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Tax competition: strategic tax rate lowering and expected impact of US 2017 reform on other countries

Bachelor's thesis

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Declaration of Authorship

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Prague, July 30, 2019

Julia Hamrakova

Abstract

This thesis deals with an international corporate income tax competition with focus on corporate income tax rate spillovers from the past tax cuts in the USA. The main research question we seek the answer to is: "Do countries follow the USA in the corporate income tax rate setting?" Empirical models were evaluated using GMM model for the panel data. Our results confirm the existence of the tax rate spillovers, however, do not prove solid leadership of the USA in the tax rate setting. We found that countries which are geographically closer to the USA and OECD jurisdictions are more likely to follow the USA in the tax rate policy changes. Our research is unique extension to the previous literature dealing with this topic as it uses not only the weighted world corporate income tax rate in the model, but also the corporate income tax rate of the USA and therefore allows us to see the effect of the past tax cuts in the USA for other countries. The results of our work can serve as a lead for examining the impact of the US tax rate cut in 2017.

JEL Classification	F12, F21, F23, H25
Keywords	tax competition, corporate income tax rate, tax spillovers, profit shifting
Title	Tax competition: strategic tax rate lowering and expected impact of US 2017 reform on other countries

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Abstrakt

Tato bakalářská práce se zabývá mezinárodní daňovou soutěží se zaměřením na vedlejší dopad předešlých škrtů daňové sazby z příjmů právnických osob v USA. Hlavní výzkumnou otázkou bylo: "Nasledují ostatní země USA v nastavovaní sazeb pro daň z přijmu právnických osob?" Empirické modely byly vyhodnoceny pomocí GMM modelu pro panelová data. Naše výsledky potvrzují existenci daňové soutěže, neprokazují však jednoznačné vedení USA v nastavování daňové sazby. Zjistili jsme, že země, které jsou geograficky blízké USA a státy OECD budou s větší pravděpodobností následovat USA v reformách daňové politiky. Náš výzkum je jedinečným rozšířením dosavadní literatury zabývající

se tímto tématem, neboť používá model nejen s váženou světovou sazbou daně z příjmů právnických osob, ale i sazbou daně z příjmů právnických osob v USA, a proto nám umožňuje vidět dopad předešlých snížení daní v USA pro ostatní země. Výsledky našeho výzkumu mohou být použity při zkoumání dopadu reformy v USA na ostatní země.

Klasifikace JEL	F12, F21, F23, H25
Klíčová slova	Daňová konkurence, daň z korporátního příjmu, vedlejší dopad snižování daňové sazby, přesouvání zisku
Název práce	Daňová konkurence: snižování daňové sazby a dopad reformy v USA (2017) na další země
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Acronyms

FDI Foreign Direct Investment

GMM Generalized Method of Moments

OECD Organisation for Economic Co-operation and Development

CIT Corporate Income Tax

GDP Gross Domestic Product

TCJA Tax Cut and Jobs Act

BEPS Base erosion and profit shifting

MNE Multinational Enterprise

IP Intellectual Property

UNCTAD United Nations Conference on Trade and Development

EATR Effective Tax Rate

EMTR Effective Margin Tax Rate

CFC Controlled Foreign Corporation

BEAT Base Erosion Anti−Abuse Tax

GILTI Global Intangible Low−Taxed Income

ERTA Economic Recovery Tax Act

EBIT Earnings Before Interest and Tax

NAFTA North American Free Trade Agreement

OLS Ordinary Least Squares

Bachelor's Thesis Proposal

Author	Júlia Hamráková
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Proposed topic	Tax competition: strategic tax rate lowering and expected impact of US 2017 reform on other countries

Motivation On December 22, 2017, President Trump signed the Tax Cuts and Jobs Act. Apart from other changes, such as a systematic shift in taxing foreign-source profits to territorial system and abolishing the worldwide taxation, it cuts the corporate tax rate from 35 percent to 21 percent beginning in 2018, the lowest since 1939. There is evidence that countries tend to respond to tax rate reductions elsewhere by cutting their own tax rate (Crivelli *et al.* (2016)). The argument is that by lowering tax rates relative to other jurisdictions more capital will locate within the jurisdiction and higher revenues result from the larger base even with slightly lowered rate (Whalley (2002)). I will try to find evidence of the US to be a leader in corporate tax setting by re-evaluating the model of CIT rate spillovers (Crivelli *et al.* (2016)) as there exists evidence on the leadership role of USA (Altshuler & Goodspeed (2015)). I will consider the geographical distance from USA as some of empirical studies suggest that distance negatively affects FDI (Markusen (2002)), which may affect also the responsiveness of countries to the tax competition. Furthermore, I will examine other possible factors, which may be deterministic for tax competition. Countries with high statutory rate, for example, all other things equal, are significantly more likely to cut their taxes than countries with lower rate (Heinemann *et al.* (2010)). Another point of interest will be the role of the level of economic development, as a possible factor affecting the response to tax rate lowering in the USA. I will also examine the question of openness of the economy and trade relation of the countries to US economy, as taxes can determine the direction and size of trade flows and potentially are an important element in understanding trading patterns between countries.

Hypotheses

Hypothesis #1: Reducing CIT rate in the USA in the past caused significant decrease of CIT rate in the rest world economies.

Hypothesis #2: Tax rate spillovers of past tax cuts in the USA were higher in countries, which were geographically close to USA

Hypothesis #3: Tax rate spillovers of past tax cuts in the USA were higher in countries, which had CIT rate (Australia, Japan, France, etc.)

Hypothesis #4: Tax rate spillovers of past tax cuts in the USA were higher for developing countries.

Hypothesis #5: Tax rate spillovers of past tax cuts in the USA were higher in countries, which had more open economies/have bigger part of their FDI in the US.

Results of our research can serve as a potential lead to predict future possible effects of this policy for other countries.

Methodology I will use the International Centre for Tax and Development- World Institute for Development Economics Research (ICTD-WIDER) Government Revenue Database (GRD). The additional data will be obtained from publicly available sources, such as World Bank databases, Official Website of United states Government and private companies' databases (i.e. KPMG). Concerning the model itself, I will use Generalized Method of Moments (GMM) estimator for panel data. Model will contain following explanatory variables: past CIT tax rate of given country, US CIT rate, weighted average of CIT rates in other countries (except the US) and the vector of controls consisting of log of GDP per Capita, trade openness and inflation. I will try to prove that USA is a significant player in the tax competition and that the US tax spillovers effect was not equally distributed and varied for groups of states in with respect to their geographical and economical closeness, own tax level and openness index.

Expected Contribution Tax competition, its benefits and its harmful effects is one of still ongoing topics discussed by economists. Important milestone in these debates was the paper written by U.S. economist Charles Tiebot (1956). The basic idea is that people (companies) would move to jurisdictions with the best conditions (regarding taxes and services) and this results into the sorting of jurisdictions into optimal communities. The main drawbacks concerning the corporate tax competition are those concerning so called race to the bottom (race to the zero CIT rates) which can cause immense damage to the economy and neglecting the existence of tax havens. Although the opinions on effects of tax competition differ, it is obvious that it is an

important topic for every jurisdiction and needs to be taken into consideration. My work will contribute to the research that already has been made by more detailed study of possible effect of the US tax reform by adjusting an already existing model for studying impacts of the US in the tax competition. By doing so, we will get a more precise idea about possible consequences of this tax reform. Our results can be useful not only for further research of effects of this policy to the global economy, but also for predictions about future tax competition trends based on already existing data.

Outline

1. Abstract
2. Introduction
3. Literature review
4. US tax reform and its possible impact
5. Methodology and data
6. Results
7. Interpretation
8. Conclusion

Core bibliography

Crivelli, E. et al. (2015). Base Erosion, Profit Shifting and Developing Countries. International Monetary Fund, IMF Working Papers WP/15/118, Washington, D.C.

Cobham, A. & Janský, P. (2017). Global distribution of revenue loss from tax avoidance: Re-estimation and country results. WIDER Working Paper 2017/55. Helsinki: UNU-WIDER.

Devereux, M. & Loretz, S. (2012). What do we know about corporate tax competition? Working Papers 1229, Oxford University Centre for Business Taxation.

Roodman, D. (2009b). How to do xtabond2: An introduction to difference and system GMM in Stata. Stata Journal, StataCorp LP9 (1): 86-136.

Devereux, M. P., B. Lockwood, M. Redoano (2008). Do countries compete over corporate tax rates? Journal of Public Economics 92 (5-6): 1210-1235.

Altshuler, R. & Goodspeed T. (2015). Follow the Leader? Evidence on European and U.S. Tax Competition. Public Finance Review 43 (4): 485-504.

Arellano, M. & Bond S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. Review of Economic Studies 58 (2): 277-297.

Wooldridge, J. M. (2010). Econometric Analysis of Cross Section and Panel Data. Washington, DC: The MIT Press.

Devereux, M. et al. (2008). Do countries compete over corporate tax rates? Journal of Public Economics, 92 (5-6), 1210-1235.

Cobham, A. & Janský, P. (2015). Measuring Misalignment - The Locationof Us Multinationals' Economic Activity Versus the Location of Their Profits. ICTD Working Paper 42, The International Centre for Tax and Development (ICTD).

