk. The Amadeus provides accounting data of public and private firms on the unconsolidated level as well as the ownership information. Information such as tax expenses and earnings before income taxes are available to calculate effective tax rates per firm-year level under the first hypothesis. The database also contains data of reported profits, expenses, and assets to run regression based on the empirical model in the second hypothesis. Data of the statutory tax rates are available through KPMG's corporate tax rates table, whereas the World Bank database provides the country level gross domestic product (GDP) per year.

This study focuses on European firms due to several reasons. First of all, the available data for the U.S. are mostly for public firms. Beuselinck et al. (2015) show evidence that private multinationals which the parent domiciled in a weak tax jurisdiction shift income to foreign affiliate more than public multinationals. It means that excluding private firms from sample possibly alter the result. Second, as stated in the previous subsection, European setting might benefit this study from the standard harmonization under the mandatory of IFRS (De Simone,

2016) as the comparable accounting treatments drive a conformity in reported accounting numbers across the sample.

The sample periods are last ten years of the available data. Since the year 2017 financial data are not fully collected yet in the database and the most current year of available GDP's data is 2016, I stop the observation periods one year earlier, stretching from 2007 to 2016. Following Markle (2016), I apply different sample criteria for *C* and the main sample due to data availability. For a domestic firm to be included in *C* calculation, it requires data of operating revenue (*opre*), tax expense (*taxa*) and profit before tax (*plbt*). However, to be incorporated into main sample, all data of pre-tax profit (*plbt*), tangible fixed assets (*tfas*), and compensation expense (*staf*) is needed.

To perform analysis of the H_1, I begin with computing tax incentive variable (*C*), first, by collecting all parent firms from the database. Consistent with Markle (2016), I define a firm as a parent if it controls (at least) one affiliate and uncontrolled by another entity. Using the group identifier, I retrieve all related subsidiaries and then removing the observations without foreign affiliates; that classified as financial, insurance, or public service; and that reported at a consolidated level. Then I standardize all financial number to U.S. dollar and aggregate all observations in the same group-country-year at the national level. As the *C* is altered when the affiliate reporting loss (De Simone, 2016), I drop observations with an aggregated loss. Multinationals without foreign affiliate domiciled in EU are also deleted as well. Last, I remove observations that the database misidentifies their parents and those whose domicile countries have no effective rate data.

The sample selection process for second hypothesis almost similar with the process in the first hypothesis, except I choose parent with foreign subsidiaries (rather than domestic subsidiary only) and use the different requirement of financial data as stated before. Total sample used in the H_2 analysis contained 41,548 observations. The lower number of observations in H_2 compared to H_1 is caused by the lack of availability of financial data (pre-tax profit, tangible fixed assets, and compensation expense) in some countries. While it is not ideal, it does not alter the results since the empirical tests aim to contrast the tax rates measuring *C* in association with the reported profit rather than to measure profit shifting magnitude to any specific country. Panel A of Table 2 illustrates the sample selection process for both hypotheses. Panel B shows the sample distribution of H_1, while Panel C depicts the distribution of observations in H_2 per country-year.

Table 2. Composition of sample observations

Panel A: Sample selection process

	Observations	
	H_1	H_2
Parent-years with foreign affiliates and unconsolidated financial report	35,293	35,293
Plus: Subsidiary affiliate-years	174,486	174,486
	209,779	209,779
Less:		
financial, insurance, and public service firms	5,920	5,920
affiliates with consolidated reporting basis	4	4
missing or negative aggregate revenue (H_1) or profits, assets, compensation expenses (H_2)	73	24,401
aggregated to national level	118,917	111,878
observations without foreign affiliates domiciled in EU countries	17,682	21,200
unavailable tax rates data	5,345	-
unavailable tax incentive variable (*C*) value from H_1	-	9,431
identified having two or more parents at one year	565	24
Total sample	**61,273**	**41,548**

Panel B: Affiliate-year sample distribution of tax incentive variable (*C*)

Country	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Austria	101	122	145	189	259	261	281	270	263	83	1,974
Belgium	314	315	306	394	417	440	453	478	464	227	3,808
Bulgaria	0	0	0	0	0	0	0	92	92	0	184
Czech Republic	210	229	236	303	312	334	371	372	321	117	2,805
Germany	475	471	452	637	742	799	837	834	728	202	6,177
Denmark	0	0	0	0	0	204	224	249	174	198	1,049
Spain	482	506	496	722	717	768	838	898	828	295	6,550
Finland	236	232	226	277	314	348	366	392	208	303	2,902
France	636	654	625	793	827	890	941	980	923	365	7,634
United Kingdom	370	371	377	478	520	544	562	605	535	344	4,706
Hungary	126	116	122	158	167	191	197	201	191	121	1,590
Ireland	35	36	34	40	51	51	59	62	55	15	438
Italy	618	637	583	791	830	865	969	1,012	986	328	7,619
Luxembourg	0	0	0	62	67	69	76	67	46	0	387
Latvia	50	39	33	70	88	95	98	104	82	96	755
Malta	0	7	8	15	15	16	13	15	10	0	99
Netherlands	60	67	73	80	82	92	94	99	78	29	754
Poland	329	379	391	441	481	526	589	615	517	107	4,375
Portugal	0	0	0	308	286	314	357	362	357	102	2,086
Sweden	327	318	346	426	449	541	596	637	0	471	4,111
Slovakia	0	0	135	176	189	0	222	215	208	125	1,270
Total	4,369	4,499	4,588	6,360	6,813	7,348	8,143	8,559	7,066	3,528	61,273

Panel C: Affiliate-year sample distribution of second hypothesis by country

Country	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Austria	79	96	100	128	160	146	169	160	158	55	1,251
Belgium	253	240	217	300	323	314	337	350	335	174	2,843
Bulgaria	-	-	-	-	-	-	-	66	63	-	129
Czech Republic	179	165	175	225	230	245	270	284	256	96	2,125
Germany	405	399	357	463	503	530	549	552	483	159	4,400
Denmark	-	-	-	-	-	144	153	168	129	139	733
Spain	355	341	311	497	481	489	545	630	631	226	4,506
Finland	172	168	138	186	202	201	215	226	127	183	1,818
France	470	464	424	559	604	622	639	680	645	266	5,373
United Kingdom	253	232	236	323	347	360	396	401	354	225	3,127
Hungary	96	85	76	96	99	129	136	134	144	90	1,085
Ireland	21	21	21	20	31	33	37	36	33	11	264
Italy	475	474	401	574	612	601	688	747	731	253	5,556
Luxembourg	-	-	-	40	48	47	47	48	32	-	262
Latvia	4	6	4	7	7	8	10	9	7	8	70
Malta	-	1	2	3	2	2	3	1	1	-	15
Netherlands	25	19	23	24	25	35	28	28	20	9	236
Poland	233	232	262	304	321	342	377	421	358	71	2,921
Portugal	-	-	-	220	200	193	240	259	264	75	1,451
Sweden	226	205	207	275	275	301	354	369	-	264	2,476
Slovakia	-	-	86	118	140	-	168	156	143	96	907
Total	3,246	3,148	3,040	4,362	4,610	4,742	5,361	5,725	4,914	2,400	41,548

4.5. Cross-sectional and robustness tests

To get a deeper insight into the issue and strong evidence several additional tests are added to this thesis. First, cross-sectional comparisons to the extent of the tax rates generating dissimilar tax incentive variable are conducted. Appendix I indicates that there is a gap between the statutory and effective tax rate that combined with Equation (1) lead to difference identification of tax incentive variable. For example, *Cstr* shows a positive value, while *Cetr* provides a negative sign or vice versa. Hence, it is interesting to re-perform the test focus on the sub-sample which tax incentive variable are contradicting in term of the coefficient sign.

