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**Profit shifting of multinational
enterprises: A refined FDI approach**

Bachelor thesis

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Declaration of Authorship

I hereby proclaim that I wrote my bachelor thesis on my own under the leadership of my supervisor and that the references include all resources and literature I have used.

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Prague, July 30, 2019

Signature

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Abstract

Base erosion and profit shifting by multinational enterprises is an issue which has recently been getting increased attention from many researchers and other stakeholders. The main objective of this thesis is to quantify the scale of profit shifting and the resulting tax revenue losses incurred by individual governments. For this purpose, we exploit data on foreign direct investment from the International Monetary Fund's database. We begin by testing our main hypothesis that there is a negative relationship between the rate of return on FDI and the share of investment originating from low-tax jurisdictions. Assuming that this relationship is negative due to profit shifting, we arrive at a global estimate of shifted profits in the amount of \$611 billion in 2016. Resulting tax revenue losses reach almost \$200 billion which represents 0.39% of countries' GDP. In total, we deliver estimates for 46 individual countries of which the majority belongs to the high-income class. Our results suggest that the tax revenue losses of a number of high-income countries are higher than some of the existing studies have estimated.

Keywords profit shifting, multinationals, foreign direct investment, tax avoidance

JEL Classification F21,F23,H25

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Abstrakt

Rozměňování daňové základny a přesouvání zisků v podání mezinárodních organizací je problém, kterému se v poslední době dostává zvýšené pozornosti od akademiků, ale i od dalších zainteresovaných skupin. Hlavním cílem této práce je vyčíslit množství přesunutých zisku a z toho pramenící daňové ztráty jednotlivých zemí. Za tímto účelem používáme data na přímé zahraniční investice z databáze Mezinárodního měnového fondu. Začínáme tím, že otestujeme naši hlavní hypotézu, že existuje negativní vztah mezi výnosem z přímých zahraničních investic a výší podílu investic pocházejících z jurisdikcí s nízkou daňovou sazbou. Dále předpokládáme, že příčinou tohoto negativního vztahu je přesouvání zisků, což nás dovedlo k odhadu, že v roce 2016 bylo přesunuto 611 miliard amerických dolarů. Toto množství pak představuje daňovou ztrátu dosahující téměř dvouseti miliard amerických dolarů, což odpovídá 0,39 % HDP těchto zemí. Na závěr dodám, že odhady jsou poskytnuty pro 46 zemí, kde největší zastoupení mají ty vysokopříjmové. Naše výsledky naznačují vyšší odhady daňových ztrát pro řadu vysokopříjmových zemí než-li stávající studie.

Klíčová slova	přesouvání zisků, nadnárodní společnosti, přímé zahraniční investice, vyhýbání se dani
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Research question and motivation:

In this thesis, I would like to focus on the issue of tax avoidance. It is a worldwide phenomenon practiced especially by multinational enterprises (MNEs) which abuse the loopholes in the countries legal systems in order to lower their tax liabilities. To do so, they use various practices, which are usually, for their nature, very hardly identifiable. Nevertheless, the main principle is the same for all of them, to artificially shift the profits from the countries with high rates of corporate income tax to countries with lower ones. As a result, governments lose substantial amount of their revenue, using FDI-driven approach it is globally estimated around USD 200 billion in 2012, from which almost a half - USD 90 billion is represented by developing countries (UNCTAD 2015). Considering the size of the economy or total government revenues, the impacts are much more serious. The off-shore financial centers play key role in these operations, as it was proven in several papers, like the one from Janský & Palanský (2019) and therefore, they are rightfully the subject of many discussions regarding this topic. For all this, it has drawn attention of not only economists and policy-makers, but also of a broad public after leakage of confidential information from tax havens in recent years, resulting in a number of scandals.

The objective is to build upon already existing research, especially the mentioned paper above, from Janský & Palanský (2019), and investigate if there exists correlation between the tax rate differential and the rate of return on FDI.

Contribution:

The thesis should broaden the existing research concerning the topic of tax avoidance and determine if there is positive correlation between the difference in tax rates of individual countries and the rate of return on foreign direct investment. The result might provide a hint illustrating the degree to which the MNEs are motivated to tax avoidance by the size of the tax rate and might be interesting for many economists and policy-makers.

Methodology:

For the analytic part, I am going to build a model which will hopefully provide a clear answer to my thesis question if there exists correlation between the difference in tax rates of individual countries and the rate of return on foreign direct investment. I am going to obtain the data for the rate of return on FDI for the particular countries from the share of their FDI income on total FDI stocks. The IMF's CDIS will serve as a source of this data for around 100 countries in the period from 2009 to 2015. The corporate tax rates for individual countries are available at the KPMG's corporate tax tables. The linear regression to be estimated using the method of ordinary least squares (OLS).

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Acronyms

MNE multinational enterprise

OFC offshore financial centre

PP&E property, plant, and equipment

UNCTAD United Nations Conference on Trade and Development

SPE special purpose entity

FDI foreign direct investments

BEPS base erosion and profit shifting

EBIT earnings before interest and taxes

LACIT lowest available corporate income tax

CTHI Corporate Tax Haven Index

Chapter 1

Introduction

Base erosion as a result of profit shifting activities performed by multinational companies represents a severe problem for national governments of individual countries because it has huge impact on their budgetary income. Things are getting even worse for developing countries which are more dependent on the contributions made by multinational companies, and on tax revenue from corporate income in general. In addition, the money are needed in order to achieve sustainable development goals.

That is why the topic of profit shifting is in a center of interest for many researchers, policymakers and multinational organizations who aims at international cooperation and development. Moreover, recent leaks of confidential information bring another wave of interest all above mentioned parties as well as public eyes whose attention is attracted especially towards the cases concerning multinational giants such as Google, Microsoft or Skype and their anecdotal worldwide tax obligations. For example, the effective tax rate on foreign profits for the American company Microsoft does not exceed 3,1% in 2014 (Zucman 2014). Just for a comparison, the global average statutory tax rate in that year was roughly 22,5%, signalling the enormous difference which persist even after consideration of various tax deductions, etc.

As a result, there is a growing body of literature dealing with this topic, some of them, the most relevant for us, mentioned in the literature review. Nevertheless, the nature of this behavior makes things very complicated and therefore, researchers have to rely in their studies on indirect evidences. Growing number of databases and their improved quality, which are essential for such studies, enables researchers to improve on existing methods or come up with new one. But mainly, as a consequence of both, improved data quality

and better methodological approaches, it leads to more precise estimates which can consequently serve to policymakers.

An example of one such approach is the one upon which we build in our empirical part. This approach exploits data on foreign direct investment and was presented by UNCTAD (2015) and further developed by Janský & Palanský (2019). It examines the relationship between the rate of return on foreign direct investment and the share of investments originating from tax havens. We modify this by putting low-tax jurisdictions instead of tax havens which allows more generality as the list of countries is not rigid anymore. The relationship is supposed to be negative, i.e. higher share implies lower rate of return and vice versa and all of this is attributed to tax-motivated behavior of multinationals which artificially shift profits to countries with low or zero tax rates. Consequently, the tax revenue losses are derived from this relationship and provided at country level.

For this purpose, we exploit data on FDI which are compiled by the International Monetary Fund. We need data on FDI income which come from the Balance of Payments dataset and also data on inward direct investment position which are gathered in the Coordinated Direct Investment Survey dataset. The first year for which data are provided is 2009. Interestingly, data are reported by individual countries on the voluntary basis. An innovation in studies dealing with BEPS issues represents the incorporation of newly created measure called LACIT which is explained more in detail lately in the text.

Our empirical part lead to several important findings. Firstly, we confirm our hypothesis and find negative relationship for the rate of return and the share of investments. The negative relationship found in our preferred model is very strong, it implies a drop in the rate of return on FDI by 2.88% for a mean value in our sample. Secondly, we deliver estimates of tax revenue losses for 46 countries which in total amount \$188 billion in 2016 which is nearly equal to 0.4% of countries' GDP. Thirdly, our results suggest that high-income countries loose most revenue as share of GDP.

We see our contribution to the existing literature in several points. Most importantly, we provide a set of new estimates of revenue losses for 46 countries. Further, our data show a negative relationship for the rate of return and the share of investments which is not trivial. At last, we present and use the newly established indicator called LACIT - 'lowest available corporate income tax'.

The thesis is structured as follows. We begin with a literature summary of the relevant studies in *Chapter 2* and then we list the data used in our

empirical part and comment on them in *Chapter 3*. *Chapter 4* for is dedicated to the methodological concept which is applied. In *Chapter 5* we present our results and compare them with another three recent studies with country-level estimates. The last *Chapter 6* concludes.

Chapter 2

Literature review

2.1 Tax havens

The term tax haven, for which a phrase offshore financial centre (OFC) is quite interchangeably used in the literature and we will follow this trend through this text as well, denotes countries which have adopted sets of policies whose combination with low tax rates make them attractive locations for foreign investors. Deciding whether country belongs to the group of these countries is to certain extent arbitrary as there is no strict definition and therefore it depends on chosen attributes. Some lists are produced by supranational organizations such as OECD or EU, however, these lists predominantly disregard various qualitative indicators and their nature is rather political. Fortunately, there are several lists, created by different authors for their academic purposes like Hines Jr & Rice (1994) or Dharmapala & Hines Jr (2009) which contain similar subsets of countries, especially small island countries with population below one million. This description reflects the public perception of tax havens. Tax havens undoubtedly play an important role in international environment and pose a problem for other economies, especially in terms of tax collections because their favourable regulatory settings lure income of both wealth individuals as well as large multinational enterprises whose behavior is the subject of our focus.

When establishing international business, MNEs carefully analyze every possibility how they can minimize their global tax liabilities and obviously create the corporate structure in the best efficient way. Therefore, MNEs exploit the opportunities provided by tax havens and create sophisticated corporate structures in which they locate some parts of their business in these low-tax jurisdictions. Afterwards, these parts serve as investment centres through which

parents indirectly finance their affiliates in order to avoid or defer taxation because these countries typically do not apply capital gains taxes or withholding taxes. Their position of intermediaries can be exemplified by the fact that OFC generate 42% of the foreign net income of US MNEs in 2008 while when comparing with value added, an indicator which neglects financial activity and is equal to sales minus purchases from other firms, we get only 11%. Moreover, these 11% of value added is generated by even lower share of production factors, employment (5.55%), resp. employee compensation (6,06%), and PP&E (6,49%) (Hines Jr 2010). In all cases, all these numbers are extremely high with respect to the size of tax havens economies and demonstrate how much foreign activity they attract .

Hines Jr & Rice (1994) study the role of tax havens in foreign activities of US companies as well and mention two concerns from that time regarding the position of tax havens. Firstly, if the US tax base will not be jeopardized in the long run by the ability of tax havens to attract foreign income and secondly, if US MNEs will not shift their real activities including factors of production to tax havens. The second concern can be easily evaluated by comparing data more than two decades away because they use the same data source as Hines Jr (2010), i.e. from the Bureau of Economic Analysis. In 1982, tax havens account for 4,3% of US companies foreign employment and 4,2% PP&E. We can observe a not negligible increase of about 1-2% for both indicators, however, we have to bear in mind that some part of that increase is attributable to the extension of tax haven list from 41 to 52 countries.