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Chapter 1

Introduction

Significant corporate income tax rate cut, which is a part of the the Tax reform in the US proposed in 2017, gained the attention of general public, multinational companies and policymakers worldwide. Some of them already announced the corporate income tax cut rate, too. The tax competition is nowadays a broadly discussed topic and many jurisdictions already realized that this practice is harmful for them as income from the corporate taxing is a significant part of their government budgets. However, some uncertainties arise about the consequences of this tax rate cut for countries. How will it influence the already fast so-called 'race to the bottom'? Which countries are between those most likely most affected by the reform and will respond with their own corporate income tax cuts?

The main objective of this thesis is to help finding answers to these questions using the information about countries from the past. With the help of already existing literature, we build model which aims to explain if the tendency of countries to lower the corporate income tax rate can be explained by the international tax competition. More specifically, we would like to determine to which extent was the USA leader in corporate income tax rate setting in the past for countries and whether is answer to this question dependent on other factors, such as geographical distance from the US, the level of the own corporate income tax rate, the openness of the economy and the income level of the country. The proposed model works with country-level data with the information about 187 countries during 37 years and we used the GMM estimator for panel data. The results of our estimation brings us interesting insights for predicting the future development of the tax competition and determine groups of countries which can be directly influenced by this reform.

This thesis is structured as follows: Chapter 2 summarizes the key findings from the literature about the tax competition and connected problem of profit shifting. Chapter 3 deals with the reform itself, the previous US tax reform ERTA and outlines groups of countries which could be affected the most by the reform. Chapter 4 presents our model and offers brief insights into the data we worked with and our methodology. The results of our research are presented in Chapter 5. Chapter 6 contains the interpretation of the results. The last part of our thesis, Conclusion, is followed by Appendices.

Chapter 2

Literature Review

The aim of this chapter is to summarize the most relevant findings from already published literature dealing with corporate tax competition and profit shifting. We will be interested not only in the results, but also in the approach and methodology used as it is a crucial factor when comparing the results.

2.1 Corporate tax competition and profit shifting

Numerous researchers have dealt with the corporate tax competition and literature analysis leaves us with many different approaches to this topic and varying findings. One of the broadest definitions of the tax competition by Roháč (2006) is 'interdependent setting of tax rates and tax bases.' Although not very detailed, this interpretation clarifies two main instruments which can be used by policymakers - change of strategic tax rate or tax base. The meta-analysis by Leibrecht & Hochgatterer (2012a) summarized that countries compete over three types of highly correlated assets - new firms, investments of already existing firms and profit of firms generated in one country, but shifted to another. Problem of tax competition gains on importance mainly because of the profit shifting of multinationals, which is connected with big losses in government's revenues. As Tørsløv *et al.* (2018) noted:

> ...globally, machines don't move massively to low-tax places; paper profits do.

OECD defines BEPS [1] (Base erosion and profit shifting) as 'exploiting gaps and mismatches in tax rules' and MNEs have more options to perform such

[1] see http://www.oecd.org/tax/beps/about/

activities. One part of the research is focused on various methods of such activities and explains strategies for profit shifting of multinationals, e.g. Fuest *et al.* (2013) and Nabben (2017). As they explain, most of the US-based BEPS firms are connected to the technology or life sciences and they tend to use IP-based tools (IP - intellectual property), which enables profits to be moved through virtual IP assets charging. Other techniques of profit shifting are debt-based. This strategy is based on the cross-borders intra-company loans with artificial high interest rate and subsequent deduction of this interest from tax liabilities. Another method is to avoid high taxes by high transfer pricing of the process performed in low tax jurisdiction (e.g. contract manufacturing). The existence of profit shifting practices is, given the state of things, unquestioned. According to Tørsløv *et al.* (2018) globally almost 40 percent of multinationals' profits, defined as 'profits made by multinational companies outside of the country where their parent companies are located, are shifted to tax havens in 2015.' The biggest losers in this profit-shifting are countries with high tax rate mainly from Europe (i.e. France and Germany).

Some relevant studies look for evidence of profit shifting using company-level data. For example, Lohse & Riedel (2013) estimate natural logarithm of EBIT which stands for earnings before interest and tax for affiliates using CIT together with country's transfer pricing legislation. Others work with differentials. Dharmapala & Riedel (2012) develop a model which take into account the differential of tax rates of the country of parent company and subsidiaries. Johansson *et al.* (2017) on the other hand, uses unweighted tax rate differential with other subsidiaries to estimate similar incentives. Huizinga & Laeven (2008) use similar approach, but they use weighted differential of tax rate with other subsidiaries. The meta analysis of these and similar papers, conducted by Heckemeyer & Overesch (2013) summarized this research and predicted that one percentage point smaller tax rate in host countries, is connected with subsidiary's pre-tax profit increase by approximately 0.8 percent. They also found evidence for the hypothesis that the extent of the tax base erosion is defined not only by responsiveness of shifting strategies but also by the tax base volume shifted through different channels.

Other researchers focus more on the macroeconomic aspects of the tax competition and profit shifting. Study conducted by the UNCTAD in 2015 [2] uses the so called FDI-driven approach to investigate the role of offshore investment hubs and connected corporate profit shifting and related loss of tax for

[2] see https://unctad.org/en/PublicationsLibrary/wir2015_en.pdf

countries. The results talk about global losses approximately in the order of 100 billion dollars yearly and they suggest that developing countries are relatively more vulnerable to profit shifting than developed ones. Many studies, however, indicate much higher international losses. For instance, Cobham & Janský (2017) estimated global corporate tax losses around USD 500 billion per year. The US has the highest share of foreign profits booked in tax haven from all OECD members and US MNEs use tax havens more than MNEs from other countries (Tørsløv *et al.* (2018)). The same study also estimates that the US looses approximately 15 percent of profits from corporate income taxes.

There is a big variety of approaches in the literature connected to the tax competition. One can use different variables connected with tax to explain incentives of the companies. Except for the most simple one - statutory tax rate (or CIT), some researchers work with the effective tax rate (EATR), which is in the broadest interpretation the ratio of tax burden to the income, or with effective margin tax rate (EMTR), which is similar, but used to calculate effective tax margin of addition investment. All of the options have both advantages and drawbacks. CIT rate is most easily accessible, but is not very accurate for illustrating the tax burden for companies, which depends also on CIT base and other factors, such as tax holidays. The latter two are more suitable for this purpose, but must be manually computed from often poor quality data.

The studies also differ from the theoretical point of view. Some of models are based on the idea of non-cooperative simultaneous setting of CIT rate and use Nash game model, others use Stackelberg model, where smaller countries choose their tax rate according to a bigger and more important one (i.e. the USA). One of the most cited works in this area by Devereux *et al.* (2008) uses Nash equilibrium and presents a model, in which in the first stage, the governments choose taxes, and at the second, firms choose a transfer price for an input depending on the choice of taxes. The estimation results claim that one percentage point reduction in the (weighted) average of other countries' statutory rate would lead to to the reduction of the CIT rate of country i by between 0.34 and 0.67 percentage points, depending on the choice of the weights. Altshuler & Goodspeed (2015) suggested in their study that USA might act as a Stackelberg leader that other countries follow in setting of the tax rate and at the same time they interact between each other in Nash competition. The result of their work was evidence that significant lowering of the statutory corporate tax rate in USA in 1986 was a defining moment not only for US tax policy but also for European countries and thereby found evidence for USA

being a Stackelberg leader. Useful work in this area was done by Devereux & Loretz (2012) who reviewed the literature on corporate competition and comment on differences in models and the progress of the literature. They found that although the research on the tax competition may take various forms, the literature agrees on its existence.

2.2 US tax reform

Literature regarding particularly the strategic response of countries to US tax reform is rather scarce. Spengel *et al.* (2017) focused on the impact on FDI flows and estimated that while US FDI in Germany could increase by 9 percent, German FDI in US should increase by 25 percent. Although this simulation is computed for Germany, the result is also informative for other countries. These jurisdictions can, in order to stay competitive, undertake various changes in their tax policy. Beer *et al.* (2018) estimated that the reform will cause the losses of MNEs related revenue for countries which can amount up to 13.5 percent of the MNEs' tax base after accounting for possible changes in countries' tax policies. Using the results of the previously mentioned paper, the nominal rates in the rest of the world are estimated to fall on average by 3.8 to 4.6 percentage points (Chalk *et al.* (2018)).

Chapter 3

The US tax reform and its possible impact by groups of countries

In this chapter we concisely explain the changes that the reform has brought to the US tax system and with the evidence from the past similar reform and already existing literature, we try to determine possibly most affected countries.

3.1 US Tax system before and after the reform

This section aims to describe US tax system and the way the reform changed it. We find it relevant, as different systems of taxation produce different incentives for companies to invest and to shift profit.