Markle and Shackelford (2012) alert that the database maintained by Bureau van Dijk has a constraint in identifying subsidiary at the most current update only. For example, a subsidiary (A) is owned by parent B in 2012 before being acquired by parent Z in 2014. One would erroneously treat the subsidiary A as part of group Z for any year in the sample. Unfortunately, assessing the extent to which this miscode issue may affect the results is impossible. Thus, I follow Markle and

Shackelford (2012) by limiting the sample period to last five current years in the robustness test. It is arbitrary, but logically the current year's data have a lower probability of error than old years.

In the computation of effective tax rates, I take the average and the median of available observations in each country. This measure may not vigor to represent the related population, particularly if there are only one or few local firms in a country. Therefore, I adopt Beuselinck and Pierk (2018) approach by increasing the minimum number of observations in the respective cluster.[2] Therefore, I rerun my analysis and constraint the sample where at least have ten firms in each country-year to determine the effective tax rate. As results, there no observations from Bulgaria, Czech Republic, Luxembourg, and Slovakia (check at Table 1, Panel B).

[2] Beuselinck and Pierk (2018) apply at least seven minimum observations per cluster in their robustness tests.

5. Results

The first part of this section focuses on all descriptive statistics and correlation matrix in explaining the sample characteristics. The second part describes the result of the first hypothesis as my foundation for the second hypothesis analysis. Then, the empirical results of the second hypothesis are presented to answer the research question. Last part of this section supports the main empirical finding from a potential bias that is possibly affecting the inferences.

5.1. Descriptive statistics and correlation matrix

Brooks (2014) suggests that normally distributed data should have skewness value close to zero and kurtosis value around ± 3. This assumption is a requirement to obtain a reliable OLS regression model. Table 3 shows that the skewness values of the variables used in the analysis are in the range of -0.98 to 0.23, while the kurtosis values span between 2.83 and 3.74. The numbers indicate a relatively normal distribution in the sample. These statistic values are achieved after winsorizing the data of variable *C* at 5% level for both top and low sides and transforming all other continuous variables into natural logarithm form. Moreover, considering the large number of observations in both hypothesis (61,273 affiliate-years for H_1 and 41,548 affiliate-years for H_2) I rely on the Central Limit Theorem to assume that my sample is normally distributed. The Central Limit Theorem suggests that, given a random and independent sample, the sample means distribution approaches to normality as the increase in observation numbers.

Table 3, Panel A, depicts that the average of effective tax rate (0.23) is lower than the statutory tax rate (0.27) consistent with real-world practice. Loopholes in tax rule, deductions and exemptions, tax credits, and preferential rates for specific taxpayers are some determinants. Consistent with prior reports (Dyreng, Hanlon, and Maydew (2008); Dyreng et al. (2017); Beuselinck and Pierk (2018)), breaking-down the tax rates per year shows that there is a declining trend in both tax rates (untabulated).

In Table 3 (both panels), the median of tax incentive variable (*C*) is zero from all tax rate proxies, indicating that half of the observation shifts the income out of a country (positive *C* value) and the other half is labelled as a destination country in profit shifting (negative *C* value). But, the average value of *C* in general slightly less than zero (between -0.02 to -0.01), suggesting that the sample are consist of more affiliates with a characteristic as an income shifting destination country.

Table 3. Descriptive statistics

Panel A: Sample descriptive statistics of H_1

variable	min	p25	mean	p50	p75	max	sd	sk	k
str	0.10	0.22	0.27	0.29	0.31	0.38	0.06	-0.46	2.27
etr (avg.)	0.04	0.20	0.23	0.22	0.25	0.40	0.06	0.68	4.36
etr (med.)	0.01	0.20	0.24	0.23	0.27	0.41	0.07	0.11	3.96
Cstr	-0.29	-0.06	-0.02	0.00	0.02	0.34	0.07	-0.33	3.41
Cetr (avg.)	-0.17	-0.05	-0.01	0.00	0.01	0.17	0.08	0.12	3.73
Cetr (med.)	-0.17	-0.06	-0.02	0.00	0.02	0.15	0.08	-0.01	3.05

Panel B: Sample descriptive statistics of H_2

variable	min	p25	mean	p50	p75	max	sd	sk	k
Ln PLBT	2.39	13.06	14.68	14.64	16.24	23.80	2.48	0.09	3.32
Cstr	-0.27	-0.06	-0.02	0.00	0.02	0.34	0.07	-0.33	3.43
Cetr (avg.)	-0.16	-0.04	-0.01	0.00	0.02	0.17	0.07	0.23	3.74
Cetr (med.)	-0.16	-0.06	-0.01	0.00	0.02	0.15	0.07	0.04	3.05
Ln Assets	0.19	12.33	14.56	14.82	16.78	25.61	3.13	-0.18	2.83
Ln Comp	1.93	14.14	15.61	15.56	16.98	23.63	2.06	0.08	3.48
Ln GDP	8.85	10.28	10.44	10.61	10.73	11.69	0.44	-0.98	3.44

Panel A shows the sample of the first hypothesis consists of 61,273 affiliate-years. Panel B illustrates the sample of the second hypothesis consists of 41,548 affiliate-years. All sample is from multinationals domiciled in 21 EU countries between 2007 to 2016 that are aggregated into national level and having required data to perform the analysis. *Ln PLBT* is logarithm of affiliate pre-tax income. *C* is the revenue weighted differential tax rate retrieved from Huizinga and Laeven (2008). *Cstr* is *C* that is calculated using STR, *Cetr* (avg.) is *C* that is calculated using the average of domestic firm only ETR, and *Cetr* (med.) is *C* that is calculated using the median of domestic firm only ETR. *Ln Assets* is the logarithm of aggregated affiliate tangible fixed asset in the same country-year. *Ln Comp* is the logarithm of aggregated affiliate compensation expense in the same country-year. *Ln GDP* is the logarithm of gross domestic product as proxy of national productivity. *Ln PLBT, Ln Assets, Ln Comp* are converted into USD and *Ln GDP* is reported in USD millions.

Table 4 presents the Pearson correlation matrix between the determinants used in the regression of the second hypothesis. Contradict with my prediction, the matrix shows a positive correlation between reported pre-tax profit (*Ln PLBT*) and the revenue-weighted tax rate differential (*C*). As a preliminary analysis, the correlation between tax incentive variable calculated using statutory tax rate (*Cstr*) and the other one using effective tax rate (*Cetr*) is around half (0.50 and 0.57), indicating that both variables are different in value as predicted in the first hypothesis. All control variables positively correlated with the dependent variable at 1% significance level. However, the tangible fixed assets (*Ln Assets*) is relatively correlated with another control variable, the compensation expense (*Ln Comp*), at 75%. It is similar with Huizinga and Laeven (2008) sample which those two controls are correlated at 84%. Per-capita income (*Ln*

GDP) is positively related with all other control variables, suggesting that firms are bigger in wealthier countries. Last, the tax incentive variable is also positively correlated with *Ln GDP*, reflecting that rich countries tend to have higher tax rates.