The position of tax havens as intermediaries is derived from their involvement in the cross-border investment activity. Two categories of investment are distinguished, portfolio and direct investment, where the investor's controlling share in a company, generally 10%, is used as a criterion to talk about direct investment. In this kind of investment we are primarily interested as they are made exclusively by MNEs. UNCTAD (2015) examines the importance of OFCs in cross-border direct investments. They divide 42 OFCs into two categories - tax havens and SPE jurisdictions (special purpose entity) where the main difference is the size of the country as well as their real economic activity. Using bilateral FDI data for a year 2012, they combine information about recipient/investor country and create an investment matrix assigning a total share for each group. Focusing on inward investment into non-OFC countries, \$6,5 trillion out of total \$21 trillion was routed through OFC, accounting for more than 30%. On the other hand, OFC countries received from non-OFC

countries around \$7 trillion which almost mirrors the outward investment from OFCs and where lion share is attributed to SPEs with the likes of the Netherlands or Luxembourg. Here, we can see that majority of investments which are routed through OFCs can be related to letterbox companies, entities founded in order to minimize tax obligations. Moreover, these flows are responsible for double counting in global investment corporate figures which causes trouble to researchers.

2.2 Profit Shifting

As we mentioned above, MNEs take advantage of their global operations which are located in countries with different tax systems and most importantly corporate tax rates in a way to minimize their global corporate tax liabilities. They arrange their corporate structures in such ways that they can shift profits from high-tax jurisdictions to jurisdictions with low tax rates and their global operations allow them to do so. They spend huge amount of money on tax planning and employ plenty of tax avoidance schemes, from which the 'Double Irish-Dutch Sandwich' is the most famous. Although an affiliate located in tax haven is considered as an indicator of tax-planning activity, according to Desai *et al.* (2006) or Dharmapala & Riedel (2013) almost 40% of MNEs in their datasets do not involve such affiliate in their corporate structure. Dharmapala (2014) claims that this is caused by high fixed costs of tax planning which smaller firms cannot afford and thus are not so sensitive to taxes.

In the literature, there are considered three main profit shifting channels, specifically strategic transfer pricing, the location of intangible assets and debt shifting. It is noteworthy that MNEs seldom employ only one of channel, however, the extent to which an individual channel is employed is heavily influenced by the type of industry in which MNE operates. For example IT companies take advantage of intangible form of their products and thus shift profits mainly through the strategic location of intangible assets whereas companies, which operate in capital intensive industry, prefer debt shifting. Nevertheless, the aim is still the same - artificially shift profits from high- to low-tax countries (Janský & Palanský 2019).

Firstly, MNEs manipulate the price of intrafirm transactions of goods and services. They inflate the prices of exports and deflate the prices of imports in a case of low-tax jurisdictions and vice versa for high-tax jurisdictions. Clausing (2003) analyzes behavior of US companies related to tax-motivated transfer

pricing over the years 1997-1999. For this purpose, she uses data on export and import prices from Bureau of Labor Statistics (BLS) which are recorded in monthly intervals. Separate models for import and export prices are constructed and either statutory or effective tax rates are used as a main explanatory variable. Her data show strong evidence of US MNEs' manipulative behavior for both statutory and effective tax rates. Specifically, results suggest that a 1 percentage point lower country's statutory tax rate equals to 2.0% increase in US import prices and 1.8% decrease in US export prices of intrafirm transactions relatively to non-intrafirm.

Secondly, intangible assets as a result of research and development are located in foreign affiliates in countries with the lowest tax rates. Consequently, these affiliates collect royalty payments for providing the asset to the rest of the company. Moreover, the research itself usually does not take place in this affiliate but in a high-tax jurisdiction where some deductions for R&D can be applied. When the research is almost finished, the asset is transferred for a low price to the desired country with low tax rate where it is consequently finished and claimed (UNCTAD 2015). Dischinger & Riedel (2011) analyze how European MNEs allocate their intangible assets with respect to the country's corporate tax rate. For that purpose, they exploit panel data from Amadeus database over 1995-2005. They conclude that 1% decrease in the tax difference between the affiliate and company's average results in 1.7% increase in the amount of intangible assets recorded on the affiliate's balance sheet. In addition, they examine the sensitivity of profit to tax rates differentials which is supposed to be negative. Their data suggest that pre-tax profit of companies which are R&D intensive are twice as much sensitive. That is in line with Grubert (2003).

Thirdly, in case of debt shifting, MNEs' affiliates in low-tax jurisdictions provide excessive loans with high interest rate to the other parts of the company. For these parts, the interest payments represent a deductible item when computing the tax base. This channel influences also the MNE's decision making process regarding an establishing of a new affiliate in a foreign country. This issue is discussed by Hines Jr (1999). The company may finance a new affiliate either via equity or debt. In case of equity funding, parent company puts money into a foreign affiliate through equity funds and the generated profit is subsequently taxed in a host country. If MNE applies debt financing, parent company provides a loan to a foreign affiliate which consequently pays interest payments which represent a deductible item reducing their pre-tax income.

From this setting results a pretty clear incentive to finance foreign affiliate in a country with higher tax rate through debt financing and an affiliate in a country with lower tax rate through equity. This is in line with the literature, where we can find an evidence of this behavior (See, e.g. Hines Jr & Hubbard (1990) or Grubert (1998)). This behavior can be partly limited by implementation of various measures such as thin capitalization rules or introducing withholding taxes. Prime example of this is a change in the behavior of US multinational companies after introducing a Tax Reform Act of 1986 which contains a provision limiting deductions of all domestic interest expenses for companies with foreign operations (Collins & Shackelford 1992).

Several researchers attempt to disentangle the contribution of individual channels and find out which one is responsible for the biggest share of profit shifting. However, only two categories are considered with respect to this question - financial structures and transfer pricing. The third channel of intangible assets is included in transfer pricing. On one hand, Dharmapala & Riedel (2013) claim that debt shifting represents the main technique how multinationals shift their profit from high to low-tax jurisdictions. On the other hand, Grubert (2003) argues that non-financial shifting techniques account for similar volume as debt shifting. Heckemeyer & Overesch (2013) address this question as well and attempt to settle this debate. They start with their predicted overall tax semi-elasticity of 0,82 which includes both channels of profit shifting techniques. Basic premise lies in an idea that earnings before interest and taxes (EBIT) correspond exclusively to non-financial techniques. Using coefficients from their meta-regression and consequently, relating the number to pre-tax profit to make it comparable, they conclude that non-financial techniques, like transfer pricing and licensing, account for almost three quarters (72%)¹.

2.3 Magnitude of Profit Shifting

National governments are trying to limit profit shifting through these channels by implementing policies such as thin capitalization rules or arm's-length principles. However, this issue cannot be solved only by individual national governments and asks for deep international cooperation with involvement of supranational organizations and researchers who can offer their expertise. Despite all the efforts, the magnitude of profit shifting activity, as documented

¹for precise methodology see Heckemeyer & Overesch (2013), pp. 23-25

by countless of empirical studies, persists at undesirable levels. But to which extent multinationals shift their profits? As I said, plenty of researches tried to assess the scale of profit shifting and when they do so, they usually rely on indirect evidence of profit shifting activity which means that they are trying to reveal a relationship between some measure of profitability and tax variable such as tax rates differentials which should represent an incentive to shift profits between individual jurisdictions in which the particular multinational group operates.

At first, I would like to focus on studies which are using tax rate differentials and the main objective of their works is a sensitivity of profits to these differentials rather than some absolute estimate of profit shifting. Although, individual estimates are quite distinct and there is no consensus about the true magnitude of profit shifting, there is a consensus that the extent to which multinational companies shift their profits between individual jurisdictions is significant and considerably influence tax collections in individual countries. The wide variety in estimated magnitude arises, quite obviously, from certain model and data characteristics as if aggregated country-level or detailed firm-level data are used. The effects, especially the direction of those effects, on the resulting estimate are closely investigated in a latter study Heckemeyer & Overesch (2013), however, now we start from the primary efforts.

One of the early works which is, nowadays, considered as a breakthrough in the area of estimation of corporate profit shifting is Hines Jr & Rice (1994). The basic premise of their model is a division of affiliate's total, i.e. recorded, profits into two components - 'real' and 'shifted', where the former stands for profits generated by the affiliate's real activity, the ones derived from the use of production factors and the latter stands for the profits which correspond to tax-motivated cross-border shifting and therefore can take either positive or negative values, regarding to the prevailing direction of shifting, i.e. if profits are shifted rather into or away from the affiliate. The coefficient of interest stands for a semi-elasticity of pre-tax income with respect to tax variable which should reveal a presence of profit shifting activities. The authors use country-level data for a year 1982 from the Bureau of Economic Analysis which gathers information about foreign activities of US companies. Running several regressions, including few where they control for countries' population as an instrumental variable, they obtain results which imply the semi-elasticity ranging from 2,25 to 3,65. It is important to mention that the pre-tax income is net of financial operations, thus does not account for a whole debt shifting

channel.

Using cross-sectional firm-level data for a year 1999 from Amadeus database where accounting information as well as information about ownership structures of European companies are collected, Huizinga & Laeven (2008) follow the work of Hines Jr & Rice (1994) and apply similar approach for their research. However, they believe that the tax variable should not reflect only the profit shifting incentives in a form of tax rate differentials but the opportunities to shift profits as well, arguing that with increasing number of company's operations in a particular country their ability to shift profits in or out of this country is increasing. Thus, they construct composite tax variable where the tax rate differentials are scaled by company's profits as a measure of their undertaken operations. They incorporate an instrumental variable of country's population into their model as well as Hines Jr & Rice (1994) in order to remedy for the downward endogeneity bias. Consequently, they use regression's estimates to compute semi-elasticities with respect to top statutory tax rates for individual countries. The average value for their subset of countries is equal to 1,31. The lowest semi-elasticities belong to larger countries like Germany (minimum of 0,28), Italy, France and quite surprisingly also Czech Republic (0,69). On contrary, smaller western countries like the Netherlands, Belgium or Portugal have the highest estimated semi-elasticities which are higher than 2.

These are examples of studies which use cross-sectional data to address this question and they indicate higher estimates of BEPS than more recent studies which employ panel data. Dischinger (2007) and Lohse & Riedel (2013) both use panel data from Amadeus database across an 11-year long period, i.e. observed period is of the same length but separated by four years. Thus, examined periods are 1995-2005, 1999-2009 respectively. As we mentioned, both studies indicate smaller semi-elasticity of 0.7 and for the latter study even only 0.4. From this point of view, more recent studies, which are built upon more sophisticated models and more detailed databases, suggest that the base erosion and profit shifting is lower in magnitude. However, it is important to bear in mind that there are many characteristics influencing the resulting magnitude of the particular regression and therefore take this claim with a caution. Furthermore, Clausing (2016) argues that the usage of firm-level financial data from databases like Amadeus or Orbis is not appropriate because they are limited in a coverage of affiliates from tax havens which are supposed to be the key players in international corporate profit shifting and therefore underestimate

the true magnitude. In addition, she run her own regressions on aggregated country-level panel data over the period 1983-2012 which result in estimates of semi-elasticity ranging from 1.85 to 4.61, with an average of 2.92.