To begin with, there exist two main types of taxation. Jurisdictions can either practice worldwide or territorial tax system. Under worldwide tax system, companies are taxed subject to their income earned worldwide, independently from the country or countries where it was earned. By contrast, jurisdictions with territorial tax system tax the income earned by companies only within their borders. Nowadays, most of the countries use the combination of both. Before the reform, US tax system was regarded as worldwide, with high tax on business profit between 35 and 40 percent. This appeared as an obvious disadvantage for US companies when compared to companies from other jurisdictions (Spengel *et al.* (2017)). The CIT rate in the USA consisted of 35 percent federal tax rate and the local state tax rate, which was allowed to vary to some extent. The income of a foreign branch (which was considered not to be legally separated from US-based mother company) was subject to US taxation. On the other hand, foreign subsidiary considered legally separated from

mother company, were taxed in USA only if the money was brought to the USA in some way (e.g. through dividends paid to shareholders or a sale of shares). Companies, however, had possibilities to avoid paying the taxes on their foreign earnings. Subpart F of the CFC rules contained many exceptions under which companies were not obliged to tax earnings held abroad. Together with "Check the box regulation", which allowed companies to choose whether foreign companies are foreign disregarded entities or controlled foreign corporations, provided the way of tax evasion for companies. Payments between disregarded entity of the CFC and other subsidiaries then were not subject to the U.S. taxation. This and tax holidays, granted in the US since 1996 belonged to the most popular tax planning tools (Spengel *et al.* (2017)). Prior to the reform, the tax setting made debt financing preferable to equity financing as interest payments were tax deductible with some limits.

Except from already mentioned CIT rate cut, other significant changes were made in foreign profits taxation. The law introduces a (partial) territorial tax system, under which only domestic earnings are subject to tax, as it is common in most of countries. Every business with more than 500 million dollar in annual gross receipts is now subject to the base erosion anti-abuse tax (BEAT). This tax is introduced to prevent base erosion and profit shifting. Under the BEAT, large companies are obligated to pay 10 percent (from 2019) tax from a broader base and concerns certain service payments, royalties and interest.[1] As Janský (2019) noted, this seems to be a strong instrument for companies, because it applies without regard to tax rate in other countries. The law further changes the treatment of intangible property held abroad, such as patents, copyrights and similar. Second important provision is GILTI [2] which applies changes to taxation of income generated abroad and focuses on intagible assets like patents of software controlled by a foreign corporations (CFC). Both BEAT and GILTI are supposed to restrict tax haven activities, however, their impact and significance for MNEs are for now unsure. Contradictory to the expectation of the policymakers, territorial tax system may create new incentives for companies to shift real production offshore.[3] The TCJA also offers, under some conditions, more generous depreciation system for companies, which could increase domestic capital spending.

[1] see https://www.taxpolicycenter.org

[2] see https://www.bdo.com/insights/tax/international-tax/the-gilti-effect-tax-reform-and-global-intangible

[3] see https://www.businessinsider.com/r-how-us-tax-reform-rewards-companies-that-shift-profit-to-tax-havens-2018-6

To conclude, the new tax bill brings more significant changes for US (and also non-US) multinationals than the single tax rate cut. They were designed to achieve foreign profits repatriation and discourage MNEs from various tax evasion practices. Making conclusions on real effects for companies and countries would be premature, but we can make some assumptions, as we will do in the following chapters.

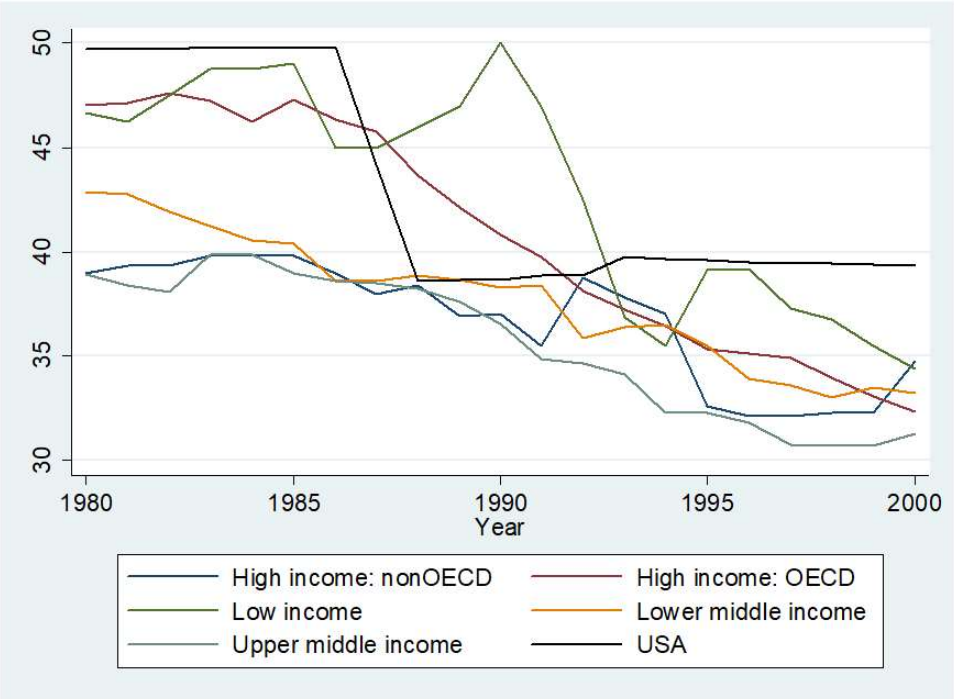
3.2 The ERTA and its CIT rate spillovers

Although the 2017 US reform is far the biggest corporate tax cut in the history of USA so far, it is not the first significant one. In 1981 the Economic Recovery Tax Act (ERTA) was signed by the President Ronald Reagan, which was aimed to promote economic growth and help the plummeting economy in 1980s. One of the proposed changes was lowering the corporate tax rate what resulted in reduced effective tax rate for companies. The ERTA is considered to start the international tax race as countries responded with introducing measures that not only discouraged the outbound migration of their countries' capital, but also encouraged the investments from higher-taxing jurisdictions (Tanzi (1995)).

As can be seen from the figure below the average of CIT rates (excluding countries with unavailable data), most of the countries in 1980s and 1990s mostly followed the trend of decreasing CIT rates. After sharp lowering of the rate in USA, which came into the effect in 1986 and continued till 1987, the rate setting was different for specific country groups. Low income countries started (on average) to radically reduce their CIT rates only from 1990, with the exception of experiencing short growth in 1994 and 1995. The average of lower middle income countries was falling gradually before and after the ERTA came into the effect. During the period from 1980 till 2000, upper middle countries, high income OECD countries and high income non-OECD countries showed similar behaviour in lowering the CIT rate steadily from 1985, with the difference being that high income OECD countries had in start of 1980s higher average of the tax rates. Without cutting other effects off, however, we are not able to see exact influence of the reform for other countries. Other possible explanation for CIT rate decrease is that countries lowered the CIT rate independently of other countries and followed their inner incentives, such as support their domestic economy. The reasons may vary from country to country

and may even be combination of previously stated and others, but thanks to the previous research we can suspect the presence of the tax competition.

Figure 3.1: Average CIT rate by groups of countries with different income level and US CIT rate



Source: Author's elaboration based on data from Cobham & Janský (2015)

3.3 The TCJA and its possible impact by groups of countries

Many questions arise about which countries will be affected by the TCJA reform the most and which jurisdiction will respond with further lowering of the corporate income tax rate. As already mentioned, many of the developed countries with higher CIT rates (i.e. Germany and France), which are the ones that loose with this game the most, have already announced decreasing of the statutory tax rate. Possible decrease in the tax revenue could be severe for them as there is a positive correlation between countries GDP per capita lev-

els and tax-to-GDP levels, although there are few exceptions.[4] On the other hand, for poorer countries is the corporate income tax a much more important source of revenue than for richer ones - to compare, income from the corporate income tax rate sum up to 19,3 percent of revenue with 9,3 for developed countries (Gordon & Li (2009)). With corporate tax rates having fallen so significantly in the last 40 years, there are suggestions that the spillover effect is especially significant for developing countries.[5] Despite this, according to the World Bank and IMF recommendation, developing countries should optimally rely on income from the value-added taxes rather than corporate income taxes.

Table 3.1: Fifteen Highest Corporate Income Tax Rates in the World, 2018

Country	Rate	Region
United Arab Emirates	55%	Asia
Comoros	50%	Africa
Puerto Rico	39%	North America
Suriname	36%	South America
Chad	35%	Africa
Congo, The Democratic Republic of the	35%	Africa
Equatorial Guinea	35%	Africa
Guinea	35%	Africa
India	35%	Asia
Kiribati	35%	Oceania
Malta	35%	Europe
Saint Maarten	35%	North America
Sudan	35%	Africa
Zambia	35%	Africa
Sint Maarten (Dutch part)	35%	North America
Worlwide Average	23,03%	-
Worldwide weighted average by GDP	26,47%	-

Source: Tax Foundation (2019)

Another assumption connected to the development of tax competition after the TCJA is that specifically high tax jurisdictions will be forced to lower their income rate, no matter how developed they are or how economically close they are to the USA. The intuition here is, that country with very low rate would not feel threatened by lowering the rate of the US, for example, from 35 to 30 percent. However, situation could be different for countries with rate around 35 percent, which could become relatively less attractive for multinationals.

[4] see http://www.oecd.org/tax/tax-policy/global-revenue-statistics-database.htm
[5] see https://www.imf.org/external/np/pp/eng/2014/050914.pdf

Although it is true that economically developed countries with open economies are usually the ones with the high corporate income tax rate, countries with the 15 highest corporate income tax rate worldwide are mostly developing countries from regions like Africa, Oceania and South America, as can be seen in the Table 3.1. As we already mentioned, the TCJA and following speeding of the race to the bottom is especially dangerous for them, as incomes from corporate taxation are often crucial parts of national incomes. It is difficult to predict the reaction of those, particularly because of often bad political situation, turmoils, wars and the incompetence of local governments.