Table 4. Correlations matrix

	Ln PLBT	*Cstr*	*Cetr* (avg.)	*Cetr* (med.)	Ln Assets	Ln Comp
Cstr	0.1455*					
Cetr (avg.)	0.0821*	0.5073*				
Cetr (med.)	0.0813*	0.5681*	0.9616*			
Ln Assets	0.7143*	0.0975*	0.0594*	0.0594*		
Ln Comp	0.7729*	0.2093*	0.1249*	0.1340*	0.7524*	
Ln GDP	0.1955*	0.5059*	0.1985*	0.2553*	0.0708*	0.2711*

Pearson correlations matrix for the variables used in the second hypothesis analysis. *Ln PLBT*, the dependent variable, is the logarithm of affiliate pre-tax income. *C* is the revenue weighted differential tax rate retrieved from Huizinga and Laeven (2008). *Cstr* is *C* that is calculated using STR, *Cetr* (avg.) is *C* that is calculated using the average of domestic firm only ETR, and *Cetr* (med.) is *C* that is calculated using the median of domestic firm only ETR. *Cstr*, *Cetr* (avg.), or *Cetr* (med.), is used in different regression model. *Ln Assets* is the logarithm of aggregated affiliate tangible fixed asset in the same country-year. *Ln Comp* is the logarithm of aggregated affiliate compensation expense in the same country-year. *Ln GDP* is the logarithm of gross domestic product as proxy of national productivity. *Ln PLBT, Ln Assets, Ln Comp* are converted into USD and *Ln GDP* is reported in USD millions. * indicates statistical significance at the 1% level.

5.2. Result of hypothesis 1

I begin with testing the first hypothesis, whether *Cstr* differs from *Cetr*. As stated before, it is important to identify that statutory tax rate and effective tax rate generate dissimilar values of tax incentive variable developed by Huizinga and Laeven (2008). To do so, I perform matched-paired t-tests which opposing the mean of those two variables. Table 5, Panel A, presents the t-test results. By definition, the mean value of *Cstr* is lower than *Cetr* because the tax rate is the denominator in Equation (1). Given that the statutory tax rate is higher than the effective tax rate in majority countries in the world, the former produces a lower *C* value than the later, for example the mean of *Cstr* (-0.021) is lesser than the mean of *Cetr* (avg.) at -0.015. It is also shown by the negative value of mean difference (-0.0061 for *Cstr* and *Cetr* (avg.)) that implies the effective tax rate generates higher tax variable values. T-statistics value (-20.347 for *Cetr* (med.)) is lower than the critical value and p-value is lower than 5%, indicating that *Cstr* is different or lower than *Cetr*.

Recall that t-test suffers in presence of outlier and requires a normal data distribution, I run a non-parametric test to corroborate the t-test results. The Wilcoxon signed-ranks test compares the median difference instead of the mean difference; thus, outlier less likely biases the results.

The Wilcoxon reveals a conforming result to the t-test as it shows that the *p*-values for both alternative proxies of effective tax rate are lower than 5%. Therefore, the first alternative hypothesis that stating *Cstr* is unequal from *Cetr* is accepted. Table 5, Panel B summarizes the Wilcoxon signed-ranks test results.

Table 5. Mean and median comparison of tax incentive variable (*C*) from statutory and effective tax rate

Panel A: Matched-paired t-test

measure of *Cetr*	mean		mean difference	t - stat	*p* - value
	Cstr	*Cetr*	(*Cstr* - *Cetr*)		
average ETR	-0.0211	-0.0150	-0.0061***	-21.048	0.000
median ETR	-0.0211	-0.0156	-0.0055***	-20.347	0.000

The table shows the mean comparison paired t-test of the tax variable calculated using statutory tax rates (*Cstr*) and effective tax rates (*Cetr*). Row average ETR indicates that the average of effective tax rates per country-year are used to compute *C*. Row median ETR indicates that the median of effective tax rates per country-year are applied in the *C* calculation. Number of observations are 61,273 affiliate-years. *, **, and *** denote significance at level 10%, 5%, and 1 % level, respectively.

Panel B: Wilcoxon signed-rank test

measure of *Cetr*	sum ranks (*Cstr* – *Cetr*) (*in millions*)		z - stat	*p* - value
	positive	negative		
average ETR	834.5	1,043	-23.789	0.000
median ETR	829	1,048	-25.040	0.000

The table shows the results of median comparison using Wilcoxon signed-rank test of the tax variable calculated using statutory tax rates (*Cstr*) and effective tax rates (*Cetr*). Row average ETR indicates that the average of effective tax rates per country-year are used to compute *C*. Row median ETR indicates that the median of effective tax rates per country-year are applied in the *C* calculation. Number of observations are 61,273 affiliate-years.

5.3. Result of hypothesis 2

In untabulated results, the Breusch-Pagan tests report χ^2 (chi-square) values of Equation (2) under the three proxies of *C* in range 791.71 to 797.18 with p-value less than 0.01, which indicates heteroscedasticity in all basic specification. Therefore, robust standard errors are used in the regressions. Table 6 contains the multivariate regression results of Equation (2) that vary by tax incentive variable proxies and fixed effects. The first three columns estimate Equation (2) without fixed effect to establish consistent results with past literature. Column (1) shows the result of the basic model using statutory tax rate to calculate *C*, while column (2) and (3) present the results of

average and median effective tax rate calculating *C*, respectively. The last three columns include country, industry, and time fixed effects to robust the results from a possible omitted variable. The columns sequence is similar with the basic model, column (4) presents *Cstr* with fixed effects (FE), column (5) and (6) depict *Cetr* (average) and *Cetr* (median), respectively and both are with FE.

Table 6. Estimation of income shifting based on Huizinga and Laeven (2008) using statutory tax rate and effective tax rate

$$LnPLBT_{it} = \beta_0 + \beta_1 C_{it} + \beta_2 LnASSETS_{it} + \beta_3 LnLABOR_{it} + \beta_4 LnGDP + \Sigma\ FixedEffects + \varepsilon_{it}$$

Variables	Prediction	*Cstr*	*Cetr* (average)	*Cetr* (median)	*Cstr*	*Cetr* (average)	*Cetr* (median)
		(1)	(2)	(3)	(4)	(5)	(6)
C_{it}	-	-0.542***	-0.296***	-0.567***	-1.038***	-0.878***	-1.147***
		(0.14)	(0.10)	(0.10)	(0.14)	(0.11)	(0.11)
Ln Assets	+	0.250***	0.249***	0.249***	0.240***	0.241***	0.241***
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Ln Comp	+	0.636***	0.636***	0.637***	0.635***	0.631***	0.632***
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Ln GDP	?	0.209***	0.177***	0.191***	0.164***	0.111***	0.132***
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
βo		-1.070***	-0.727***	-0.881***	-0.628***	-0.015	-0.256
		(0.23)	(0.19)	(0.19)	(0.23)	(0.19)	(0.20)
Fixed Effects		No	No	No	Country, Industry, Year	Country, Industry, Year	Country, Industry, Year
N		41,548	41,548	41,548	41,548	41,548	41,548
adj. R-squared		0.6390	0.6389	0.6391	0.6668	0.6669	0.6673

This table reports OLS estimates of Equation (2) on the sample described in Table 2, Panel B. *LnPLBT*, the dependent variable, is the logarithm of affiliate pre-tax income. *C* is the revenue weighted differential tax rate retrieved from Huizinga and Laeven (2008). *Cstr* is *C* that is calculated using STR, *Cetr* (avg.) is *C* that is calculated using the average of domestic firm only ETR, and *Cetr* (med.) is *C* that is calculated using the median of domestic firm only ETR. *LnAssets* is the logarithm of aggregated affiliate tangible fixed asset in the same country-year. *LnComp* is the logarithm of aggregated affiliate compensation expense in the same country-year. *LnGDP* is the logarithm of gross domestic product as proxy of national productivity. *LnPLBT*, *LnAssets*, *LnComp* are converted into USD and *LnGDP* is reported in USD millions. Robust standard errors are reported in parentheses. *, **, and *** show significance at level 10%, 5%, and 1 % level respectively.