There are plenty of another studies which estimate the tax semi-elasticity of profits, but as mentioned above, the data and methodology used make them hardly comparable among themselves. Therefore, Heckemeyer & Overesch (2013) go through the existing literature, collect the estimates and record the estimation's characteristics in order to account for the discrepancies and eventually arrive at a consensus value of profit shifting. Based on 238 estimated semi-elasticities from 25 different studies they run a meta-regression, technique when the estimates are regressed predominantly on binary variables which reflect the characteristics of individual approaches. Thus, it somehow assesses the impacts of certain characteristics on resulting semi-elasticity. They arrive at the estimate of tax semi-elasticity of 0.82 which should represent the best possible estimate of corporate profit shifting given the existing literature.

All previously mentioned results have something in common, they all consider only linear specification of the relationship between profits and tax variable and even though Heckemeyer & Overesch (2013) arrive at consensus semi-elasticity of 0.82, Dowd *et al.* (2017) question that, arguing that there exists heterogeneity in the sensitivity to profit shifting across the scale of tax rates. They justify this heterogeneity by the claim that once a multinational has set up a sophisticated business structure allowing for profit shifting, their optimal decision is to shift profits into the company's affiliate located in a country with the lowest tax rate available, assuming that the associated costs are not exaggerated. For this non-linearity can be accounted for by including second order approximations of the tax parameter as presented by Hines Jr & Rice (1994) who briefly examine this possibility. Nevertheless, the subsequent studies predominantly ignore that and focus on linear specification, causing on one hand underestimation of the profits' sensitivity for countries with low rates and on the other hand overestimation of the sensitivity for the countries with high rates (Dowd *et al.* 2017). In order to confirm this claim, Dowd *et al.* (2017) drop out of the sample controlled foreign companies located in countries listed among bottom decile countries for a given year with respect to the size of tax rate. In comparison with the full sample, the coefficients of interest decrease substantially, suggesting that the semi-elasticity for high-rate jurisdictions is overstated. Consequently, they run the regression with quadratic specification whose results suggest that the effect of 1 percentage point decrease in a tax

rate is heavily influenced by the initial value of the tax rate, f.e. for an initial value of 5% the drop would result in 4.7% increase in recorded profits whereas for an initial value of 30% the increase in profits would represent modest 0.7%.

In answering the question about the magnitude of the corporate profit shifting, we have focused primarily on above mentioned works which find tax semi-elasticity of profits. This approach is usually applied in the literature and measures responsiveness of affiliates' profits to a change in the tax rates, however, other methods can be found in the literature, such as the one implemented by Dharmapala & Riedel (2013). They simulate an exogenous income shock to a parent which consequently redistribute part of this extra income among group members through the already employed profit shifting channels. Assuming that this extra profit is shifted only to affiliates facing lower tax rate than parent because it will be lightly taxed, high-rate affiliates serve as a control group as there is no incentive to shift part of this incremental income to them. Another alternative methods are listed and well described in Dharmapala (2014) who provides an extraordinary review of existing literature regarding the issue of corporate profit shifting. Besides this, he briefly discusses several questions related to BEPS such as the development of BEPS in time or if there is a difference between parent-to-foreign and foreign-to-foreign shifting.

2.4 Resulting Revenue Losses

However, even some of these studies go further than estimating just the profits' sensitivity and attempt to estimate the absolute number of corporate profit shifting and the resulting revenue losses. These numbers are much more relevant for policymakers and ongoing international debates. Such studies are greatly challenging and require high-quality data which pose an issue especially in case of developing countries for which data either do not exist at all or their quality is questionable. Although, even if relevant data do exist, it is not possible to determine true scale of revenue losses due to the inherent difficulties associated with estimating of tax avoidance.

Developed countries such as the USA offer several data sources for estimating the magnitude of profit shifting and for that reason, behavior of US multinationals is subject of many studies. An example is, already mentioned, Clausing (2016) who uses the estimated semi-elasticity to determine the revenue losses incurred by US government during the year 2012 which according to her computations lies somewhere between \$77 billion and \$111 billion. Moreover,

she highlights the fact that the loss is sharply increasing in absolute numbers and points out two reasons, firstly, the increasing amount of foreign profits due to ongoing globalisation process and secondly, the decrease in foreign effective tax rates which makes foreign jurisdictions more attractive for future US investments and at the same time bolsters the incentive to shift profits. This conclusion is in line with Zucman (2014) who analyzes national accounts and balance of payments statistics. He concludes that the effective corporate tax rate paid by US-owned companies have fallen on average by one third (i.e. 10 percentage points) from initial 30% during the last 15 years preceding 2014. However, he attributes only some 6-8% to tax avoiding per se, stating that the rest is attributable to a financial crisis and some changes in the US tax base, all in all resulting in an estimated loss around \$120 billion in 2013.

Tørsløv *et al.* (2018) estimate that almost 40% out of \$ 1.7 trillion so called "multinational" profits, i.e. profits which are generated only by multinationals' affiliates located in a different country than the one where MNE is headquartered, was shifted to tax havens in 2015. These \$600 billion result on average in the revenue loss from corporate income tax of 20% for EU non-havens and 10% for the rest of the world. Furthermore, they revealed that US headquartered MNEs are the most active in shifting profits, accounting for approximately 50% of all shifted profits, while the MNEs headquartered in EU countries for roughly 30%. Wright & Zucman (2018) attributes this high share of US multinationals to provisions from 1996 which allow foreign subsidiaries of US MNEs to become disregarded entities for tax purposes (so called check-the-box provisions).

Another study, which we have already mentioned in the text and which, besides the estimates of profits' semi-elasticity provides also estimates of revenue losses, is Huizinga & Laeven (2008). Data from Amadeus database enable them to provide estimates for 21 European countries, especially for more developed countries, i.e. there are no estimates for Eastern countries except for Romania. Seventeen out of these twenty-one European countries are, based on their estimates, supposed to gain additional tax revenue due to profit shifting at the expense of four countries - Germany, Italy, Portugal and Slovakia. It is important to note that out of these four countries, Germany actually incurred 95% of aggregate losses due to the size of their economy. Thus, based on their results, Germany are true loser of profit redistribution across Europe. However, Tørsløv *et al.* (2018) warn that studies where major tax havens are missing might lead to wrong inference about the location of shifted profits.

Several recent studies attempt to widen the coverage of countries for which

the estimates are provided. These studies aim especially at developing countries which, as previously mentioned, represent a problematic group in this area for the lack of relevant data. Moreover, it is generally believed that developing countries are much more vulnerable to tax-avoiding activities because they do not dispose with capacity to effectively defend themselves against the aggressive profit shifting practices employed by MNEs (Fuest & Riedel 2009). For example, Fuest *et al.* (2011) analyze the behavior of German multinationals, specifically the scope of use of intrafirm loans to finance foreign affiliates with regards to tax incentives. Their results suggest that the effect is two times larger in developing countries, signalling their higher exposure to profit shifting.

What makes things worse in addition to higher vulnerability of developing countries is their stronger dependence on the revenues from corporate income tax. As documented by Crivelli *et al.* (2016), corporate income tax as a share of total government revenue fluctuates around the 17% threshold for developing countries whereas only around 10% for the developed. That implies less opportunities how they could possibly compensate for their losses from profit shifting.

UNCTAD (2015) goes further and analyzes the overall contribution of companies on government revenues, this includes not only corporate income tax and other revenues which companies directly pay but as well the taxes which they collect for governments such as personal income tax, indirect taxes on goods and services etc. Consequently, special attention is devoted solely to multinationals' contribution. The contribution shows up twice as much significant in developing than in developed countries, with a share of 10% on total government revenues.

These numbers signal that the presence of profit shifting behavior of multinationals would affect government revenues of developing countries more heavily. Fortunately, the literature provides an evidence in recent studies which address this concern.

One of the very first studies whose main objective is to provide estimates for developing countries is Crivelli *et al.* (2016). They analyze unbalanced panel data comprising information about 120 countries over 1980-2013. Their results, indeed, suggest that developing countries lose more revenue than developed countries, of course only in relative terms, specifically 1.3% of GDP versus 1.0% of GDP. This difference is very significant, especially if we realize that developed countries are able to collect government revenues in the amount of

40% of GDP while developing only half of that amount, i.e. 20% of GDP (UNCTAD 2015).

Although previous study manages to provide estimates for developing countries as a group, it does not provide country-by-country estimates which would be of much higher relevance for policy debates.

At the end of this section, we would like to mention such study. Janský & Palanský (2019) follow the work of UNCTAD (2015) which provides its own estimate of global annual revenue loss in the amount of \$200 billion in 2012. However, Janský & Palanský (2019) manage to deliver estimates of revenue losses for 79 countries, many of them developing. The coverage together with the strong participation of developing countries are what make this study unique because for some of these countries there are no such estimates. Moreover, wide coverage of countries allows them to discuss re-distributional impacts for national governments. Using year-, region- and income-group fixed effects in their preferred model, they arrive at the amount of \$420 billion of shifted profits and the resulting global government revenue loss of \$125 billion in 2016.

Chapter 3

Data

The aim of this section is to present the data which are used for the empirical part of this thesis. The research follows the work of Janský & Palanský (2019) and thus the data sources as well as the created dataset are similar in number of ways. The dataset contains data from various public sources which will be listed here and of which the majority is compiled by multinational organizations such as International Monetary Fund (IMF), Organization for Economic Cooperation and Development (OECD) or World Bank. However, these raw data had to be adjusted for our purposes in a way which will be described here as well. In addition, special attention will be paid to the IMF's Coordinated Direct Investment Survey (CDIS) which is the key data source for our work and to Corporate Tax Haven Index which offers an innovative way how to approach corporate tax rates.

3.1 CDIS Dataset

As already mentioned in the literature review, the research in this area brings many difficulties, especially with finding suitable data source. Researchers agree that firm-level data are the best possible for estimating the tax-motivated behavior of multinational firms and in recent years, studies using such data, especially from Orbis or Amadeus databases, some mentioned in the previous section, have occurred. However, many researchers dispute the correctness of the use of these databases because they believe that the current coverage is insufficient, i.e. these datasets lack information about affiliates located in tax havens which are generally viewed as the main agents responsible for profit shifting activities. Indeed, observed estimates are much lower for such studies

than for those with country-level data, thus very likely signalling the underestimating.