Apart from the economic situation of the country, there are other factors that may alter the response to corporate tax competition. The literature gives evidence of the positive impact of market integration on the FDI flows between the countries (Raff (2004)). This would imply that countries with more open economies, thus more advantageous trade agreements and higher FDI flows would be more interested in not loosing incomes from foreign investors and at the same time in attracting FDI incomes from others. Empiric confirms this hypothesis - Redoano (2014) found that European Union countries which closely cooperate in terms of the trade are more responsive to the change in the corporate tax rate of EU member than to the tax change of other, non-EU member jurisdiction. Having said that, we could assume that more open economies and specifically those which high FDI levels from and in the USA, will be the first ones to lower the corporate income tax rates in order to be more attractive for multinationals as a response to the TCJA.

The following two figures depict the US most significant trade partners in terms of FDI stocks. Except for countries normally considered as tax havens, such as Luxembourg, Ireland and Netherlands we can see that significant trade partners of the US are diverse countries which are mostly either the US neighbours or close countries like Mexico or Canada or developed European economies (e.g. United Kingdom, Germany). Important to mention, Mexico and Canada signed together with the US the North American Free Trade Agreement (NAFTA) which increases investment opportunities in these countries. All those countries have significant economic ties to the US and those of them which still have the high statutory rate, could be threatened with the TCJA and be potentially first ones to change their corporate tax policies.

Figure 3.2: The highest US outward FDI stock by countries, 2017

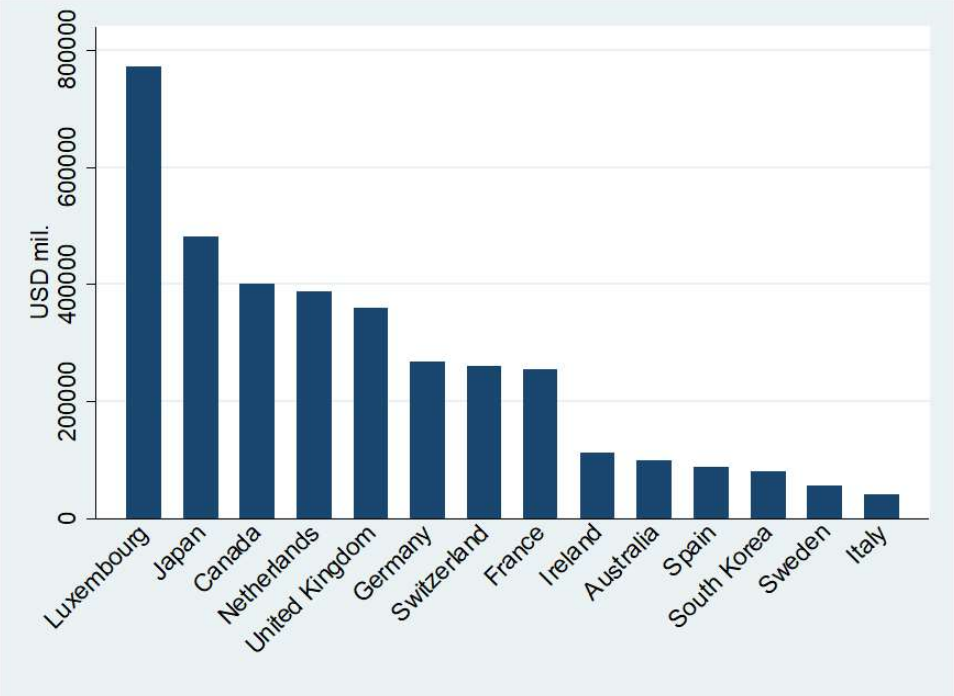
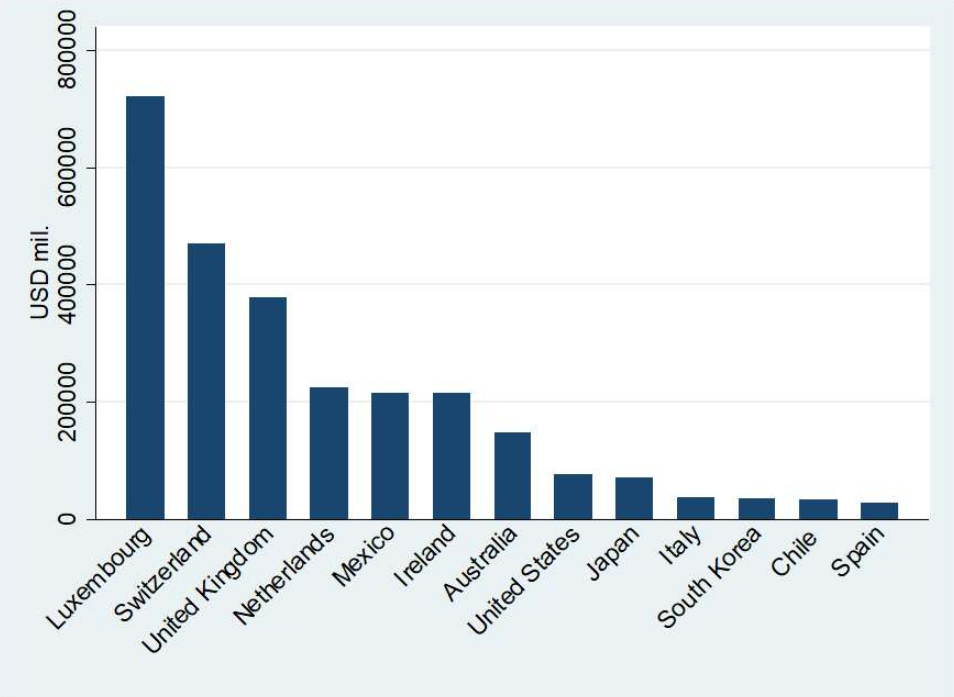


Figure 3.3: The highest US inward FDI stock by countries, 2017



Source: Author's elaboration based on data from OECD (2019)

Chapter 4

Methodology and data

This section will set our framework for dealing with the empirics. In the first part we briefly describe the model set out by Crivelli *et al.* (2016) which became the main inspiration for our research together with the results. After, we introduce our hypotheses and models. Following part is dedicated to our model specification and Generalized Method of Moments framework. The last part describes the data.

4.1 Strategic rate spillovers model by Crivelli et al.

We build on a model which was introduced by Crivelli *et al.* (2016), which tries to explain the tax competition between countries with distinguishing between the two types of spillovers - base spillover and strategic rate spillover, with the latter being the main field of interest for us. Base spillovers capture the effect of the tax policy of one country to other countries' tax base. Base erosion is done by two channels - through shifting of profits and through shifting of the real investments. In this model it is assumed that production and profit shifting are executed by a single representative multinational, which owns a single affiliate in each country. The multinational tries to maximize its profit which is composed by the revenue generated by its real activities in a country i and from which the tax is deducted. To do so, the multinational has to allocate capital or it may shift the tax base (with some cost) between the countries. The model further assumes that the multinational will allocate its capital to equalize the after-tax return across its affiliates: otherwise it could earn more by reallocating assets to wherever the after tax return is greatest.

Strategic rate spillovers, as a part of this model, measure the impact of tax competition to the tax rate setting. The model of strategic rate spillovers is estimated as follows:

$$\tau_{it} = \gamma\tau_{it-1} + \beta W_{-i}\tau_{-it} + \zeta X_{it} + a_i + c_t + \epsilon_{it} \tag{4.1}$$

In this equation τ_{it} stands for statutory tax rate in country i at the time t and W_{-it} means weighted average of the tax rates in countries different from i. The mentioned paper uses three types of weights. Firstly, GDP-weighted tax rate - this is computed by weighting the tax rate in each country (other than i) j by j's GDP as a share of total GDP of all countries other than i. Secondly, to capture the spillovers through the profit shifting, haven-weighted tax rates which are computed as unweighted average of the tax rate in those jurisdictions commonly listed as tax havens are used. At last the distance-weighted tax rate was used to depict the effect of distance to the tax competition. This rate was computed by weighting the tax rate by the inverse distance of the countries' capitals. X_{it} is a vector of control that includes variables that capture factors other than tax competition which affect statutory tax rate, namely agriculture share, logarithm of GDP per capita, trade openness and inflation. a_i and c_t are country and time specific effect, respectively. They are used to correct for the unobserved country-level and time-level heterogenity.

Crivelli *et al.* (2016) worked with unbalanced panel data for 173 countries over period of 33 years (from 1980 to 2013) with data concerned with the statutory tax rates and CIT revenues obtained from the IMF's Fiscal Affairs Database of the International Monetary Fund (IMF). Model is estimated using the system Generalized Method of Moments (GMM), which is commonly used for panel data model in which has the dependent variable high persistance or long memory, which is the case. One step, robust GMM estimator for panel data was used, with the instruments based on first lag of differences in the own CIT rate and weighted CIT rates of other countries in levels equation and second lags of their levels in the differenced equation. The results of the estimation are in the Table 4.1.