The results for all variables in all models, except *Ln GDP*, are consistent with Huizinga and Laeven (2008), Beuselinck et al. (2015), and De Simone (2016) using different time periods and Markle (2016) that utilize sample from different location. The coefficient of tax incentive variable is negative and significant across all columns, indicating a negative relationship between reported

pre-tax income and tax gap among countries where group members are domiciled. To the extent of economic significance, using the median of effective tax rate to estimate *C* gives a coefficient value of -1.147. It indicates that an interquartile decrease in *C* value (a greater incentive to shift into a country) from 0.02 to -0.06 leads to an increase in the natural logarithm of pre-tax income by 0.09176. At the mean of *Ln PLBT* of 14.68 (from Table 2, Panel B), it represents an increase in reported income by $228,126 (from $2,373,794 to $2,601,920), or 9.6 percent.[3] The coefficient of fixed assets and labor compensation expense are positive and significant, suggesting that higher production factors may improve the company's profit.

To be informed, the coefficient result of *Ln GDP* is inconsistent in past researches. Huizinga and Laeven (2008), Markle (2016) find a negative relationship between productivity and reported profit, while Beuselinck et al. (2015) and De Simone (2016) obtain a positive relationship. Thus, the positive coefficient sign of gross domestic product as productivity level's proxy in this thesis is dissimilar with the former, but consistent with the later. There are two explanations on how the economic development affects firms' reported profit (Huizinga and Laeven, 2008). In well-developed countries, higher productivity levels (i.e., high-skilled labor or advanced technologies) lead to greater profitability. However, negative characteristics of poor countries (i.e., weak law enforcement on property rights or regulations) could pressure firms to require higher expected returns. This thesis's finding implies that the former effect dominates among sample countries.

Move into main question of this paper, I compare the adjusted R^2 from column (4) to column (5) and (6). In the model with fixed effects, adjusted R-squared values of the model using *Cetr* (of both proxies) are slightly higher than one using *Cstr*. However, the gap between them is relatively small and indicate a weak evidence. Column (4) shows the adjusted R^2 of *Cstr* model is 0.6668, while the higher adjusted R^2 of effective tax rate (*Cetr* (median)) is 0.6673. Thus, both tax rates generate almost similar explanatory power of Huizinga and Laeven (2008) profit shifting model.

However, adjusted R^2 does not necessarily indicate model goodness level. Hence, I perform Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) to analyse model fitness level. Table 7 demonstrates the result of AIC and BIC test from six competing model, *Cstr*-no FE, *Cetr* (average)-no FE, *Cetr* (median)-no FE, *Cstr*-FE, *Cetr* (average)-FE, and *Cetr* (median)-FE, respectively. Overall the models with fixed effects have lower AIC and BIC score

[3] -0.08*1.147 = -0.09176; $e^{14.68} \approx 2{,}373{,}794$; $e^{(14.68 - [-0.09176])} \approx 2{,}601{,}920$.

than those basic models, signalling that including fixed effects is preferred. The model of *Cetr* (median) with fixed effects has the lowest AIC (147,592.5) and BIC (147,851.5) value, suggesting that the *Cetr* (median) model is the most parsimonious for the given data. Together with the results from R^2 comparison, the statistic results suggest that the second null hypothesis is rejected in favor of the effective tax rate, specifically the median of the effective tax rate.

Table 7. Summary of AIC and BIC results for Huizinga and Laeven (2008) income shifting model calculated using statutory tax rate and effective tax rate

$$LnPLBT_{it} = \beta_0 + \beta_1 C_{it} + \beta_2 LnASSETS_{it} + \beta_3 LnLABOR_{it} + \beta_4 LnGDP + \Sigma\ FixedEffects + \varepsilon_{it}$$

Model	FE	log likelihood (null)	log likelihood (full model)	df	AIC	BIC
Cstr	No	-96,680.68	-75,514.42	5	151,038.8	151,082.0
Cetr (average)	No	-96,680.68	-75,519.41	5	151,048.8	151,092.0
Cetr (median)	No	-96,680.68	-75,508.32	5	151,026.6	151,069.8
Cstr	Yes	-93,232.05	-73,793.71	30	147,647.4	147,906.5
Cetr (average)	Yes	-93,232.05	-73,790.77	30	147,641.5	147,900.6
Cetr (median)	Yes	-93,232.05	-73,766.24	30	147,592.5	147,851.5

This table reports Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) test of Equation (2) on the sample described in Table 2, Panel B. Number of observations are 41,548 affiliate-years. FE refers to fixed effects (industry, parent country, and year fixed effects). *df* is degree of freedom. Lower scores of AIC and BIC indicate a better model.

5.4. Sub-sample analysis

This sub-sample analysis focus on the observations with contradicted Cstr and *Cetr* coefficients. Excluding the observations with indifferent sign of *Cstr* and *Cetr* may nullify the interference caused by that deleted sample in regression result. The deletion process leads to total sub-sample with 12,877 affiliate-year observations. Table 8 illustrates the distribution of the sub-sample based on the location of the affiliates. The sub-sample are dominated by country with high statutory tax rate, i.e., France, Germany, Belgium, Spain, Italy, Sweden, and United Kingdom.

Table 8. The sample distribution of affiliate-year with different sign of the C variable by country

Country	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Austria	3	8	12	10	42	12	63	27	42	6	225
Belgium	164	186	114	192	205	165	187	272	39	9	1,533
Bulgaria	0	0	0	0	0	0	0	2	2	0	4
Czech Republic	11	53	50	4	65	6	7	5	14	3	218

Germany	272	156	171	157	260	208	209	146	196	48	1,823
Denmark	0	0	0	0	0	81	20	22	49	43	215
Spain	152	55	87	112	82	123	145	151	232	63	1,202
Finland	85	117	88	122	124	124	32	112	15	95	914
France	218	213	228	288	250	284	327	390	361	121	2,680
United Kingdom	131	57	119	154	151	139	125	62	22	35	995
Hungary	0	0	1	5	4	4	2	5	6	2	29
Italy	43	142	105	151	154	143	152	163	157	56	1,266
Luxembourg	0	0	0	31	33	8	14	17	16	0	119
Latvia	0	0	0	0	0	0	0	1	0	0	1
Malta	0	1	1	0	0	1	2	0	0	0	5
Netherlands	6	13	12	16	17	22	13	14	12	5	130
Poland	10	42	52	28	9	11	32	68	27	15	294
Portugal	0	0	0	8	19	29	6	18	1	1	82
Sweden	81	118	93	130	123	155	11	128	0	128	967
Slovakia	0	0	3	3	21	0	37	78	22	11	175
Total	1,176	1,161	1,136	1,411	1,559	1,515	1,384	1,681	1,213	641	12,877

This table reports the distribution of sub-sample which have different sign of *Cstr* and *Cetr* (i.e., an observation with a Positive *Cstr* and a Negative *Cetr* (median), or vice versa) based on the domicile of affiliate and fiscal year.