In response to the previous statement, we have decided to use country-level data on foreign direct investment. We attempt to cover as many countries as possible. Therefore, we have chosen IMF's Coordinated Direct Investment Survey (CDIS; IMF 2019a) because it provides the broadest coverage among databases on FDI. CDIS dataset provides bilateral information on FDI stocks since 2009 and the last year available is 2017. There are gathered information on inward and outward direct investment cross-classified by the immediate counter party. This classification entails great advantage because it allows us to obtain so called 'mirror' data for each economy by aggregating all the reported numbers by their counter parties. These data can be used in two ways, firstly, it enables to compare reported inward data by one economy and outward data by the second economy (corresponding counter party) and detect so the discrepancies in reported numbers between these two economies. This contributes to the improvement in data quality and to the improvement in future research conducted on these data. Secondly, it brings a possibility how to broaden the coverage of countries for which the data are provided as the participation on reporting is purely voluntary for each economy. Thus, for those countries, which are not involved, we can observe at least the number representing the lower-bound values because, in most cases, neither all counter parties reports.

In the table 3.1, we can observe that the number of reporting economies fluctuates around the threshold of 110 economies since 2011 and up to this date 121 countries have reported the data at least once, unfortunately, some of them refrains from doing so. Interestingly, numbers for inward and outward data differs which reflects the fact that countries, which decide to join the CDIS, commit themselves to report data at least for inward direct investment position. Therefore, submitting the numbers for outward investment position is not required which Angulo & Hierro (2017) justify by the statement that it is more demanding and in case of some small countries irrelevant.

In the ideal state of things, the total inward and outward direct investment position should be balanced, however, in the CDIS the total inward investments prevails over outward for every single observed year. The main causes are the lower number of countries reporting outward positions, countries which do not

Table 3.1: Number of reporting countries

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017
Inward	92	98	108	110	111	112	114	111	108
Outward	62	68	75	75	77	80	79	82	80

Source: Authors

participate at all¹ and some discrepancies between two reporting countries in general (Angulo & Hierro 2017).

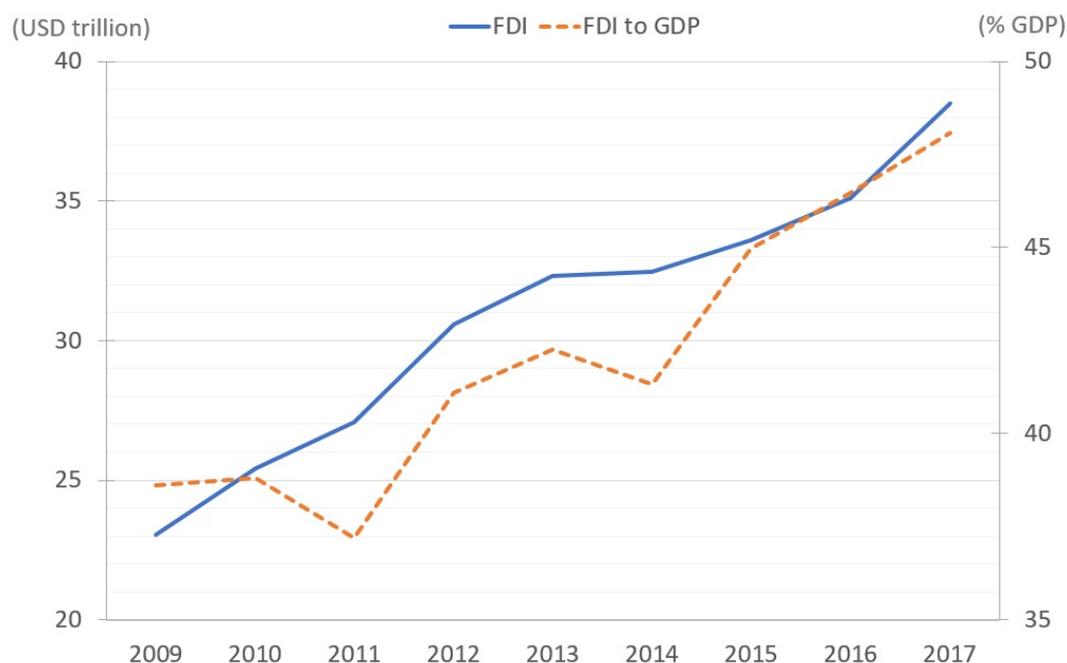
That is the reason why we exploit the data on inward direct investment position in our study. Two variables from the CDIS become crucial for our analysis, 'Inward Direct Investment Positions, US Dollars (IIW_BP6_USD)' and 'Inward Direct Investment Positions, Derived, US Dollars (IIW_DV_BP6_USD)' where the former contains data reported by individual economies whereas the latter contains 'mirror' data, id est data reported by other economies in which particular country stands as a recipient. As we mentioned, the main goal is to cover as many countries as possible and therefore we create a new variable by combining these two, above listed, variables as follows: we use primarily reported data by particular economy and when the data are missing we take the values from "mirror" data . For now on, we work with this newly created variable called 'Inward Direct Investment Positions, Combined'.

When analyzing inward FDI, we can conclude that the global volume increased in absolute terms by \$16.9 trillion or 83 % (from initial \$20.5 trillion in 2009 to \$37.5 trillion in 2017). However, for this increase is partially compensated by the movement in the number of countries for which the information about the FDI is available. Therefore, we relate the absolute volume to GDP of countries for which the data are available in that particular year in order to provide a better picture about the development of FDI over this period, as can be seen in Figure 3.1. It shows that the volume is rising in the long-run even in relative terms, however, only by modest 25 %. Moreover, the indicator is no longer growing during the whole observed period because there are two drops in 2011 and in 2014. One reason of the fall in 2011 is the situation in the area of Persian Gulf where a combined factors of the Arab spring and decreasing oil prices cause the fall of more than 53% in the inward FDI (Janský & Palanský 2019). To the year-end 2017, this region did not recover back to the level pre-

¹country with positive net position experiences higher outward investment than inward and thus its absence deepens the asymmetry

ceding the year 2011. On the other hand, all other regions recorded a growth of at least 50% during the observed period with the 'East Asia' and 'Central and South Asia' at the top².

Figure 3.1: Global FDI development; 2009-2017



Source: Authors

3.2 Other Data Sources

In order to compute the rate of return (RoR) on FDI we need, besides the information on FDI stocks, the information on the income generated by these investments. Such data are provided by IMF as well, in the Balance of Payments (BoP; IMF 2019b). Although Janský & Palanský (2019) use three alternatives of RoR in their analysis, specifically total FDI income and then its equity and debt components, we compute the RoR only for the first two mentioned. The corresponding variables in the IMF's dataset are 'Current Account, Primary Income, Investment Income, Direct Investment, Debit, USD (BMIPID_BP6_USD)' for total FDI income and 'Current Account, Primary Income, Investment Income, Direct Investment, Income on Equity and Investment Fund Shares, Debit, US Dollars (BMIPIDE_BP6_USD)' for its equity

²we follow the CDIS's regional distribution

component. Unfortunately, the main limitation of these data is the aggregation of income for the whole country which means that data do not provide bilateral information. Otherwise, such information would allow us to compute the rate of return on investments from individual countries and thus more precisely estimate the volume of shifted profits. Anyway, the rate of return is computed as the ratio of either total income on FDI or its equity component to the overall FDI stocks.

The last very crucial data input are statutory corporate tax rates for individual countries which are collected from various sources. As the prime data source we use OECD and KPMG which we have to complement with data from Trading Economies which prove itself as a valuable source of tax rates for developing countries. Additionally, in May 2019 Tax Justice Network published for the first time the results for the Corporate Tax Haven Index (CTHI; Tax Justice Network 2019) which provides us with the information on how much individual world's jurisdictions contribute to the base erosion and profit shifting by multinationals. The output is a ranking of individual jurisdictions based on many indicators which are supposed to credibly assess the extensiveness of their contribution to BEPS. Among those indicators is one in which we are especially interested - 'Lowest Available Corporate Income Tax (LACIT)'. The sources like OECD or KPMG provide us with top statutory rates, however, nowadays, national governments of individual countries compete among themselves for foreign investments and thus, in addition to steady reduction in statutory rates, some of them offer tempting tax reliefs to foreign multinationals in the form of tax holidays, partial exemptions and so on. As a result, MNEs face much lower tax rates in these countries than reported by OECD or KPMG. The CTHI's approach takes into account these incentives which must hold for a broader range of MNEs. To put it simple, they lower the reported top statutory rate until it reaches the LACIT rate³. The final indicator takes values from 0 to 100 and is computed from the LACIT rate in the following way,

$$LACIT = (35\% - LACITrate) * \frac{100}{35}. \quad (3.1)$$

Therefore, the value of 100 signals tax avoiding risk. Although this concept is really new and covers only 64 jurisdictions, we believe that it reflects the reality

³for the precise methodology please see Tax Justice Network (2019)

much better and allows us to estimate the effect more precisely. Thus, the LACIT rate is prioritized to top statutory rate when available. Nevertheless, the top statutory rate and the LACIT rate are the same for many out of those 64 countries because they simply do not offer tax reliefs in greater extent or at all. The effect from application of this measure is the reduction in the average tax rate across the observed period of 2,3 % on average⁴.

Besides these data which are key for our approach, we collect other data which occurs commonly in the analysis such as ours. Data on GDP are from World Bank and complemented from CIA where needed, while numbers on countries' population are downloaded from World Bank.

The last piece of data is needed for better analysis of the estimated tax revenue losses. Data on total tax revenue and corporate income tax revenue are downloaded from the ICTD/UNU-WIDER's (2018) Government Revenue Dataset. Unfortunately, the last year available for majority of countries is 2016. In addition, data from World Bank's income classification are used.

⁴See Figure A.1 in Appendix depicting the development of average tax rate and average tax rate with application of LACIT rate during the observed period

Chapter 4

Methodology

In the following section, we describe the applied methodology for our empirical part. As all other studies analyzing the tax-motivated behavior of multinationals, as well we rely in our approach on indirect indicators which should help us uncover that behavior and assess its magnitude. Although the approach used is nothing new, in other words it has been already used in recent studies, we make several innovations which are to be listed here. This approach exploits the data on FDI and was presented for the first time by UNCTAD (2015). Consequently, Janský & Palanský (2019) move this approach a little bit further and now we will continue and build on their work. In the first part, we describe how we empirically test our hypothesis that countries, which obtain higher share of investments from low-tax jurisdictions, subsequently report lower rate of return on FDI. In the second part, we explain how we derive the estimates for tax revenue losses of individual national governments.

4.1 Model Specification

The model, which is presented here, is very similar to the one used by Janský & Palanský (2019). As already mentioned, the basic idea of this model is that we assume that there is a difference in the rate of return on FDI originating from different countries and we argue that this difference is to a certain extent caused by profit shifting. Unfortunately, aggregated data on FDI income do not allow us to compute rates of return in this way. Therefore, we are forced to approach the model a little bit differently and run the computation on aggregated level.