As can be seen from the Table 4.1, these results provide sufficient and robust evidence of the responsiveness to the change of the CIT rate elsewhere. In the case of the GDP-weighted CIT rate, the effect is far more significant for OECD countries and one can not reject the null hypothesis that the reduction of the CIT tax rate by one percentage point elsewhere leads to cutting the own

Table 4.1: Strategic Rate Spillovers by Income Level

Dependent variable: CIT rate i	Full sample	OECD	Non-OECD
CIT rate$j$, weighted GDP	0.8015***	1.0881***	0.6128***
	(0.1740)	(0.2104)	(0.1255)
CIT rate j, weighted tax havens	0.7678*	1.8420*	0.7106*
	(0.4393)	(1.006)	(0.4127)

*p<0.1; **p<0.05; ***p<0.01

Source: Crivelli *et al.* (2016)

country's tax rate by approximately one percentage point as well, holding other factors equal. Similarly, tax-haven weighted CIT rate is surprisingly high for OECD countries. The responsiveness of the non-OECD countries (using both GDP and tax havens weights) is not that apparent, although still statistically significant and positive. As most of the OECD countries are regarded as developed, results suggest that responsiveness to the tax setting of other countries is positively correlated to the income level.

4.2 Our hypotheses and methodology

4.2.1 Model specification

Regarding our model, our goal was to estimate following:

1. **Reducing CIT rate in USA in the past caused significant decrease of CIT rate in the rest world economies.**

2. Tax rate spillovers of past tax cuts in the USA were higher in countries, which were geographically close to USA.

3. Tax rate spillovers of past tax cuts in the USA were higher in high-tax countries (Australia, Japan, France, etc.)

4. Tax rate spillovers of the past tax cuts in the USA were higher for the developing countries.

5. Tax rate spillovers of the past tax cuts in the USA were higher for countries, which had more open economies/ used to have bigger part of their FDI in USA.

Each of hypotheses requires an estimation of different set of equations. As we want to estimate the role of the tax policies in the USA, we adjust the equation by adding variable $\tau_{USA,t}$, which is equal to to the corporate income tax rate in the USA at the time t. However, we decided to keep the weighted CIT rate in countries other than i, $W_{-i}\tau_{-it}$, but we exclude the US from its computation. The variable X_{it} stands for the control vector and consists of control variables.

1. For our main hypothesis that reducing CIT rate in the past caused a significant decrease of CIT rate in the rest of the countries, our regression equation is:

$$\tau_{it} = \gamma\tau_{it-1} + \alpha\tau_{USA,t} + \beta W_{-i}\tau_{-it} + \zeta X_{it} + a_i + c_t + \epsilon_{it} \tag{4.2}$$

2. To estimate the second of our hypotheses, that geographically closer countries were more responsive to the tax setting of the US, we decided to work with two following options. Firstly, we can follow the approach of Crivelli *et al.* (2016) in estimating the same equation for countries with distance from the US smaller than the country which distance is median values between distances of all countries in our sample from the US and for the rest of countries separately. When we speak about distance, we consider the distance of countries' capitals. Should be the information about distance to Washington D.C. unavailable, we replace it the respective closest capital. Thus, we estimate the Equation 4.2 for two subsamples. All countries with the capital closer than our computed median value 8485 km are considered to be 'geographically closer countries', whereas the rest of countries is considered to be 'geographically further countries'. It is obvious, that this method is not ideal for comparing the effect of geographical distance because of two reasons. One of them is that dividing the sample in two parts and estimating them separately leads to the significant drop in the number of observations in both equations. Secondly, it is not fully correct to compare the results of these two estimations, as by doing it we allow the slope for all parameters to vary for both groups. To put it in other words, estimating the equation for two different samples means the coefficients on all variables will be probably different and the interpretation of the results for the variable we are most interested in, $\tau_{USA,t}$, would be far more difficult. However, such division

may be helpful in removing heterogeneity between countries caused by different geographical location factors.

The second of considered options is adding the interaction term, $d_i\tau_{USA,t}$ and run the estimation for the full sample:

$$\tau_{it} = \gamma\tau_{it-1} + \alpha\tau_{USA,t} + \delta d_i\tau_{USA,t} + \beta W_{-i}\tau_{-it} + \zeta X_{it} + a_i + c_t + \epsilon_{it} \quad (4.3)$$

The variable $d_i\tau_{USA,t}$ captures the possibility that the effect of tax rate settings of the US fades out with the distance. In this case the d_i is inverse distance of country i from the US and it is also included in control variables.

3. The hypothesis that countries with the higher CIT rate are more likely to reduce theirs in respond to decreasing the CIT rate in the US could be captured in similar manners as we did for the second hypothesis by estimating the Equation 4.2 separately for two groups of countries - first one composed of countries which had own CIT rate higher than that median of all observed values of CIT rates that year in our sample (for computing median we excluded countries with no information about CIT rate) and the second one with the rest of countries. One of the issues of this method is that it is possible that country belongs to 'high rate countries' for some period and to the other group for another period, as both own CIT rate and the average of world CIT rates could change over time. This could possibly create more unbalanced panel for both groups. However, because of its accuracy, we consider this rule better than the others. Alternatively, we can work with the interaction term:

$$\tau_{it} = \gamma\tau_{it-1} + \alpha\tau_{USA,t} + \delta i_{it}\tau_{USA,t} + \beta W_{-i}\tau_{-it} + \zeta X_{it} + a_i + c_t + \epsilon_{it} \quad (4.4)$$

The variable i_{it} from the interaction term stands for the index number assigned to the countries according to the their CIT rate at the time t, compared to the rest of the CIT rates in the world at that time. We attach the index number 1-4 to every observation of CIT rate in a country i at the time t using rule as described in the following table. Country with the index number equal to 4, for example, then belongs to the countries with the highest CIT rates. This allows the tax spillover effect to vary depending on the own tax level. The respective quantiles are then cal-

culated with excluding countries which miss the information about CIT rate.

CIT rate	Index number
$\tau_{i,t} <$ 1. quantile $\sum_i \tau_{i,t}$	1
1. quantile $\sum_i \tau_{i,t} \leq \tau_{i,t} <$ 2. quantile $\sum_i \tau_{i,t}$	2
2. quantile $\sum_i \tau_{i,t} \leq \tau_{i,t} <$ 3. quantile $\sum_i \tau_{i,t}$	3
3. quantile $\sum_i \tau_{i,t} \leq \tau_{i,t} <$ 4. quantile $\sum_i \tau_{i,t}$	4

4. We will study the assumption regarding the effect for developing countries using similar methodology as in the previous two cases. Firstly, we need to estimate the Equation 4.2 separately for the subsamples of developed and developing countries. For the sake of simplicity, we decided to consider all of OECD countries to be developed and the rest of the countries to be developing. The drawback of this method is obvious, as not all non-OECD countries have to be developing, but it is true that OECD countries belongs to the most developed. Then we proceed to estimate this equation:

$$\tau_{it} = \gamma\tau_{it-1} + \alpha\tau_{USA,t} + \delta g_{it}\tau_{USA,t} + \beta W_{-i}\tau_{-it} + \zeta X_{it} + a_i + c_t + \epsilon_{it} \quad (4.5)$$

The variable g used in the interaction term, $g_{it}\tau_{USA,t}$, stands for GDP per Capita. We chose the GDP per Capita from all alternative options of the economic development indicators, such as GNP per Capita, inflation or economic structure of country, because of the good accessibility to country-level data and also because it is usually considered as a reliable indicator of economic development, although we realize that such indicator does not take into account the quality of life and other factors.

5. Last of our hypotheses, that countries with more open economies were more motivated to act in response to the tax rate cuts in USA we decided to estimate using only the interaction terms. Firstly, we considered the openness index:

$$\tau_{it} = \gamma\tau_{it-1} + \alpha\tau_{USA,t} + \delta o_{it}\tau_{USA,t} + \beta W_{-i}\tau_{-it} + \zeta X_{it} + a_i + c_t + \epsilon_{it} \quad (4.6)$$

In this equation, the variable o_{it} in the interaction term stands for openness index and allows us to control for effect of US's CIT rate for other countries at different level of the openness of the economy. We also add

this variable to the vector of control. The openness index is calculated as the ratio of the sum of country's exports and imports and the GDP of the country. Alternatively, to take into account the possibility that not only countries with the open economy but particularly those who have the biggest FDI shares in the US will respond by lowering the tax rate, we also estimated following:

$$\tau_{it} = \gamma\tau_{it-1} + \alpha\tau_{USA,t} + \delta f_{it}\tau_{USA,t} + \beta W_{-i}\tau_{-it} + \zeta X_{it} + a_i + c_t + \epsilon_{it} \quad (4.7)$$

The interaction term now contains the variable f_{it}, natural logarithm of total FDI of country i in the US. We also add this variable to the vector of controls.

Concerning the above mentioned vector of control, which appears in all estimations, we use similar approach as Crivelli *et al.* (2016). and for the vector of control we use the natural logarithm of the GDP per capita, openness index (the sum of non-resource exports plus imports, relative to GDP), inflation. Moreover, for the equations with interactions, we also add the variable used in the interaction term, where it was not specified in the original equation (inverse distance, CIT index number, and GDP per Capita, respectively). For the construction of weighted average of the tax rates we used GDP and haven-weighted tax rate. The results of estimation of the latter can be found in the Appendix B. The overview of variables used for estimations can be found in the Appendix A.