Table 9 demonstrates the regression result of Equation (2) using both value of *C* (*Cstr* and *Cetr*) which the statutory and effective tax rate differently generates the tax incentive variable signs. Under three specifications of *C*, all control variables show non-negative coefficients resembling the main results and past literature. However, the *C* coefficient of *Cstr* (model (1)) changes into a significant positive value (2.606) contradict the prediction and Huizinga and Laeven (2008) empirical model. The logarithm of pre-tax income responds negatively to the tax incentive variable indicating an optimal transfer pricing should cut the reported profit down. Meanwhile, the *Cetr* models (both average and median) present steady results in the matching direction with the empirical model, a negative coefficient.

Appendix II illustrates a simple relationship between reported income, tax rate, and *C*. The group 1 exhibits a scenario which the multinational does not conduct tax-motivated profit shifting (reporting higher revenue in higher tax rate country). The group 2 depicts a situation where profit shifting is performed. Relating the fact in Table 8 (that the high statutory tax rate countries dominate the sub-sample) to the scene of group 2 in Appendix II, the firms will report a low profit in high tax jurisdiction, and one should see an inverse relationship between *C* and revenue.

However, Table 9 shows a positive correlation between *C* and income as the dependent variable. Therefore, one should carefully utilize the statutory tax rate when measuring tax incentive variable.

Table 9. Estimation of income shifting based on Huizinga and Laeven (2008) using sub-sample with difference sign of the *C* variable.

$$LnPLBT_{it} = \beta_0 + \beta_1 C_{it} + \beta_2 LnASSETS_{it} + \beta_3 LnLABOR_{it} + \beta_4 LnGDP + \Sigma\ FixedEffects + \varepsilon_{it}$$

	Prediction	*Cstr* (1)	*Cetr* (average) (2)	*Cetr* (median) (3)
C_{it}	-	2.606***	-0.738***	-1.053***
		(0.44)	(0.25)	(0.27)
Ln Assets	+	0.242***	0.241***	0.242***
		(0.01)	(0.01)	(0.01)
Ln Comp	+	0.640***	0.646***	0.645***
		(0.02)	(0.02)	(0.02)
Ln GDP	?	0.157**	0.262***	0.248***
		(0.06)	(0.06)	(0.06)
βo		-0.552	-1.744***	-1.593***
		(0.64)	(0.59)	(0.59)
Fixed Effects		Country, Industry, Year	Country, Industry, Year	Country, Industry, Year
N		12,877	12,877	12,877
adj. R-squared		0.6842	0.68338	0.68355

This table reports OLS estimates of Equation (2) on the sample limited only to the affiliate-year with *C* value that are differently classified (i.e., an observation with a Positive *Cstr* and a Negative *Cetr* (median), or vice versa). *LnPLBT*, the dependent variable, is the logarithm of affiliate pre-tax income. *C* is the revenue weighted differential tax rate retrieved from Huizinga and Laeven (2008). *Cstr* is *C* that is calculated using STR, *Cetr* (avg.) is *C* that is calculated using the average of domestic firm only ETR, and *Cetr* (med.) is *C* that is calculated using the median of domestic firm only ETR. *LnAssets* is the logarithm of aggregated affiliate tangible fixed asset in the same country-year. *LnComp* is the logarithm of aggregated affiliate compensation expense in the same country-year. *LnGDP* is the logarithm of gross domestic product as proxy of national productivity. *LnPLBT*, *LnAssets*, *LnComp* are converted into USD and *LnGDP* is reported in USD millions. Robust standard errors are reported in parentheses. *, **, and *** denote significance at level 10%, 5%, and 1 % level respectively.

One may argue that the sample may drive the phenomenon, hence I split the sub-sample according to the disparity between the country statutory tax rate and the related effective tax rate. Two category sub-sub-sample are constructed based on where the tax rate gap located on its distribution, those that lie on the top quartile (low quartile) are considered as a big gap (small gap). The sub-sub-sample of the small tax rate gap consists of 2,020 affiliate-years and the big tax rate gap sample incorporate 5,057 affiliate-years observations. Table 10 column (1) presents the

estimation report of Equation (2) for the sub-sample *Cstr* with the small gap, while the *Cstr* with big tax rate gap is shown in column (4). Both columns coefficient signs remain positive, but the coefficient in column (1) becomes insignificant, whilst one in column (4) continue significant at 1% significance level. This may indicate that the erroneous coefficient more pronounces for observations with characteristic domiciled in countries with the big gap between statutory and effective tax rate. The coefficient *C* sign for the rest models is unchanged relative to main results, suggesting that the statutory to effective tax rate difference does not impair the relationship between profit shifting incentive, production factor, productivity level and reported income.

Table 10. Estimation of income shifting based on Huizinga and Laeven (2008) using sub-sample with difference sign of the *C* variable and located in low and high quartile of statutory-effective tax rate gap distribution.

$$LnPLBT_{it} = \beta_0 + \beta_1 C_{it} + \beta_2 LnASSETS_{it} + \beta_3 LnLABOR_{it} + \beta_4 LnGDP + \Sigma\ FixedEffects + \varepsilon_{it}$$

	small statutory-effective tax rate gap			big statutory-effective tax rate gap		
	Cstr	*Cetr* (avg.)	*Cetr* (med.)	*Cstr*	*Cetr* (avg.)	*Cetr* (med.)
	(1)	(2)	(3)	(4)	(5)	(6)
C_{it}	2.961	-3.395***	-3.629***	5.223***	-2.915***	-4.070***
	(2.16)	(1.13)	(1.38)	(0.88)	(0.88)	(0.85)
Ln Assets	0.264***	0.261***	0.261***	0.160***	0.158***	0.159***
	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)
Ln Comp	0.544***	0.540***	0.542***	0.753***	0.754***	0.756***
	(0.05)	(0.05)	(0.05)	(0.03)	(0.03)	(0.03)
Ln GDP	0.129	0.266**	0.273**	0.716***	0.645***	0.579***
	(0.14)	(0.13)	(0.13)	(0.19)	(0.18)	(0.18)
βo	1.17	0.244	0.033	-7.605***	-6.599***	-6.046***
	(1.40)	(1.23)	(1.25)	(2.06)	(2.01)	(1.99)
Fixed Effects	Country, Industry, Year	Country, Industry, Year	Country, Industry, Year	Country, Industry, Year	Country, Industry, Year	Country, Industry, Year
N	2,020	2,020	2,020	5,057	5,057	5,057
adj. R-squared	0.6194	0.6216	0.6211	0.7144	0.7127	0.7134

This table reports OLS estimates of Equation (2) on the sample limited only to the affiliate-year with *C* value that are differently classified (i.e., an observation with a Positive *Cstr* and a Negative *Cetr* (median), or vice versa) and located in top and low quartile of statutory-effective tax rate gap distribution. *LnPLBT*, the dependent variable, is the logarithm of affiliate pre-tax income. *C* is the revenue weighted differential tax rate retrieved from Huizinga and Laeven (2008). *Cstr* is *C* that is calculated using STR, *Cetr* (avg.) is *C* that is calculated using the average of domestic firm only ETR, and *Cetr* (med.) is *C* that is calculated using the median of domestic firm only ETR. *LnAssets* is the logarithm of aggregated affiliate tangible fixed asset in the same country-year. *LnComp* is the logarithm of aggregated affiliate compensation expense in the same country-year. *LnGDP* is the logarithm of gross domestic product as proxy of

national productivity. *LnPLBT*, *LnAssets*, *LnComp* are converted into USD and *LnGDP* is reported in USD millions. Robust standard errors are reported in parentheses. *, **, and *** denote significance at level 10%, 5%, and 1 % level respectively.