We assume that countries receiving higher share of investments from low-tax jurisdictions report on average lower rate of return on FDI because the

incentives as well as opportunities to shift profits are greater. We intentionally talk about low-tax jurisdictions, although Janský & Palanský (2019) in their model work explicitly with offshore financial centres. Here we can observe the first innovation, specifically, the way how the share of investments which, based on our assumption, affects the RoR is constructed. While Janský & Palanský (2019) use rigid list of countries which is made of three categories - list of tax havens from UNCTAD (2015), self-declared special-purpose entity (SPE) countries and 'other SPE countries', we determine the share based on the difference in the corporate income tax rate of the recipient and investor country. In reality, it means that the 'list' of countries, for which holds that investments originating from them are considered as a more risky to profit shifting, is different for each individual country, and even for a particular country the 'list' is changing as the corporate tax rates are changing (usually diminishing), all is based on the size of their corporate tax rate. Moreover, as presented and explained in the previous chapter, we apply the LACIT rate where available. All in all, we believe that this approach helps us to capture the incentives for profit shifting in the best possible way because even countries with significantly lower corporate tax rate and at the same time not labelled as a offshore financial centre embody an incentive to shift profits.

The share is calculated on 5%, 10%, 15% and 20% level and the steps are following. At the beginning, we have an observation with country of investor, country of recipient, year and the amount of investments. Therefore, we assign tax rates valid in that year to both investor and recipient and if the tax rate of the recipient is higher than the tax rate of the investor plus the corresponding threshold, we consider that amount of investment as risky. Afterwards, all these risky investments are aggregated and divided by the total volume in the particular year in the particular country.

Now, when we have presented the way in which our main independent variable is constructed we can move on to the model itself. Our goal is to estimate the relationship between the rate of return on FDI and the share of FDI originating from countries with lower tax rate while controlling for other characteristics. We are using similar model as Janský & Palanský (2019), however, with updated data over the year 2009 and 2017.

Therefore, the proposed model can be written as:

$$FDI_RoR_{it} = \beta share_It_jurisdictions_{it} + \Gamma x_{it} + \delta_t + \mu_i + \epsilon_{it} \quad (4.1)$$

where i denotes a country and t denotes a year. Two alternatives are used for the dependent variable. Firstly, the rate of return on overall FDI income and secondly, the rate of return on its equity component. On the other side of the estimated equation, the coefficient β is of our main interest and based on our hypothesis we expect the coefficient to take negative values for both alternatives of the dependent variable as well as all alternatives of the independent variable share. Furthermore, we include controlling variables of GDP, GDP per capita and population which are variously used in the individual model's specifications. These controlling variables are common for the models as ours in the literature. The vector x stands for these in the equation and the Γ is a vector of the corresponding coefficients. Additionally, δ_t stands for the full set of year-fixed effects and μ_i stands for time-invariant unobserved country effects.

Before we move on to the theoretical aspects of our model, we would like to devote a few words to the dataset adjustments which have to be done. Firstly, we assume that profits are artificially shifted from countries with higher tax rates to low-tax jurisdictions, thus it does not make any sense to observe the effect of a change in the defined share on the rate of return in the low-tax jurisdictions and we exclude countries with corporate tax rate lower than 15%. Further, CDIS's data contain an item called 'Not specified (Including confidential)' as a investor country and for some countries this item has a share exceeding 20%. As the share is substantial and we cannot determine if it belongs to investments from low-tax jurisdictions or not, we decide to drop such countries. Moreover, we drop observations for five outliers which display extreme values for their rates of return. This step is either in line with UNCTAD (2015) who run robustness tests for this exclusion or countries which do not participate in CDIS and thus their rates of return are calculated based on 'mirror' data which are clearly undervalued. At the end, we restrict our dataset to countries with observations for all nine years. Therefore, we are left with a balance dataset of 46 countries.

We are well aware that all the adjustments made can possibly influence the estimate and cause selectivity bias, especially in a case of rate of return which figure in the regression as a dependent variable. However, we observe each outlier in detail and find a logical explanation. Therefore, we believe that all the adjustments made are essential for estimating the real relationship between our variables. In addition, the decision to undertake the restriction only

to countries with observations for all nine years (countries for which data are missing at least for one year and for reasons not associated with adjustments made) was made in order to avoid the problem called attrition, i.e. when the missing observation is correlated with the time-variant unobserved effect.

There are several estimation methods which can be applied for panel data regression and we have to choose from these methods the best possible for our model. Firstly, the Pooled OLS is the basic one, which is seldom applied in panel regressions because no correlation between our independent variables and unobserved fixed effects is required to produce consistent estimator. This is very strong assumption which is often violated and the violation implies heterogeneity bias. In our case, there is a strong hint that individual countries have some time-invariant characteristics which are very likely correlated with our regressors.

Further, Random effects is an method which is superior to Pooled OLS when dealing with panel data because it can remove at least part of the unobserved fixed effects and of the serial correlation, an issue associated with time series. Therefore, it is usually more consistent and more efficient. Nevertheless, no correlation between unobserved fixed effects and regressors is required as well as for Pooled OLS. A method which provides an option how to deal with this correlation is Fixed effects method which eliminates the unobserved fixed effect from the regression.

To check whether this method is more suitable for us we use the Hausman test which examines the correlation between individual effects and other regressors. It means that the presence of correlation imply the violation of assumptions for RE to be the best linear unbiased estimator. In other words, a FE model is favored if the null hypothesis is rejected. Moreover, we are working with large geographical units, when we should not consider our sample as a random and thus incorporation of separate intercepts for individual countries is suggested (Wooldridge 2015).

Moreover, when working with panel data things are a little bit more complicated and we have to check for several data properties in order to come up with the correct statistical inference. Two main issues are heteroskedasticity and serial correlation which are both very often detected and thus we test for them. In their presence, more sophisticated methods such as Feasible GLS are provided, however, even OLS methods can correct for them by computing special standard errors.

In this whole section about different estimating methods we exploit knowledge from Wooldridge (2015).

4.2 Estimating Revenue Losses

Given the coefficient estimate indicating the relationship between the share of investments from low-tax jurisdictions and the rate of return on FDI from our preferred model, we are able to quantify the tax losses incurred by individual national governments. We begin by computing the estimated drop in the rate of return for individual countries for a given year and from this drop we arrive at the amount of shifted profits by MNEs.

$$Shifted_Profits_{it} = \beta * Share_LT_Jurisdictions_{it} * IDIP_{it}. \quad (4.2)$$

Before multiplying these numbers with the corresponding corporate tax rates to get the revenue losses estimates, we have to bear in mind that these shifted profits are recorded after-tax. Thus, at first, we convert these after-tax values to pre-tax values and after that we can apply the corresponding corporate tax rate.

$$Revenue_Loss_{it} = Shifted_Profits_{it}/(1 - CTR_{it}) * CTR_{it}. \quad (4.3)$$

To perform better analysis of the effects of profit shifting on certain countries with similar properties, we divide countries into income categories according to the World Bank's classification. It happens during the observed period that some countries migrate between individual categories. In order provide the clearest picture of the development in the individual categories, we place a country into the category where the country spends most years.

Chapter 5

Results

In this section, we present the results of our empirical part in three stages. Firstly, we provide a short summary on descriptive statistics for our final balanced dataset and special attention is paid to our main independent variable - share of investment from low-tax jurisdictions. Secondly, we present our preferred model and explain the choice of individual variables. Moreover, we perform sensitivity analysis, i.e. show the results for different model specifications and provide several robustness checks. In the final part, we present the estimates of shifted profits and revenue losses incurred by individual governments and compare our results with other three studies.

5.1 Descriptive statistics and the development of investments from low-tax jurisdictions

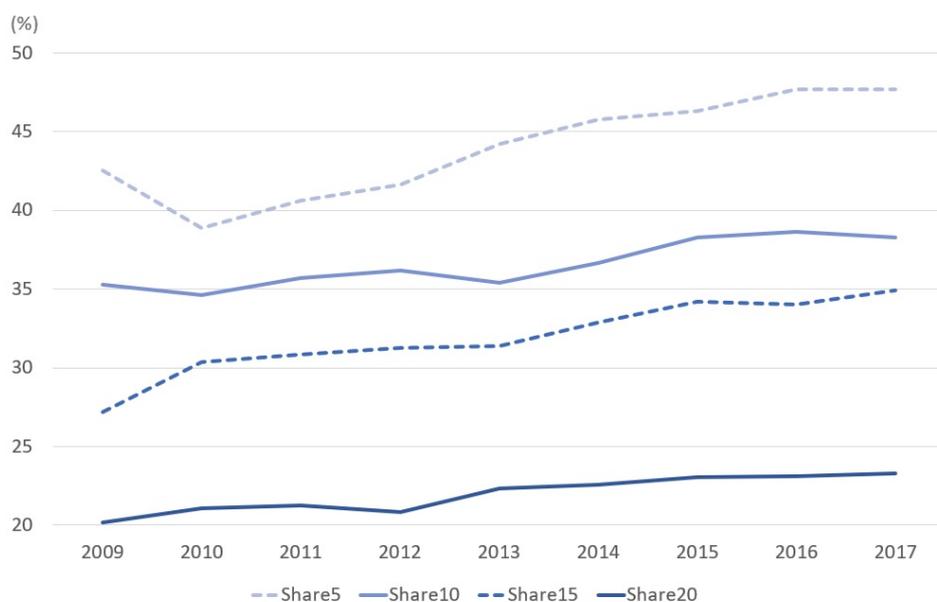
Our final dataset is formed by 46 countries and as it is balanced we have 9 observations for every each of them. The list of individual countries can be seen in Appendix with the revenue losses estimates (*Table B.7*). Here, we at least mention that the dataset is almost balanced even in terms of economic development as 21 out of 46 countries belong among OECD members. Although non-OECD prevails, the sample still involves rather high income countries as the values for GDP per capita signal. World GDP per capita for observed period fluctuates in a range from \$8 to 11 thousand whereas the range for our sample average is from \$17 to 19.5 thousand. The minimal GDP per capita stands for Bangladesh which is true for each year. Moreover, it is the only country from our sample which appears for some years as a lower-income country per

se World Bank's classification. However, since 2014 even Bangladesh belongs to higher class of lower-middle-income countries.

Although the rate of return on FDI fluctuates over the observed period, totally it drops for both alternatives by about 1.5 percentage points. This is in line with UNCTAD (2018) which records the same trend on a global level. The average value for overall RoR in our sample is very close (0.2% diff.) to global average as reported by the same publication. Another information on sample data summary statistics can be observed in Appendix *Table B.1*.

Now, we focus on our main independent variable indicating the share of investments from low-tax jurisdictions. As mentioned in the methodology section, we determine four alternatives. Firstly, we examine how the share changes in time, as can be seen in *Figure 5.1*. Quite surprisingly, the share has increased over the observed period for all levels. We would rather assume reverse trend as high-tax countries' corporate tax rates are diminishing towards the low-tax countries' rates and thus, the gap among them should be shrinking. On the other hand, and it is this case, more and more investments are routed through low-tax jurisdictions which therefore strengthen their position of offshore financial hubs. As these investments are viewed as more prone to profit shifting, it signals an increase in profit shifting for our estimates.