4.2.2 GMM estimator

The GMM estimator that we intend to use was designed by Arellano & Bond (1991), Arellano & Bover (1995) and Blundell & Bond (1998) and is suitable for linear dynamic panel data models. The GMM estimator uses instruments to deal with endogeneity issue. To be concrete, let us consider this simple panel model:

Let us have simple panel model with $i = 1, .., N$ and $T = 1, ..., T$

$$y_{it} = \alpha_{it} + \beta\mathbf{x}_{it} + \epsilon_{it}$$

with the OLS estimator calculated for pooled model as

$$\beta = (\mathbf{x}'\mathbf{x})^{-1}\mathbf{x}'y$$

we need the assumption of exogeneity:

$$E(\epsilon_i|x_i) = 0$$

However, regarding our equation, the dependent variable τ_{it} depends very likely on the past observations $\tau_{i,t-1}$ if not on the more past realizations and this is clear violation of the exogeneity assumption. Such endogeneity would result in an inconsistent estimator using OLS estimation. Luckily, GMM estimation using instruments is designed to correct for this problem and this is the main reason for its use in our model. Simply put, instruments are variables which affects the dependent variable only through their effect on explanatory variables. According to Wooldridge (2010), the instrumental variable is variable (let us denote it z) which is not in the regression equation, but has these two following characteristics:

- z is uncorrelated with the error term in our regression, therefore exogenous.
- z is partially correlated with one of the explanatory variable, once it was accounted for the effect of other exogenous variables on this specific explanatory variable.

The system GMM (proposed by Blundell & Bond (2000)) is an extension of GMM estimator and was invented to deal with the weak instrument problem. It allows us to use different moment conditions (instruments) for the equation in level and in first differences. The advantage of the system GMM over the original difference GMM estimators is in allowing for more instruments and hence more efficient estimates. Additionaly, system GMM is more suitable for panels with gaps than difference GMM (Roodman (2009b)), which is our case.

Regarding the choice of instruments for our model, we used instruments based on first lag of differences in the own CIT rate and weighted CIT rates of other countries in levels equation, and second lags of their levels in the differenced equation, which is standard treatment for the endogenous variables. This choice is used also in the work of Crivelli *et al.* (2016) in the model we build on. The choice of the instrumental variables is well reasoned, given that

the tax policy and thus CIT rate for specific country tend to be based on the past of both the CIT rate of given state. Similar logic applies for the weighted CIT rate.

The correct use of GMM estimator is conditioned with following assumptions (Roodman (2009b)):

- The panel is composed out of small number of time periods and large number of crossectional units (countries), thus is so-called 'small T, large N' panel
- Linear functional relationship
- The independent variable is dynamic, in the sense that the current value is influenced by the past realizations
- The model contain variables which are not strictly exogenous
- Fixed effects model (with country-specific means, in our case)
- Heteroskedasticity and autocorrelation within countries but not across them

All of these assumptions can be considered true for our model, except for the first one, which is questionable. Our panel data contains 37 time periods, which is more than what is usually considered as 'small T'. The main problem with using the GMM estimator with longer time periods is that the number of instruments gets too big. This is called the 'instrument proliferation' problem and can cause the GMM estimator to be biased (Roodman (2009a)). However, using the system GMM it is possible to limit the number of lags of instruments and collapsing instruments to decrease the number of instruments, which makes then the count of instruments invariant in T (Roodman (2009a)), what was the approach used by Crivelli *et al.* (2016) and also ours.

4.3 Data

The Table 4.2 provides descriptive statistics for the data we are working with. Our panel is unbalanced with gaps, with the information about 187 countries and 37 years (from 1980 to 2017). The advantage of our sample compared to the one Crivelli *et al.* (2016) worked with is mainly its size, which may

improve the accuracy of our estimation. We also updated the data, as we added observations collected for years 2014 to 2017. One of the issues is that observations may not miss randomly, given that missing observations tend to be more frequent for countries, which are usually less developed or less stable and for which the collection of data is problematic. Similarly, missing observations may be more frequent for earlier years, if we assume that the data collection has became more precise over the time. This could lead to potential bias in our estimation, however, we decided not to remove observations to get the balanced panel. Although we are aware of this problem, we favour working with the full information with as many observations as possible.

Concerning the sources, our data comes from various ones. Significant part of the dataset was obtained from the authors of the Wider paper *Global Distribution of revenue loss from tax avoidance* (Cobham & Janský (2017)) to whom we are grateful. Specifically it is International Centre for Tax and Development-World Institute for Development Economics Research (ICTD-WIDER) Government Revenue Database (GRD)[1]. We combined this data with the publicly available data on GDP from the World Bank Group (2019) and CIT rate country-level data from the database of the private company KPMG (2019). The data on the distance come from CEPII (2019) database and the data on Foreign Direct Investment in the USA (FDI) come from an Official Website of United States Government[2].

	Obs.	Mean	Std. Dev.	Min	Max
Statutory CIT rate (%)	4204	30.35	12.53	0	75
Statutory CIT rate in the USA (%)	6319	41.38	4.08	38.59	49.83
GDP weighted world CIT rate (%)	6203	36.83	6.42	24.16	46.10
Haven weighted CIT rate(%)	6319	24.83	1.05	16.94	35.17
GDP per capita (USD)	5646	9518.26	13852.33	50.04	120857
GDP(USD)	5580	1.74e+11	5.57e+11	3.67e+07	9.49e+12
Inflation (%)	5064	26.01	256.20	-17.64	11749.64
Openness Index (%)	5599	85.02	52.14	0.31	562.06
FDI in USA(mil. USD)	3730	12349.7	49876.48	-5242	540922

Table 4.2: Summary statistics

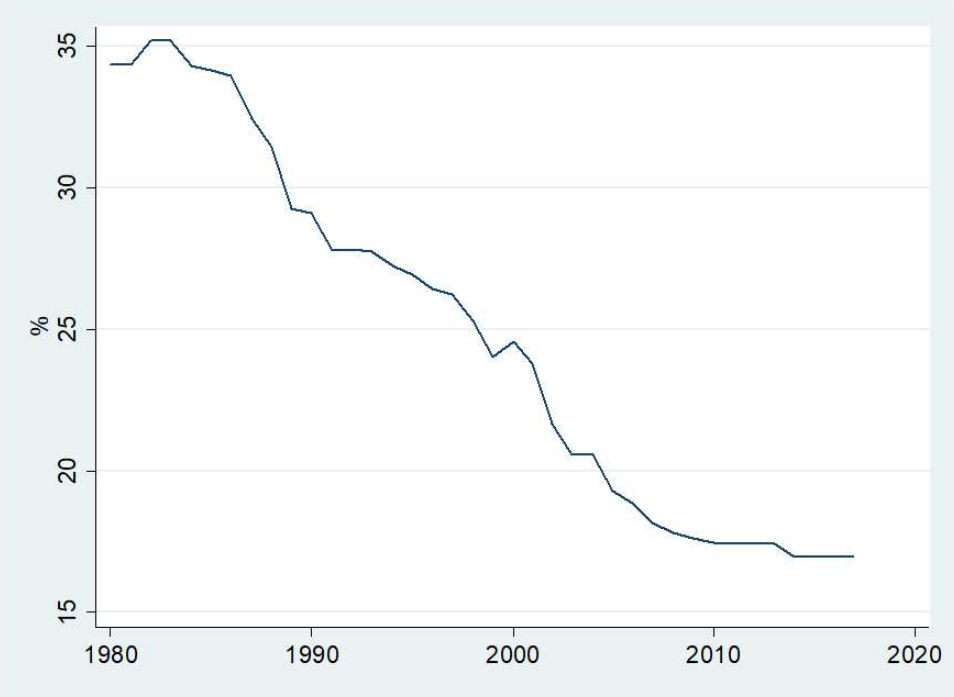
As mentioned above, we use two alternatives for the construction of the weighted world CIT rate - the GDP and haven-weighted tax rate, the latter to illustrate the most attractive CIT rates for companies. For the construction of the tax haven weights, we use tax rates of the six major profit misalignment

[1]https://www.wider.unu.edu/about-grd
[2]https://www.bea.gov/data

jurisdictions of the Netherlands, Ireland, Luxembourg, Bermuda, Switzerland, and Singapore, identified for US-headquartered multinationals by Cobham & Janský (2015), although the list of all tax havens is much longer. Although we call it haven-weighted CIT rate, it is computed as simple average of CIT rates in these six countries. We followed the approach of Crivelli *et al.* (2016) for construction of GDP-weighted world tax rate, which is constructed for the country i like weighted average $\sum_{j\neq 1}^{n} \omega_{ij}\tau_{ij}$ of the statutory CIT rates in countries $j \neq i$ with $\sum_{j\neq 1}^{n} \omega_{ij} = 1$ (as we mentioned we also do not include the US into this GDP-weighted world tax rate). As a result, the value of the GDP-weighted CIT rate is unique for every country i at the time t. Following two figures depict the average of the GDP-weighted CIT rate and the haven-weighted CIT rate for our sample.

Figure 4.1: Average GDP-weighted CIT rate

Figure 4.2: Tax haven-weighted CIT rate



Source: Author's elaboration based on data from various sources.

Chapter 5

Results

This chapter summarizes our results[1]. They are sorted according to hypotheses in Chapter 4.