5.5. Robustness tests

The quality of the dataset may affect the validity of analysis results. To avoid such concern, I repeat the analysis with the application of additional data restrictions. The first issue is the misidentification of parent and subsidiary relationship. I reduce the observation periods into last past five years following Markle and Shackleford (2012) suggestions and present the regression results in Table 11 columns (1), (2), and (3). The sample size declines to 23,142 affiliate-years. The coefficient of *C*, however, remains negative and significant at 1% significance level. The adjusted R^2 of the *Cetr* (median), again, is slightly higher than *Cetr*, qualitatively similar to the main results.

Table 11. Estimation of income shifting based on Huizinga and Laeven (2008) using sub-sample of last past five years (2012 – 2016) and observations that are located in country with at least ten domestic firms per country year.

	last past five years			at least ten domestic firms per country-year to calculate ETR		
	Cstr	Cetr (avg.)	Cetr (med.)	Cstr	Cetr (avg.)	Cetr (med.)
	(1)	(2)	(3)	(4)	(5)	(6)
Cit	-1.062***	-0.937***	-1.212***	-1.253***	-1.004***	-1.331***
	(0.17)	(0.15)	(0.15)	(0.15)	(0.11)	(0.12)
Ln Assets	0.225***	0.226***	0.226***	0.230***	0.232***	0.232***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Ln Comp	0.652***	0.648***	0.649***	0.652***	0.648***	0.648***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Ln GDP	0.142***	0.091***	0.109***	0.083***	0.012	0.029
	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)
βo	-0.579**	-0.012	-0.221	0.209	1.010***	0.827***
	(0.28)	(0.25)	(0.25)	(0.25)	(0.22)	(0.22)
Fixed Effects	Country, Industry, Year	Country, Industry, Year	Country, Industry, Year	Country, Industry, Year	Country, Industry, Year	Country, Industry, Year
N	23,142	23,142	23,142	36,341	36,341	36,341
adj. R-squared	0.6648	0.6648	0.6652	0.6711	0.6711	0.6715

This table reports OLS estimates of Equation (2) on the sub-sample of last past five years (2012 – 2016) and observations that are located in country with at least ten domestic firms per country year. *LnPLBT*, the dependent variable, is the logarithm of affiliate pre-tax income. *C* is the revenue weighted differential tax rate retrieved from

Huizinga and Laeven (2008). *Cstr* is *C* that is calculated using STR, *Cetr* (avg.) is *C* that is calculated using the average of domestic firm only ETR, and *Cetr* (med.) is *C* that is calculated using the median of domestic firm only ETR. *LnAssets* is the logarithm of aggregated affiliate tangible fixed asset in the same country-year. *LnComp* is the logarithm of aggregated affiliate compensation expense in the same country-year. *LnGDP* is the logarithm of gross domestic product as proxy of national productivity. *LnPLBT*, *LnAssets*, *LnComp* are converted into USD and *LnGDP* is reported in USD millions. Robust standard errors are reported in parentheses. *, **, and *** denote significance at level 10%, 5%, and 1 % level respectively.

Uneven spread of firm distribution in the sample is the second issue. Particular countries (i.e., Bulgaria, Czech Republic, Luxembourg, and Slovakia) have a low number of domestic firms. Therefore, calculating the average effective tax rate from the small sample may not adequately represent the whole population. Applying at least ten domestic firms in a country-year is my choice to obtain sample with proper representation. Table 11 columns (4), (5), and (6) depict the analysis results under the second requirement. The sample size reduces to 36,341 affiliate-years and all variable of interests show similar results with the main results in term of coefficient signs. The *Cstr* model adjusted R^2 score fails to overcome the *Cetr* (median) model, suggesting that the later has more explanatory power. Overall, I conclude that the concerned data limitations do not alter the main results.

6. Conclusion

Past works of literature use either statutory tax rate or effective tax rate when gauging country's tax burden level. Some apply the statutory tax rate due to simplicity and unspoiled by endogeneity, whereas others choose the effective tax rate as it incorporates tax base effects. Notably, the former argues that the effective tax rate is not an exogenous factor of firm profit as it reflects business decisions made by the firm. This thesis attempts to examine between those two definitions of the tax rate in representing country attractiveness level in term of taxation. To mitigate the endogeneity, I estimate the effective tax rate of each country-year using locally domiciled firms only. This approach based on evidence suggesting a similar behavior between domestic and multinational firms to the extent of tax avoidance.

Utilizing Huizinga and Laeven (2008) profit shifting model, I perform a horse race for both tax rates and find weak evidence in favor of the effective tax rate in explaining the relationship between reported profit, income shifting variable, production factors, and productivity level. The corroborate to past evidence result is achieved by employing multinational firms domiciled in European Union countries, specifically 41,548 affiliate-year observations. Moreover, by focusing on sub-sample which the statutory and effective rate differently identify the tax incentive variable values, I find that the use of statutory tax rate may generate a contradicting regression result to the empirical prediction, especially in country-year that experiences large gap between statutory and effective tax rates.

To improve this thesis and contribute to the knowledge of international taxation, further research with a larger setting might be exciting. For example, by including the unprofitable affiliates in the sample following the finding from De Simone et al. (2014). They suggest that the multinational possible to benefit from profit shifting scenario in affiliates with negative income, especially in a country with a tax system that allows loss carry-forward and carry-back. Further research with a more in-depth investigation of the inconsistency of the statutory tax rate when measuring tax burden level is also interesting.

There is no perfect set in empirical studies. Similar with preceding literature, several limitations attenuate this thesis. First, the use of European settings is unavoidable due to the data availability. The exclusion of affiliates located in tax haven countries may affect the investigations. However, to my knowledge, the financial data of the firms in tax haven are not publicly available.

Another caveat is that the inference relies on the validity of the empirical model of reported income. Huizinga and Laeven (2008) develop the model using true income rather than reported profit. Unfortunately, the true income is unobservable; thus it imposes to use operating revenue as the proxy. This revenue is measured with error due to the standard reporting differences between observations. I hope that the use of European settings with the mandatory of IFRS could allay the limitation.

Though some limitations constraint this study, I look forward that this thesis gives a positive contribution to the international taxation study and inspires the others with a new idea, because big flames come from a little spark.

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Appendix

Appendix I: Tax rates by country and year.