Figure 5.1: Development of the share variable; 2009-2017



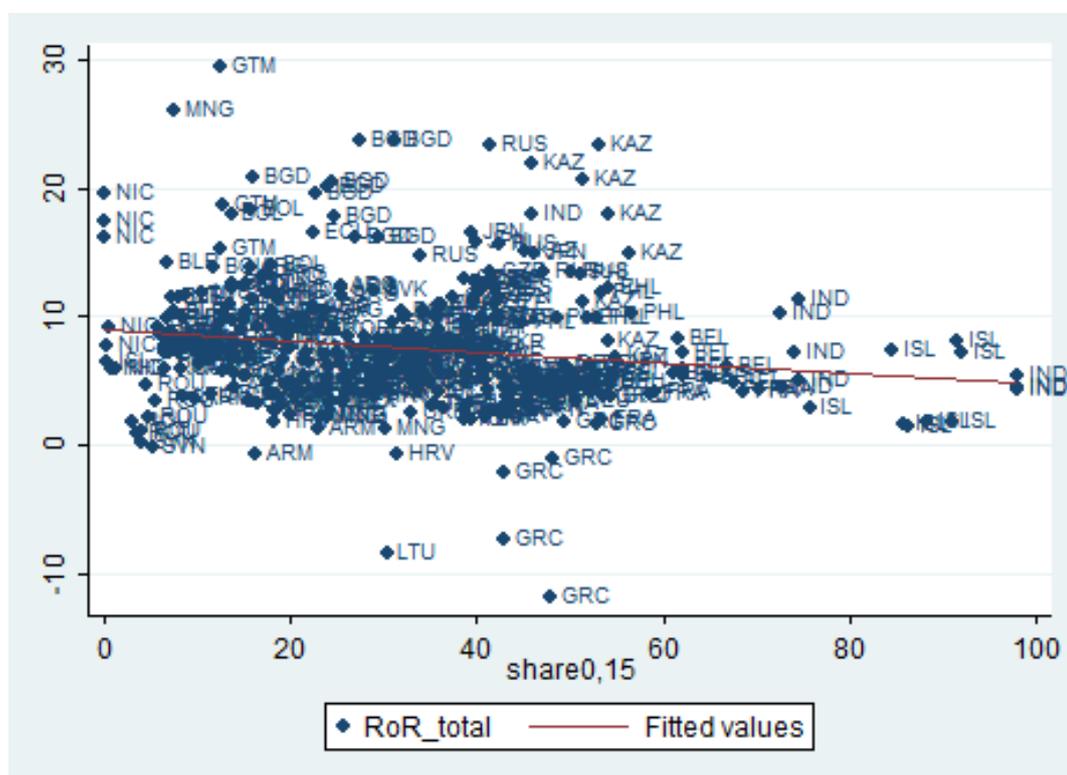
Source: Authors

Further, we display the development of the share computed on the 15%-level as shown in Appendix *Figure A.2*. The countries are grouped according to

the income classification. The income group experiencing the greatest increase over the observed period are low-income countries (14.0%). On the other hand, the share for upper-middle a high-income groups of countries increased only by modest 3.6% and 6.3%. Although, high-income countries record unambiguously highest share, lower-middle countries are slowly catching up and by this rate of growth it would not take long time to overcome high-income group at the top.

At the end of this first part of results, we attach the scatter plot, *Figure 5.2*, for the rate of return on total FDI and the share for 15% level. Interesting are especially points for countries with a share of investment from low-tax jurisdictions exceeding 60% - India, Belgium and Iceland. It is caused by enormously high corporate income rates for the first two countries - India (45%) and Belgium (34%). On the other hand, Iceland's corporate tax rate is only 20% but here, it is caused by sizeable investment from Luxembourg and Netherlands. Moreover, several countries record negative rate of return which is an consequence of either high loans or losses. However, only Greece experience negative rate of return on FDI for more than one year.

Figure 5.2: Scatter plot - RoR and share on % level



Source: Authors

5.2 Model Analysis

We now move on to the second part of our results which brings us to our model. Firstly, we comment on the chosen estimation method. We use data on large geographical units and therefore the assumptions of randomness is little bit shaky and the literature recommends to include separate intercepts for individual countries. We run the F-test in order to statistically check this and indeed, the null hypothesis is rejected and it is not really surprising that at least some intercepts are statistically different from zero as we have 46 countries. The obtained value from the test is 11.92 and it confirms that Pooled OLS is not a suitable method.

Further, to decide between the Fixed effects and Random effects we run the Hausman test. However, the test's result shows to be not as much conclusive as the p-value 0.053 signals marginal significance. Nevertheless, the literature encourages the use of FE when working with countries and because the FE method delivers the unbiased estimates of coefficients even in a case when the RE method would be more appropriate we decide to stick to FE method. Moreover, the RE method eliminates the unobserved fixed effects only partially which could cause a bias if correlated with regressors.

At the end, we perform tests for data properties which distort statistical inference - namely heteroskedasticity and serial correlation. Tests for both issues signal their presence. In such case, panel data provide more sophisticated method which can deal with it. Therefore, we run the regression using Feasible GLS method. However, this method is more restrictive on the assumption about the correlation between regressors and time-varying error than OLS which consequently can lead to the inconsistency while OLS, assuming that correlation between regressors and idiosyncratic error in time t is equal to zero, still delivers consistent estimates and is therefore preferred (Wooldridge 2015). Because the estimated coefficients from FE and FGLS regressions are quite distinct, as can be seen in Appendix, *Table B.2* we conclude that it might be our case. Fortunately, if we run regression using FE method there is a way how to correct for both heteroskedasticity and serial correlation at the same time by computing special type of standard errors called cluster-robust standard errors which we do.

At this point, we would like to present the results for our preferred model and comment on our choice as well as the results. In *Table 5.1* we provide estimates for 5 different regressions in which the total rate of return figures as

a dependent variable. We prioritize this indicator over its equity component because it contains both components which are relevant for profit shifting, although the debt component is not as much substantial. On the other side of the estimated equation of our preferred model, we use share computed on 15 % level as the main independent variable. We consider this level as optimal because the difference in the recipient's and investor's tax rate is large enough to motivate companies to shift profits and, at the same time, small enough to generate different share values for different countries. Meaning that, when applying higher difference many countries reach zero share only because their tax rate is too small and the analysis become meaningless (the mean value of CTR for our countries is slightly below 26 %) .

Table 5.1: Sensitivity analysis

ror_total	(1)	(2)	(3)	(4)	(5)
share015	-0.106** (0.0444)	-0.103** (0.0466)	-0.0833** (0.0412)	-0.0902* (0.0483)	-0.0772* (0.0432)
gdp_pc		-4.94e-05 (8.60e-05)		-9.19e-05 (8.87e-05)	
gdp			-0.000279 (0.000654)		-0.000389 (0.000783)
population			-0.0685*** (0.0193)		-0.0556** (0.0176)
Constant	10.98*** (1.415)	11.81*** (1.687)	15.52*** (0.617)	12.17*** (1.875)	14.81*** (0.770)
Year fixed-effects	No	No	No	Yes	Yes
Observations	414	414	414	414	414
R-squared	0.059	0.061	0.078	0.082	0.093
Countries	46	46	46	46	46

Cluster-robust standard errors in parentheses

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

We can see that our data confirm our hypothesis in all regression's specifications. We find negative relationship between the total rate of return on FDI and the share of investments from low-tax jurisdictions which is always statistical significant at least on 10% significance level. What is more, controlling for year-fixed effects diminishes slightly the share's effect in both specification in which are included and thus we include them into our preferred model. Further, the obtained results suggests that GDP in the both forms is significant neither

from statistical nor economic perspective. On the other hand, the population seems to be of statistical significance, however, we prefer to control rather for GDP per capita which signals the level of country's development and thus we pick the specification of the fourth model as our preferred.

All in all, the coefficient of interest is of similar magnitude across all specifications, therefore we conclude that it is robust to the involvement of other regressors. The coefficient's value from our preferred model is -0.0902 which represents the decrease in the total rate of return if the share computed at 15% increases by 1%. This imply that for our sample mean of the share variable - 31.9% - the drop in the rate of return is 2,88% which is not a trivial impact.

We as well run regressions for other alternatives of our variables. When switching between alternatives of the share of investments from low-tax jurisdictions we find a negative relationship for each. However, only 10% level and 15% level are statistically significant as can be seen in Appendix in *Table B.3*. The estimated magnitude is increasing in absolute terms as the level on which the share is computed grows. It makes sense because the share's magnitude is diminishing in this direction and thus the relationship should become stronger. However, this is not true for the share computed on the greatest difference - 20% level. In reality, the share on 20% level becomes zero for many countries just because their corporate tax rates are too small and it lead to the distortion of the regression.

Additionally, we use the rate of return on equity component as the dependent variable. The estimated relationship is slightly lower in absolute terms and no more statistically significant for any specification.

5.3 Revenue Loss Estimates

Given the equations in the methodology section and the results from our preferred model, we derive the estimates of revenue losses incurred by individual governments. In addition to the estimates of revenue losses, in *Table B.7* we provide estimates of shifted profits (pre-tax) and revenue losses expressed in relative terms as a shares of GDP, total tax revenue and corporate income tax revenue. Using these numbers, we can more easily asses the impacts of profit shifting to the tax-generating process of national governments. All values are estimated for a year 2016 because more recent data on tax revenue statistics are not available.

To the results, we provide estimates in total for 46 countries. We conclude

that multinationals shift totally \$611 billion of profits which results in the tax revenue loss of \$188 billion. If we look on estimates in relative numbers, national governments lose on average 0.46% of GDP, 1.20% of total tax revenue and 12.74% of corporate income tax revenue. In reality, the total revenue loss for our sample accounts for 0.39 % of aggregate GDP of countries in our sample. This implies that there are few countries whose estimates significantly exceed the rest. In general, this concerns countries with high share of investment from low-tax jurisdictions. Therefore, we would take estimates for these countries with a caution.

When we move on from the aggregate level to the group perspective, the results become much more interesting. Firstly, we divide countries on OECD and non-OECD members. We could look at this division as on developed and developing countries - a perspective which is in a centre of attention for many researchers as well as politicians. There is no doubt that OECD countries will account for a lion share when talking about absolute numbers. More than two thirds of total revenue losses are incurred by OECD countries and even greater share for shifted profits which reflects the fact that non-OECD tax profits more softly, as can be seen in *Table 5.2*. Interestingly, our results suggest that OECD countries incur greater losses relative to GDP than non-OECD ones. This is in contradiction with the evidence from recent literature. However, the average result for a group of OECD countries is substantially influenced by the enormous estimate for Belgium - 3.38 % of GDP. If we exclude Belgium, the relative loss would be on average 0.40 % of GDP, however, even this value is slightly higher. For the revenue loss as a share of corporate tax rate is the difference even almost double which is not so surprising as income taxes are less important in developed countries and it is compensated for them by indirect taxes which have the characteristic that they are less 'visible' and therefore more popular among politicians who do not want to upset the potential voters.