5.1 Main hypothesis

Following table describes estimation results made for full sample:

Dependent variable *corp_inc_tax*	
l.corp_inc_tax	-0.1341594*
	(0.0762767)
corp_inc_tax_usa	-0.1447234
	(0.130376)
gdp_w_inc_tax	1.103667***
	(0.2320121)
ln_pcgdp	1.175329
	(5.36393)
op_in	0.5108009**
	(0.2238179)
inf	0.5108009
	(0.2238179)
constant	-53.12068
	(43.28155)
Number of observations	3071
Number of countries	160
Number of instruments	23
*p<0.1; **p<0.05; ***p<0.01	

Table 5.1: Strategic Rate Spillovers, estimation for full sample

[1]Robust standard errors reported

5.2 Geographical distance

In the table below, we can find results of estimation for our second hypothesis. The results are organized in the following way: column denoted (1) contains the information from the estimation using the interaction term, column (2) from the estimation for geographically closer countries and column (3) provides information about estimation for geographically more distant ones.

Dependent variable *corp_inc_tax*	(1)	(2)	(3)
l.corp_inc_tax	-0.441989	-0.0131218	-0.0810813
	(0.0532644)	(0.1055575)	(0.1051913)
corp_inc_tx_usa	4.073197	0.5636105***	-0.8034883
	(3.288558)	(0.1761796)	(0.65044995)
corp_inc_tx_usa∗ inv_dist	-22745.02		
	(19883.07)		
inv_dist	2039218		
	(1819501)		
gdp_w_inc_tax	0.4158248	0.1896035	1.091832**
	(0.7675313)	(0.2793509)	(0.4356725)
ln_pcgdp	-13.758828	-17.58507*	9.369736
	(15.3141)	(8.997769)	(7.801061)
op_in	0.2042929**	0.2275074	-0.7444239
	(0.0724406)	(0.1839696)	(0.5012022)
inf	0.0019731	0.0043851	0.223908
	(0.0069682)	(0.0041389)	(0.2567162)
constant	-230.0942	141.1412*	-112.7281
	(192.4976)	(77.41898)	(74.63713)
Number of observations	3071	1641	1430
Number of countries	160	82	78
Number of instruments	23	23	23
			*p<0.1; **p<0.05; ***p<0.01

Table 5.2: Strategic Rate Spillovers, geographical distance

5.3 Own tax level

The results of the second of our subhypotheses are presented in the following table. Column (1) contains results from the equation with the interaction term, column (2) and (3) summarizes findings for the subsample of high tax countries and low tax countries, respectively.

Dependent variable *corp_inc_tax*	(1)	(2)	(3)
l.corp_inc_tax	0.0038568	0.0361822	0.064206
	(0.0266158)	(0.066706)	(0.067594)
corp_inc_tx_usa	0.4645062	-0.0232675	0.1194672
	(0.6748564)	(0.2429981)	(0.137299)
corp_inc_tax_usa∗cit_i	-0.2222909		
	(0.300275)		
cit_i	21.70842*		
	(13.08642)		
gdp_w_inc_tax	1.003025***	0.7125397**	0.4632422***
	(0.1347164)	(0.3161429)	(0.1440461)
ln_pcgdp	-5.090617***	-5.58876	3.370348*
	(1.87126)	(5.299196)	(1.270785)
op_in	0.034997	0.4209862*	0.0326127
	(0.0535452)	(0.2168394)	(0.1038505)
inf	-0.0100387	0.003711	-0.0034748
	(0.0092935)	(0.0063098)	(0.0051154)
constant	-12.6259	8.252183	-16.20626*
	(30.99516)	(45.22019)	(9.578065)
Number of observations	3071	1784	1287
Number of countries	160	141	123
Number of instruments	23	23	23
			*p<0.1; **p<0.05; ***p<0.01

Table 5.3: Strategic Rate Spillovers,own tax level

5.4 Economic development

Column (1) of the following table describes the results of estimation for the full sample, using the interaction term. Columns (2) and (3) then describe the results for OECD and non-OECD countries, respectively.

Dependent variable *corp_inc_tax*	(1)	(2)	(3)
l.corp_inc_tx	-0.1069548	0.1995829*	-0.1057339
	(0.0750535)	(0.1029924)	(0.1157392)
corp_inc_tax_usa	-0.107259	0.4363634**	-0.6220665
	(0.1580766)	(0.1419135)	(0.5249504)
corp_inc_tax_usa∗gdppc	-0.0000927*		
	(0.0000562)		
gdppc	0.0063747*		
	(0.0035498)		
gdp_w_inc_tax	1.200694***	0.710699***	1.271526**
	(0.0035498)	(0.1915487)	(0.531768)
ln_pcgdp		-14.99088	2.824174
		(12.18136)	(6.676545)
op_in	0.3288899*	0.3089543	0.9454588*
	(0.18195767)	(0.2307289)	(0.5332351)
inf	0.0368167	-0.1628206	0.0152631
	(0.0272098)	(0.1525625)	(0.015809)
constant	-75.32177*	112.3204	-91.32251
	(35.56802)	(108.4284)	(72.89486)
Number of observations	3071	867	2204
Number of countries	160	34	137
Number of instruments	23	23	23
			*p<0.1; **p<0.05; ***p<0.01

Table 5.4: Strategic Rate Spillovers, economic development

5.5 Openness of economy

Table (number) summarizes our findings for the last of our subhypotheses. Column (1) contains results for the estimation with the openness index in the interaction term, whereas column (2) with the natural logarithm of FDI in the USA.

Dependent variable *corp_inc_tax*	(1)	(2)
l.corp_inc_tax	-0.158779*	0.0665812
	(0.0858577)	(0.0593012)
corp_inc_tax_usa	3.264501	3.160204
	(2.125829)	(2.646526)
corp_inc_tax_usa∗op_in	-0.0429713	
	(0.0264418)	
corp_inc_tax_usa∗ ln_fdi_usa		-0.5232324
		(0.4606456)
ln_fdi_usa		31.63928
		(23.92634)
gdp_w_inc_tax	1.190736***	2.254667***
	(0.2619071)	(0.9573526)
ln_pcgdp	0.8634467	-7.411164
	(1.190736)	(7.827262)
op_in	2.351796**	0.0918308
	(1.142074)	(0.0071079)
inf	0.0462058	0.0071079
	(0.0344874)	(0.0195932)
constant	-199.3893**	-197.7461
	(96.8549)	(128.9427)
Number of observations	3071	1672
Number of countries	106	105
Number of instruments	23	23
	*p<0.1; **p<0.05; ***p<0.01	

Table 5.5: Strategic Rate Spillovers, openness of economy

5.6 Results of tests

In this section, we provide results of the tests. With the GMM estimator for panel data it is not common to report R^2. Instead we use following four tests to verify correct specification of our models.

5.6.1 The Sargan and Hansen tests

The Sargan and Hansen test verifies the choice of instruments used. The null hypothesis is:

H_0: All restrictions of overidentification are valid.

The statistics reported is χ^2 and the criteria for the acceptation is:

$$Prob > \chi^2 \geq 0.05$$

If the probability obtained is higher or equal to 0.05 that implies that our instruments are valid as there is not enough evidence to reject the null hypothesis. To put it simply, Sargan test verifies the right choice of instruments - i.e. whether they are uncorrelated with error term and whether the right number of lags was used. However, as Parente & Santos Silva (2011) argue, the use of these tests is misleading and provide very limited information about the right choice of instruments. Similarly, Roodman (2009a) warns about relying on the results of these tests too faithfully. Hence, in practice, we will rely more on the economic intuition, other tests and acceptable number of instruments used.

5.6.2 The Arellano-Bond test

The Arellano-Bond test is used to check the assumption of no correlation in the error term for panel data. The null hypothesis is:

H_0: Autocorrelation is not present in our sample.

For not rejecting the null hypothesis, the test require that for AR(2) the probability $pr > z$ is higher than 0.05. This imply that errors are not serially correlated and we can not reject the null.

This test is of greater concern for us, given that it has greater power as the previous tests (Roodman (2009a)). There are two important assumptions for this test. First one, there must not be any serial correlation across individuals

and the second one, the N (number of cross-sections) should be large (Roodman (2009a)).

5.6.3 The Wald test

The Wald test is used to test the overall significance of our parameters, with the null:

H_0: Regressors are jointly statistically insignificant.

For rejecting the null, the criterion is that the p-value of observed statistics is smaller than 0.05. It is important to be sure that variables in our model are jointly significant and therefore have explanatory power, thus rejecting the null hypothesis is a crucial step in order to be confident in the interpreting our results.

	Sargan Test $\Pr > \chi^2$	Hansen Test $\Pr > \chi^2$	A-B AR(2) $\Pr > z$	Wald Test $\Pr > \chi^2$
Full sample	0.005	0.062	0.062	0.000
Geographically closer countries	0.000	0.013	0.220	0.000
Geographically more distant countries	0.999	0.540	0.927	0.199
Countries with lower CIT rate	0.000	0.001	0.802	0.000
Countries with higher CIT rate	0.000	0.003	0.947	0.000
non-OECD countries	0.127	0.662	0.931	0.179
OECD countries	0.000	0.394	0.294	0.000

Table 5.6: Tests results, estimation by groups

	Sargan Test $\Pr > \chi^2$	Hansen Test $\Pr > \chi^2$	A-B AR(2) $\Pr > z$	Wald Test $\Pr > \chi^2$
Inverse distance	0.000	0.085	0.214	0.000
GDP per Capita	0.247	0.109	0.113	0.001
CIT rate index	0.743	0.274	0.377	0.000
Openness index	0.006	0.333	0.201	0.000
log(FDI)	0.000	0.380	0.502	0.012

Table 5.7: Tests results, estimation with the interaction term

Chapter 6

Interpretation of the results

Following chapter provides brief comment on results and is an attempt to give an answer to main questions of this research. Results are for the sake of transparency interpreted by hypotheses we have formulated (see Chapter 4).