Country	2007				2008			
	STR	N	avg ETR	med ETR	STR	N	avg ETR	med ETR
Austria	0.25	5	0.08	0.07	0.25	23	0.15	0.11
Belgium	0.34	102	0.23	0.25	0.34	99	0.23	0.22
Bulgaria	0.10	-	-	-	0.10	-	-	-
Cyprus	0.10	-	-	-	0.10	-	-	-
Czech Republic	0.24	4	0.16	0.18	0.21	5	0.21	0.20
Germany	0.38	555	0.25	0.26	0.30	611	0.22	0.19
Denmark	0.25	-	-	-	0.25	-	-	-
Estonia	0.22	-	-	-	0.21	-	-	-
Spain	0.33	412	0.27	0.29	0.30	445	0.23	0.26
Finland	0.26	697	0.22	0.25	0.26	861	0.22	0.25
France	0.33	629	0.26	0.28	0.33	679	0.26	0.28
United Kingdom	0.30	1,407	0.27	0.29	0.30	1,646	0.25	0.28
Greece	0.25	-	-	-	0.25	-	-	-
Croatia	0.20	-	-	-	0.20	-	-	-
Hungary	0.16	10	0.10	0.09	0.16	7	0.17	0.12
Ireland	0.13	15	0.21	0.14	0.13	21	0.18	0.14
Italy	0.37	561	0.40	0.41	0.31	599	0.37	0.37
Lithuania	0.15	-	-	-	0.15	-	-	-
Luxembourg	0.30	-	-	-	0.30	-	-	-
Latvia	0.15	2	0.14	0.14	0.15	3	0.15	0.13
Malta	0.35	-	-	-	0.35	9	0.33	0.35
Netherlands	0.26	116	0.26	0.26	0.26	153	0.24	0.25
Poland	0.19	253	0.21	0.20	0.19	255	0.21	0.20
Portugal	0.25	-	-	-	0.25	-	-	-
Romania	0.16	-	-	-	0.16	-	-	-
Sweden	0.28	1,608	0.23	0.23	0.28	1,583	0.22	0.23
Slovenia	0.23	-	-	-	0.22	-	-	-
Slovakia	0.19	-	-	-	0.19	-	-	-

Statutory tax rates (STR) are accumulation of national and sub-national statutory tax rates retrieved from KPMG corporate tax rate table (KPMG, 2018). N is number of domestic-only firms used to calculate effective tax rate. Effective tax rates (ETR) = income tax expense / profit before tax. Avg. ETR is the average of ETR. Med. ETR is the median of ETR.

Country	2009				2010			
	STR	N	avg ETR	med ETR	STR	N	avg ETR	med ETR
Austria	0.25	67	0.16	0.17	0.25	96	0.13	0.14
Belgium	0.34	99	0.25	0.26	0.34	112	0.23	0.25
Bulgaria	0.10	-	-	-	0.10	-	-	-
Cyprus	0.10	-	-	-	0.10	-	-	-
Czech Republic	0.20	2	0.20	0.20	0.19	4	0.14	0.12
Germany	0.29	663	0.21	0.19	0.29	813	0.20	0.20
Denmark	0.25	-	-	-	0.25	-	-	-
Estonia	0.21	-	-	-	0.21	-	-	-
Spain	0.30	490	0.24	0.28	0.30	572	0.24	0.27
Finland	0.26	790	0.22	0.25	0.26	897	0.22	0.24
France	0.33	683	0.24	0.27	0.33	776	0.25	0.27
United Kingdom	0.28	2,341	0.25	0.27	0.28	3,087	0.25	0.27
Greece	0.25	-	-	-	0.24	-	-	-
Croatia	0.20	-	-	-	0.20	-	-	-
Hungary	0.16	5	0.16	0.09	0.19	9	0.09	0.08
Ireland	0.13	22	0.17	0.11	0.13	26	0.14	0.12
Italy	0.31	639	0.38	0.38	0.31	778	0.37	0.37
Lithuania	0.20	-	-	-	0.15	-	-	-
Luxembourg	0.29	-	-	-	0.29	1	0.34	0.34
Latvia	0.15	14	0.16	0.16	0.15	44	0.17	0.15
Malta	0.35	11	0.28	0.32	0.35	11	0.34	0.35
Netherlands	0.26	200	0.23	0.25	0.26	226	0.24	0.25
Poland	0.19	299	0.20	0.20	0.19	350	0.19	0.19
Portugal	0.25	-	-	-	0.25	117	0.21	0.21
Romania	0.16	-	-	-	0.16	-	-	-
Sweden	0.26	1,772	0.21	0.22	0.26	1,982	0.21	0.22
Slovenia	0.21	-	-	-	0.20	-	-	-
Slovakia	0.19	1	0.08	0.08	0.19	1	0.06	0.06

Statutory tax rates (STR) are accumulation of national and sub-national statutory tax rates retrieved from KPMG corporate tax rate table (KPMG, 2018). N is number of domestic-only firms used to calculate effective tax rate. Effective tax rates (ETR) = income tax expense / profit before tax. Avg. ETR is the average of ETR. Med. ETR is the median of ETR.

Country	2011				2012			
	STR	N	avg ETR	med ETR	STR	N	avg ETR	med ETR
Austria	0.25	105	0.18	0.20	0.25	114	0.18	0.21
Belgium	0.34	126	0.24	0.24	0.34	128	0.24	0.25
Bulgaria	0.10	-	-	-	0.10	-	-	-
Cyprus	0.10	-	-	-	0.10	-	-	-
Czech Republic	0.19	6	0.26	0.20	0.19	4	0.19	0.19
Germany	0.29	848	0.21	0.20	0.29	902	0.21	0.21
Denmark	0.25	-	-	-	0.25	251	0.22	0.25
Estonia	0.21	-	-	-	0.21	-	-	-
Spain	0.30	592	0.24	0.28	0.30	579	0.25	0.28
Finland	0.26	1,209	0.22	0.25	0.25	1,366	0.21	0.23
France	0.33	936	0.27	0.28	0.33	1,074	0.26	0.28
United Kingdom	0.26	3,426	0.24	0.26	0.24	3,764	0.23	0.24
Greece	0.20	-	-	-	0.20	-	-	-
Croatia	0.20	-	-	-	0.20	-	-	-
Hungary	0.19	4	0.06	0.02	0.19	9	0.04	0.04
Ireland	0.13	21	0.13	0.13	0.13	27	0.15	0.13
Italy	0.31	834	0.39	0.39	0.31	796	0.37	0.36
Lithuania	0.15	-	-	-	0.15	-	-	-
Luxembourg	0.29	2	0.30	0.30	0.29	2	0.15	0.15
Latvia	0.15	56	0.20	0.16	0.15	68	0.16	0.15
Malta	0.35	14	0.33	0.35	0.35	13	0.33	0.35
Netherlands	0.25	254	0.23	0.25	0.25	266	0.23	0.24
Poland	0.19	383	0.20	0.20	0.19	394	0.19	0.19
Portugal	0.25	95	0.22	0.22	0.25	100	0.21	0.23
Romania	0.16	-	-	-	0.16	-	-	-
Sweden	0.26	2,056	0.21	0.21	0.26	2,070	0.20	0.20
Slovenia	0.20	-	-	-	0.18	-	-	-
Slovakia	0.19	1	0.20	0.20	0.19	-	-	-

Statutory tax rates (STR) are accumulation of national and sub-national statutory tax rates retrieved from KPMG corporate tax rate table (KPMG, 2018). N is number of domestic-only firms used to calculate effective tax rate. Effective tax rates (ETR) = income tax expense / profit before tax. Avg. ETR is the average of ETR. Med. ETR is the median of ETR.