Table 5.2: OECD vs non-OECD

Year 2016	Shifted Profits (USD Bio)	Revenue Loss (USD Bio)	RL as % of GDP	RL as % of TTR	RL as % of CITR
non-OECD (25)	160.27	56.16	0.39	1.29	10.78
OECD (21)	450.95	132.46	0.55	1.45	20.14

RL - Revenue Loss; TTR - Total Tax Revenue; CITR - Corporate Income Tax Revenue

Number of countries in parentheses

Source: Authors

Additionally, we create tables with two more divisions into categories according to the regional and income perspective, see Appendix *Tables* B.4 and B.5. Although, they provide a little bit more granular perspective, the conclusion is very similar. Development regions of Europe and North America 'dominate' in the outflow of profits as well as in incurred revenue losses in USD volume. However, when compared to GDP, Europe incur losses almost double and stands for the region with the highest share to GDP.

Before moving to the comparison with another three studies, we would like to briefly comment on the development of tax revenue estimates in time. In Appendix in *Figure* A.3, we can see that the estimates of revenue losses growth during the observe period for both groups. Moreover, non-OECD countries record sharp increase between first two years. However, it can be explained by the absence of India among reporting countries which imply that 'mirror' data are used for India in the first year and the number is most likely underestimated. Further, OECD countries experience drop in revenue loss relative to GDP for which mainly Belgium and France are responsible. The former experience decrease in inward FDI whereas France decreases their corporate tax rate which results into lower share of investments from low-tax jurisdictions.

We compare our results with another three recent studies which uses different approaches except the Janský & Palanský (2019) whose research we follow. Tørsløv *et al.* (2018) examines national accounts and other statistics on MNEs' activities whereas Clausing (2016) exploits data on US based MNEs from BEA dataset. Moreover, she provides estimates primarily for US tax revenues and thus admits that the extension on other countries is highly speculative. For all this, we compare our estimates only in the basic aspects with these latter mentioned studies and look closely on estimates of ours and Janský & Palanský (2019).

As showed in *Table* B.7, our coverage is quite extensive as only Janský & Palanský (2019) deliver estimates for higher number of countries. Their study seems to be exceptional from this perspective. Moreover, *Table* B.6 in Appendix displays a weak coverage for developing countries except for the lastly mentioned study. The total revenue estimates ranges from USD 125 to 280 billion and our estimate is similar to Tørsløv *et al.* (2018).

At the end of our result section, we compare our results, grouped by the income category, with the results of Janský & Palanský (2019) whose study uses same data, is built upon a same idea, however, uses different methodology

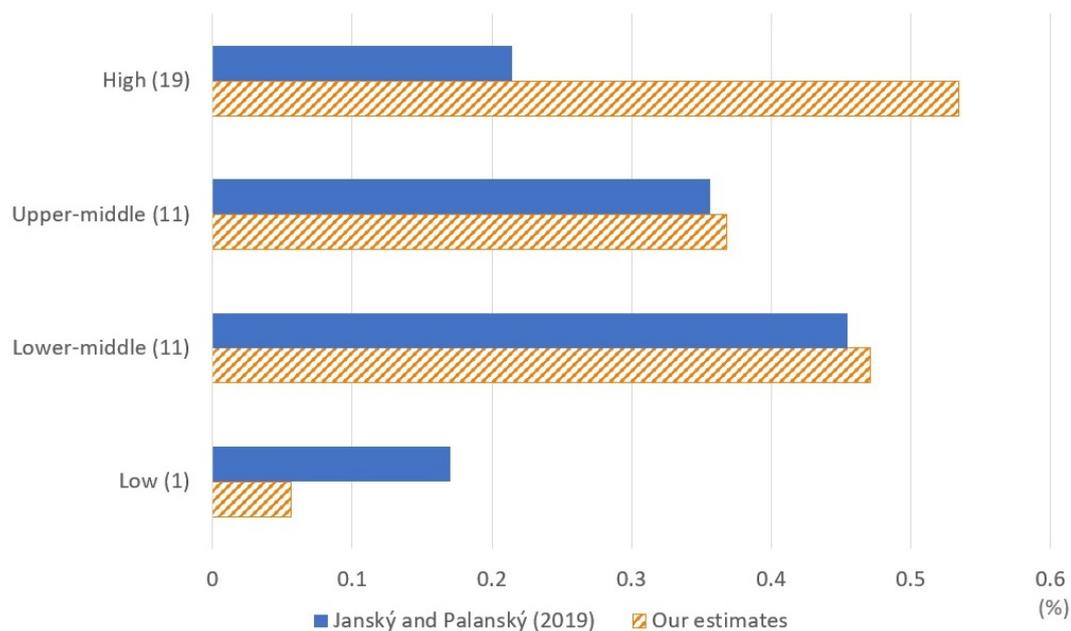
Table 5.3: Estimated tax revenue losses and their shares

	Countries	Total revenue loss (USD billion)	Average revenue loss as a % of GDP
Our estimates	46	189	0.46
Janský and Palanský (2019)	79	125	0.26
Tørsløv et al. (2018)	37	165	0.26
Clausing (2016)	25	280	0.48

Source: Authors, Janský & Palanský (2019), Clausing (2016), Tørsløv *et al.* (2018)

in several basic ways. *Figure 5.3* displays the estimates of revenue losses as a share of GDP only for countries which appear in both studies. We can observe similarities for both middle classes and low class is not representative as estimates only for one country are provided. However, the result for the high income group diverge widely. Janský & Palanský (2019) refer to other studies and conclude that the magnitude of profit shifting in high income countries is diminishing with an increasing number of covered countries. Indeed, both other mentioned studies, whose coverage is even lower than ours, display estimates of higher magnitude for high income countries as well as we do.

Figure 5.3: Revenue Loss as a % of GDP



Source: Authors, Janský & Palanský (2019)

Chapter 6

Conclusion

In this thesis, we examine the tax-motivated behavior of multinational companies which lately attracts attention of many researchers and other concerned parties. We exploit data on foreign direct investment from the IMF's CDIS database over the years 2009 and 2017 and we build upon the work of UNCTAD (2015) and Janský & Palanský (2019). Specifically, this methodological approach is based on the hypothesis that countries, which obtain higher share of investment from tax havens, in our particular case from low-tax jurisdictions, report on average lower rates of return on FDI and the profit shifting is on the blame.

Indeed, using the Fixed effects estimation method, we find on our data negative relationship between the rate of return on FDI and the share from low-tax jurisdictions. This relationship is robust to different model specifications, however, is not statistically significant for all of them. Based on the results from our preferred model we derive the estimates of shifted profits as well as resulting tax revenues losses for 46 individual countries. Aggregating those numbers results in total annual tax revenue loss of \$188 billion for countries in our sample as a consequence of \$611 billion in shifted profits in 2016. The analysis of estimates suggests that the developed high income countries loose the most tax revenue in both, absolute, however, even relative terms. The latter is in contradiction with several recent studies which find an evidence that developing countries are more prone to the profit shifting. On the other hand, several other studies arrive at similar results and all have in common lower coverage of countries. Specifically, they lack countries from low income class.

As the main contribution to the existing literature we see our results which

brings a set of new country-level estimates of profit shifting and resulting revenue losses, even though some of them, especially for countries with enormously high share of investment from low-tax jurisdictions, are highly illustrative. Moreover, the results suggest that the magnitude of profit shifting is substantial and distort countries' tax generating process as well as fair competition as some companies face lower tax burden than others.

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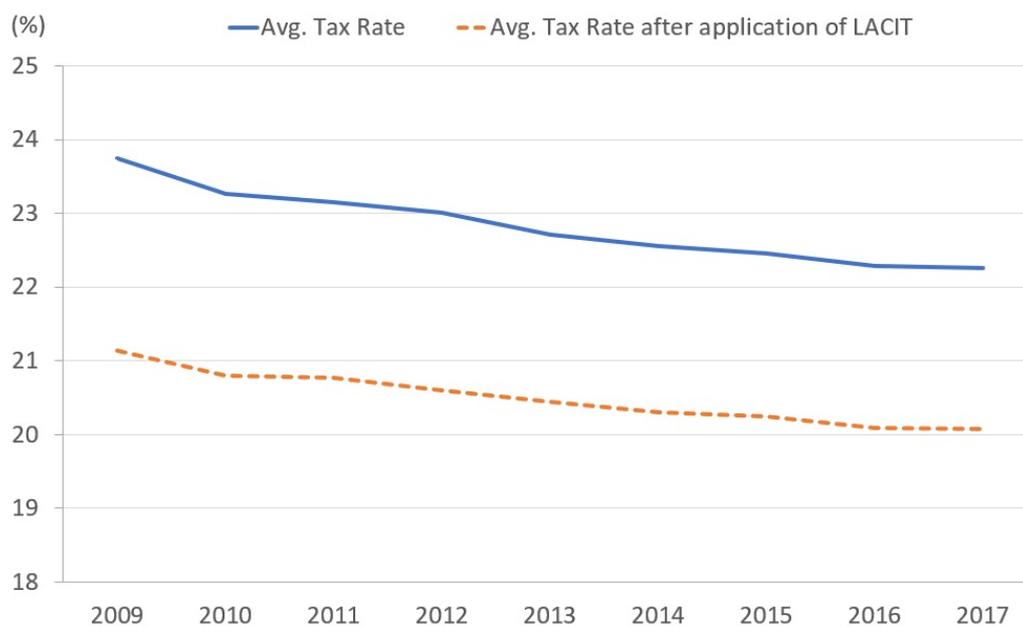
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Appendix A