Country	2013				2014			
	STR	N	avg ETR	med ETR	STR	N	avg ETR	med ETR
Austria	0.25	118	0.20	0.23	0.25	131	0.19	0.22
Belgium	0.34	142	0.23	0.24	0.34	169	0.21	0.22
Bulgaria	0.10	-	-	-	0.10	2	0.10	0.10
Cyprus	0.13	-	-	-	0.13	-	-	-
Czech Republic	0.19	7	0.16	0.16	0.19	8	0.15	0.16
Germany	0.30	969	0.22	0.22	0.30	901	0.22	0.22
Denmark	0.25	255	0.19	0.20	0.25	309	0.20	0.22
Estonia	0.21	-	-	-	0.21	-	-	-
Spain	0.30	689	0.25	0.28	0.30	757	0.25	0.27
Finland	0.25	1,545	0.21	0.22	0.20	1,640	0.17	0.19
France	0.33	1,224	0.24	0.25	0.33	1,277	0.22	0.23
United Kingdom	0.23	4,325	0.22	0.23	0.21	4,877	0.21	0.22
Greece	0.26	-	-	-	0.26	-	-	-
Croatia	0.20	-	-	-	0.20	-	-	-
Hungary	0.19	7	0.04	0.05	0.19	10	0.13	0.06
Ireland	0.13	34	0.15	0.13	0.13	44	0.14	0.13
Italy	0.31	888	0.37	0.37	0.31	1,025	0.37	0.36
Lithuania	0.15	-	-	-	0.15	-	-	-
Luxembourg	0.29	4	0.29	0.22	0.29	5	0.07	0.01
Latvia	0.15	79	0.17	0.15	0.15	84	0.18	0.17
Malta	0.35	17	0.29	0.33	0.35	11	0.34	0.34
Netherlands	0.25	294	0.23	0.24	0.25	355	0.23	0.24
Poland	0.19	461	0.20	0.20	0.19	470	0.20	0.20
Portugal	0.25	165	0.22	0.21	0.23	177	0.21	0.22
Romania	0.16	-	-	-	0.16	-	-	-
Sweden	0.22	2,280	0.18	0.18	0.22	2,322	0.17	0.17
Slovenia	0.17	-	-	-	0.17	-	-	-
Slovakia	0.23	4	0.24	0.22	0.22	7	0.23	0.23

Statutory tax rates (STR) are accumulation of national and sub-national statutory tax rates retrieved from KPMG corporate tax rate table (KPMG, 2018). N is number of domestic-only firms used to calculate effective tax rate. Effective tax rates (ETR) = income tax expense / profit before tax. Avg. ETR is the average of ETR. Med. ETR is the median of ETR.

Country	2015				2016			
	STR	N	avg ETR	med ETR	STR	N	avg ETR	med ETR
Austria	0.25	146	0.18	0.21	0.25	48	0.19	0.20
Belgium	0.34	195	0.23	0.25	0.34	49	0.26	0.29
Bulgaria	0.10	2	0.12	0.12	0.10	-	-	-
Cyprus	0.13	-	-	-	0.13	-	-	-
Czech Republic	0.19	8	0.21	0.19	0.19	2	0.13	0.13
Germany	0.30	818	0.21	0.21	0.30	123	0.22	0.22
Denmark	0.22	345	0.19	0.22	0.22	347	0.18	0.21
Estonia	0.20	-	-	-	0.20	-	-	-
Spain	0.28	847	0.23	0.25	0.25	395	0.21	0.23
Finland	0.20	1,630	0.17	0.19	0.20	901	0.17	0.18
France	0.33	1,186	0.22	0.22	0.33	584	0.22	0.22
United Kingdom	0.20	5,159	0.20	0.20	0.20	4,490	0.19	0.20
Greece	0.29	-	-	-	0.29	-	-	-
Croatia	0.20	-	-	-	0.20	-	-	-
Hungary	0.19	12	0.11	0.06	0.19	10	0.14	0.09
Ireland	0.13	38	0.15	0.13	0.13	13	0.17	0.14
Italy	0.31	1,171	0.33	0.33	0.31	183	0.33	0.33
Lithuania	0.15	-	-	-	0.15	-	-	-
Luxembourg	0.29	4	0.17	0.18	0.29	-	-	-
Latvia	0.15	75	0.15	0.14	0.15	11	0.21	0.15
Malta	0.35	5	0.40	0.37	0.35	-	-	-
Netherlands	0.25	335	0.23	0.25	0.25	173	0.24	0.25
Poland	0.19	386	0.19	0.19	0.19	154	0.18	0.18
Portugal	0.21	203	0.19	0.19	0.21	7	0.22	0.12
Romania	0.16	-	-	-	0.16	-	-	-
Sweden	0.22	-	-	-	0.22	2,454	0.17	0.17
Slovenia	0.17	-	-	-	0.17	-	-	-
Slovakia	0.22	5	0.21	0.21	0.22	6	0.19	0.16

Statutory tax rates (STR) are accumulation of national and sub-national statutory tax rates retrieved from KPMG corporate tax rate table (KPMG, 2018). N is number of domestic-only firms used to calculate effective tax rate. Effective tax rates (ETR) = income tax expense / profit before tax. Avg. ETR is the average of ETR. Med. ETR is the median of ETR.

Appendix II: Calculation of the tax incentive variable (*C*)

Consistent with Huizinga and Laeven (2008), De Simone (2016), Beuselinck et al. (2015), and Markle (2016), I define the tax incentive variable (*C*) for each using the following formula:

$$C_{it} = \frac{1}{(1-\tau_{it})} \frac{\sum_{k \neq i}^{n} \frac{B_{kt}(\tau_{it}-\tau_{kt})}{1-\tau_{kt}}}{\sum_{k=1}^{n} \frac{B_{kt}}{1-\tau_{kt}}}$$

The following scenarios demonstrate two multinational groups with different operating revenues and income tax rates. Both groups have three nationally-aggregated affiliates that are located in different countries and do different revenue allocation across group members.

Group 1

Affiliate	Operating revenue	Tax rate	C_{it}
foreign 1	10	0%	(0,22)*
foreign 2	50	10%	(0,14)
parent	80	20%	(0,03)
foreign 3	100	30%	0,11
mean	60	15%	(0,07)
median	65	15%	(0,08)

Group 2

Affiliate	Operating revenue	Tax rate	C_{it}
foreign 1	100	0%	(0,10)
foreign 2	80	10%	0,00
parent	50	20%	0,13
foreign 3	10	30%	0,29
mean	60	15%	0,08
median	65	15%	0,07

$$* \; C_{it} = \frac{1}{(1-0)} \frac{\frac{50*(0-0.1)}{1-0.1} + \frac{80*(0-0.2)}{1-0.2} + \frac{100*(0-0.3)}{1-0.3}}{\frac{10}{(1-0)} + \frac{50}{(1-0.1)} + \frac{80}{(1-0.2)} + \frac{100}{(1-0.3)}}$$

Appendix III: Predictive validity framework of H_2 (Libby boxes)