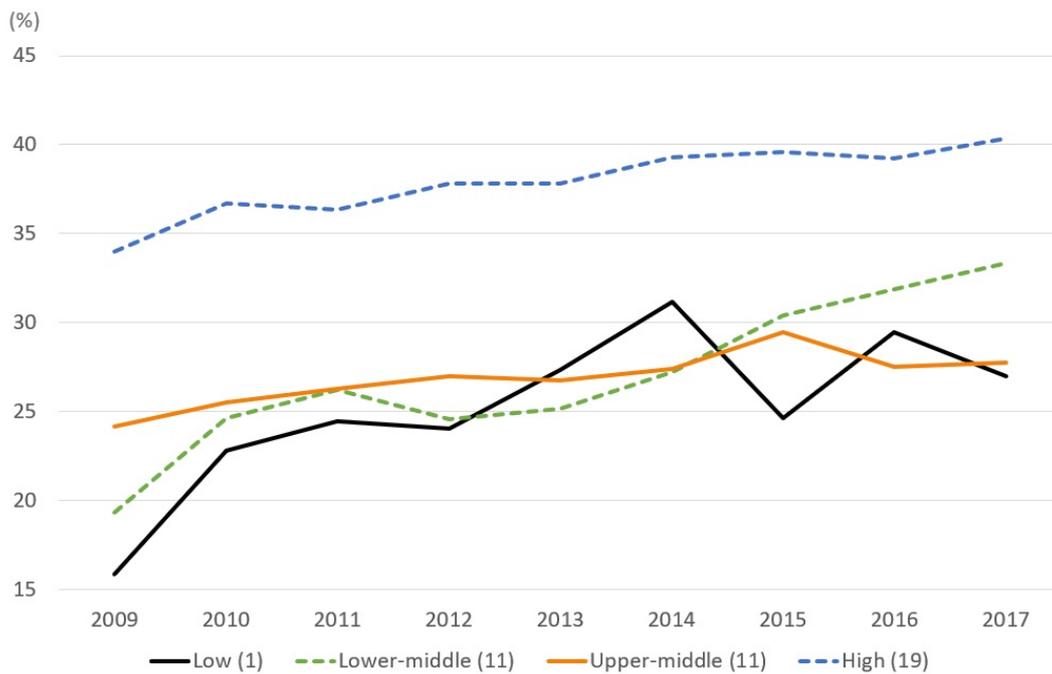
Figures

Figure A.1: Corporate Income Tax Rate Development; 2009-2017



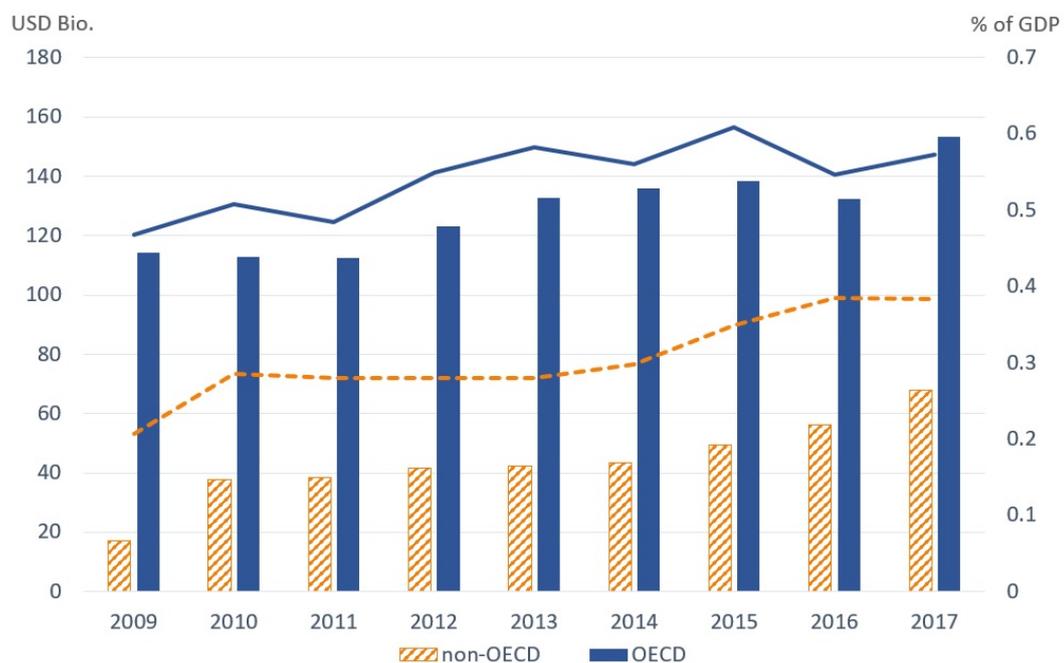
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Figure A.2: Development of 15% as grouped by income; 2009-2017



Source: Authors

Figure A.3: Development of revenue loss estimates; 2009-2017



Note: Bar chart - left axis - Revenue loss (USD Bio)

Line chart - right axis - Revenue loss as a % of GDP

Source: Authors

Appendix B

Tables

Table B.1: Summary statistics

Variable	Mean	Std.Dev.	Min	Max	Source
share02 (%)	21.96	18.59	0	73.22	IMF CDIS
share015 (%)	31.9	18.67	0	98.11	IMF CDIS
share01 (%)	36.56	19.48	0	99.93	IMF CDIS
share005 (%)	43.93	21.8	.61	100	IMF CDIS
ror_equity (%)	6.69	5.03	-12.10	29.34	IMF CDIS & BoP
ror_total (%)	7.60	4.78	-11.94	29.46	IMF CDIS & BoP
CTR (%)	25.82	6.54	15	47.92	OECD,KPMG & TE
population (Mio)	72.53	190.44	.32	1338.66	WB
gdp (\$Bio)	1048.52	2604.74	4.58	19500	WB, CIA
gdp_pc (\$)	18584.55	17448.17	698.99	71314.77	WB, CIA

Note: 414 obs. for each variable

Source: Authors

Table B.2: FE & FGLS comparison

ror_total	(1) FE	(2) FGLS
share015	-0.0902* (0.0483)	-0.0318*** (0.0105)
gdp_pc	-9.19e-05 (8.87e-05)	-3.88e-05*** (9.98e-06)
Constant	12.17*** (1.875)	8.505*** (0.445)
Year-fixed effects	Yes	Yes
Observations	414	414
R-squared	0.082	
Countries	46	46

Cluster-robust standard errors in parentheses for FE

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

Table B.3: Robustness check for share alternatives

ror_total	(1)	(2)	(3)	(4)
share005	-0.0263 (0.0392)			
share01		-0.0690** (0.0333)		
share015			-0.0902* (0.0483)	
share02				-0.0304 (0.0784)
gdp_pc	-0.000127 (8.84e-05)	-0.000121 (9.15e-05)	-9.19e-05 (8.87e-05)	-0.000125 (9.15e-05)
Constant	11.43*** (2.770)	12.64*** (2.179)	12.17*** (1.875)	10.89*** (2.040)
Year fixed-effects	Yes	Yes	Yes	Yes
Observations	414	414	414	414
R-squared	0.049	0.064	0.082	0.048
Countries	46	46	46	46

Cluster-robust standard errors in parentheses for FE

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

Table B.4: Region groups

Year 2016	Shifted Profits (USD Bio)	Revenue Loss (USD Bio)	RL as % of GDP	RL as % of TTR	RL as % of CITR
Africa (2)	6.79	1.96	0.51	1.59	8.52
Central & South Asia (6)	73.60	31.49	0.50	2.48	10.94
East Asia & Pacific (6)	29.72	7.68	0.40	1.99	15.83
Europe (20)	254.21	69.96	0.56	1.47	21.28
Latin America (10)	51.62	16.82	0.28	1.11	9.08
North America (2)	195.28	60.71	0.33	1.15	12.42

RL - Revenue Loss; TTR - Total Tax Revenue; CITR - Corporate Income Tax Revenue
Number of countries in parentheses
Source: Authors

Table B.5: Income groups

Year 2016	Shifted Profits (USD Bio)	Revenue Loss (USD Bio)	RL as % of GDP	RL as % of TTR	RL as % of CITR
High(21)	447.82	131.84	0.56	1.48	20.9
Low (1)	0.5	0.12	0.06		
Lower-middle(12)	67.52	30.82	0.43	1.65	14.74
Upper-middle(12)	95.38	25.85	0.34	0.9	7.8

RL - Revenue Loss; TTR - Total Tax Revenue; CITR - Corporate Income Tax Revenue
Number of countries in parentheses
Source: Authors

Table B.6: Income groups in other studies

Study	Low	Lower middle	Upper middle	High	Total
Our estimates	1	12	12	21	46
Janský and Palanský (2019)	9	24	17	29	79
Tørsløv et al. (2018)	0	1	7	29	37
Clausing (2016)	0	2	5	18	25

Source: Authors, Janský & Palanský (2019), Tørsløv *et al.* (2018), Clausing (2016)

Table B.7: Estimated tax revenue losses and their shares

Year 2016	Shifted Profits (USD Mio)	Revenue Loss (USD Mio)	RL as % of GDP	RL as % of TTR	RL as % of CITR
Argentina	2,455.32	859.36	0.15	0.49	5.26
Armenia	79.13	15.83	0.15	0.69	5.99
Bangladesh	498.06	124.51	0.06		
Belarus	147.05	26.47	0.06	0.15	2.04
Belgium	46,670.49	15,863.30	3.38	7.64	98.02
Bolivia	274.03	68.51	0.20	0.77	4.58
Brazil	31,549.10	10,726.70	0.60	1.75	18.87
Canada	21,524.84	5,747.13	0.38	1.17	11.74
Costa Rica	487.18	146.15	0.26	1.09	9.43
Croatia	997.05	199.41	0.39	1.10	
Czech Republic	5,463.43	1,038.05	0.53	1.56	14.71
Denmark	4,611.81	1,014.60	0.33	0.71	12.05
Ecuador	236.67	52.07	0.05	0.26	3.70
El Salvador	386.71	116.01	0.48	2.61	14.88
France	46,818.22	16,119.51	0.65	1.44	31.96
Georgia	179.93	26.99	0.19	0.73	6.03
Germany	47,507.87	10,846.05	0.31	0.83	15.56
Greece	1,843.70	534.67	0.27	0.71	
Guatemala	289.69	72.42	0.11	0.84	3.82
Honduras	352.50	105.75	0.49	2.16	
Iceland	1,573.66	314.73	1.52	4.18	60.21
India	60,004.36	28,754.09	1.26		
Italy	20,523.17	6,213.06	0.33	0.78	15.59
Japan	10,616.98	3,181.91	0.07	0.21	1.52
Kazakhstan	8,707.95	1,741.59	1.27		
Korea	6,317.72	1,528.89	0.11	0.41	3.02
Lithuania	162.44	24.37	0.06	0.19	3.49
Mexico	15,589.54	4,676.86	0.43		12.07
Mongolia	589.48	147.37	1.32	6.46	60.51
Morocco	1,836.71	569.38	0.55		
New Zealand	1,642.41	459.88	0.25	0.74	4.99
Nicaragua	2.60	0.78	0.01	0.03	
Philippines	2,559.50	767.85	0.25		
Poland	7,609.35	1,445.78	0.31	0.91	16.53
Portugal	6,979.81	1,961.00	0.95	2.77	31.03
Romania	504.23	80.68	0.04	0.17	1.92
Russia	18,629.99	3,726.00	0.29	1.00	9.10
Slovak Republic	2,056.05	452.33	0.50	1.54	13.29
Slovenia	185.21	31.49	0.07	0.19	4.42
South Africa	4,953.65	1,387.02	0.47	1.59	8.52
Spain	29,392.44	7,348.11	0.59	1.77	26.00
Sweden	11,565.49	2,544.41	0.50	1.13	19.82
Thailand	7,993.59	1,598.72	0.39	2.13	9.12
Turkey	4,129.99	826.00	0.10	0.38	5.80
Ukraine	964.89	173.68	0.19	0.60	7.36
United States	173,758.37	54,967.60	0.29	1.13	13.10
Total	611,222.33	188,627.03	0.46	1.20	12.74

RL - Revenue Loss; TTR - Total Tax Revenue; CITR - Corporate Income Tax Revenue
Source: Authors