1. **Reducing CIT rate in USA in the past caused significant decrease of CIT rate in the rest world economies.**

The main hypothesis about the US to be the leader in corporate tax rate setting was not confirmed. The coefficient connected to the variable *corp_inc_tax_usa* (in the Section 5.1) has negative sign and is not statistically significant. The results, on the other hand, confirm findings of Crivelli *et al.* (2016) and we find that if *gdp_w_inc_tax* decreases by 1 percentage point, country i will decrease its own corporate income tax rate by approximately 1.10 percentage point, holding other factors equal. The Wald test confirmed the joint significance of parameters and Arellano-Bond Test confirmed the absence of serial correlation.

2. Tax rate spillovers of past tax cuts in the USA were higher in countries,which were geographically close to USA.

We will firstly comment on the estimation results by groups. For the group of countries geographically closer to the USA (that is countries with capital closer than a country with median capital distance form Washington, D.C.) is the statistically significant coefficient on *corp_inc_tax_usa* equal to approximately 0.56, while the coefficient on *gdp_w_inc_tax* decreased significantly to 0.19 and became statistically insignificant (compared to Crivelli *et al.* (2016), where this coefficient varied from 0.66 to 1.08). On the other hand, for countries more distant to the US our estimation leave us with the negative coefficient on

corp_inc_tax_usa with big standard error and coefficient on *gdp_w_inc_tax* not too different from the estimation without *corp_inc_tax_usa* (made for the full sample). This result is in favour of accepting our hypothesis that countries closer to US, such as Canada, Mexico and countries in Middle America region are more likely to follow the tax rate setting in the US. However, the results for both groups are not comparable. This is because when we run two different estimations, we allow all coefficients vary for both groups. Therefore are results from the estimation by groups, we gained information about both groups, but not about difference between them. For both groups there is no evidence for serially correlated errors, but the parameters from the estimation for countries further from the US became jointly insignificant even at 10 percent level (according to Wald Test). This means that for this group we can not rely on the results. The estimation using interaction provide us, on the other hand, with no significant coefficient of our interest. Therefore, our main finding can be summarized as that for countries, which are closer to the US than median value in our sample, 1 percentage point cut in the *corp_inc_tax_usa* would mean own tax rate cut by approximately 0.56 percentage point, holding other factors equal.

3. Tax rate spillovers of past tax cuts in the USA were higher in high tax countries.

According to our results from the estimation by groups, the tax rate spillover effect from GDP-weighted CIT rate is significantly smaller for countries with lower tax rate and equals to 0.46 with acceptable standard error. Interestingly enough, the coefficient connected to *corp_inc_tax_usa* variable is small and statistically insignificant for both of groups. Given this, the most straightforward interpretation is that countries with low tax rate for companies could be in the past less responsive to the world tax setting, but not at all following the USA lead. From the estimation for countries with high CIT rate, on the other hand, we can suspect higher sensitivity for the world level of CIT rate, but the results did not confirm any responsiveness of these countries to the *corp_inc_tax_usa*. Both of estimations have jointly statistically significant parameters and according to Arellano-Bond test do not suffer from autocorrelation. The estimation with the interaction terms did not confirm our result as the coefficient connected to variable *corp_inc_tax_usa* turned out to be connected with bigger standard error than the coefficient itself, while the coefficient connected to GDP weighted CIT rate remain similar to what Crivelli

et al. (2016) assumed and equals to 1.00, approximately. To conclude, the results of our estimation suggest that countries with lower CIT rate to be less responsive to the world tax setting. High-tax countries with coefficient on the *gdp_w_inc_tax* being equal to 0.71 are more sensitive, but we were not successful in proving that countries with high tax rate follow USA in the tax rate setting.

4. Tax rate spillovers of the past tax cuts in the USA were higher for developing countries.

For simplicity, we divided the panel into observations for OECD and non-OECD countries, while we assumed OECD countries to be more developed than the rest. The outcome of our estimation is a bit surprising. OECD countries showed, on average, to be followers of the USA when it comes to tax setting, with the (statistically significant) coefficient on the *corp_inc_tax_usa* being approximately 0.44. Results of the test rule our the autocorrelation and also confirm joint significance of parameters. For non-OECD countries on the other side, we did not have enough evidence to reject the null hypothesis of the *corp_inc_tax_usa* not being statistically important. However, for non-OECD countries, the used parameters are not jointly significant even at 10 percent level, therefore we can suspect existence of factors important in explaining their tax setting, we may have missed in our specification. This issue makes our results not trustworthy enough to interpretate them. The outcome of our estimation with the *gddpc* used in the interaction term with the *corp_inc_tax_usa* is dubious as the interaction term turned out significant only 10 percent level and negative, against our assumptions. For illustration, if we plug in 1 percentage point decrease in US tax rate and GDP per Capita of Czech Republic and Ukraine for 2017 [1] (US 37,371 and US 9,283 respectively), we come to the conclusion that 1 percentage point of tax cut in the USA would mean 3.4 percentage point increase in the statutory tax rate for the Czech Republic and 0.75 percentage point increase for Ukraine, holding others factors equal. Parameters are jointly significant and we do not have evidence of autocorrelation, however, the interaction is only significant at 10 percent level and therefore we do not have convincing evidence of the level of GDP per Capita alternating the responsivity to the US tax rate. Coefficient on *gdp_w_inc_tax* is statistically very significant and vary from approximately

[1] see https://data.oecd.org/gdp/gross-domestic-product-gdp.htm

0.71 to 1.25. In conclusion, the most important piece of information for us, that the tax rate of OECD countries showed some positive correlation to the US tax rate at that particular time.

5. Tax rate spillovers of the past tax cuts in the USA were higher for countries, which had more open economies/used to have bigger part of their FDI in USA.

For the estimation of the last of our hypotheses, we decided not to estimate the regression for different groups, but instead we used two types of interaction terms. First one, the interaction term with the openness index, $corp\_inc\_tx\_usa * op\_in$ (where openness index is calculated as a sum of export and import of the country relatively to GDP) turned out not to have expected sign and is also very insignificant. Similarly, the the interaction term with log of FDI, $corp\_inc\_tx\_usa * ln\_fdi$ (where ln_fdi is natural logarithm of the sum of FDI held by countries in the USA) brought us a result that is also insignificant and therefore we can not rely on it. On the other hand, the coefficient on $gdp\_w\_inc\_tax$ remains positive and significant and equals to 1.19 and 2.25 respectively. However, the result for the second model may be affected by lower number of observations caused by high number of missing values of ln_fdi. Both estimation do not suffer from the serial correlation, however, in the second one, the Wald statistics confirmed the joint significance of parameters only at 5 percent level. To conclude, we do not have enough evidence to confirm that the dependence of countries' CIT rate on USA statutory rate varies significantly with openness of economy, or the FDI held by those countries in the USA.

Chapter 7

Conclusion

Corporate tax competition and related tax evasion and profit shifting is one of the most discussed and troublesome issues in today's international economic topics. The main purpose of this work was to extend the model proposed by Crivelli *et al.* (2016) of the strategic tax rate spillovers. While they found the evidence of countries tax rate to be dependent on weighted world tax rate and thus confirmed tax rate spillovers, we were looking for the proof of the existence of the US tax rate spillovers.

Using system GMM for panel data, with country-level information which was put together from different sources and contained information about more countries and longer time period than the data Crivelli *et al.* (2016) worked with, our results can be summarized as following:

- Our main hypothesis about the US being leader in corporate income tax rate settings for other countries (when estimated for full sample) turned out not to be valid. On the other hand, even our data, which differ from the data used by Crivelli *et al.* (2016) confirms that countries are responsive and set their tax in response to the (GDP-weighted) weighted world tax rate.

- We proved the first of our following supplementary hypotheses, which was connected to the geographical distance from the US and found evidence that countries closer to the US were in the past more responsive to the corporate rate tax setting than more distant countries using estimation by groups.

- The hypothesis about high tax countries lowering the tax rate in response to US corporate income tax decreasing more compared to the countries

with the low corporate income tax rate was not confirmed. However, the estimation by groups brought us an interesting result of high tax countries to be also less responsive to the GDP-weighted corporate income tax rate.

- The hypothesis about tax rate spillovers of the past cuts in the USA being higher for developing countries turned out not to be valid using the estimation with the interaction term (we used the GDP per Capita). On the other hand, despite our assumptions, the results of the estimation by groups provide evidence for OECD countries to follow the USA in the tax rate setting. Specifically, we found that for the CIT rate cut in the US by one percentage point, the OECD country lowered the CIT rate by 0.44 percentage point, holding other factors equal.

- Contrary to our expectations, we were not successful in proving that the countries with more open economies or bigger FDI in the US are following the US in the tax rate setting.

The existence of the US tax spillovers for specific groups of countries suggest that this tax reform is a milestone in the 'race to the bottom'. Although our model is too simple to predict the future shape of the tax competition and to quantify the real impact of this step, it can be further used as an useful tool for building more complex models (e.g. using game theories). The results of our work can be further used for predicting the behaviour of countries' policymakers in the corporate tax setting and also for further works dealing with the impacts of tax cuts for other countries.

The possible extension of our work would be doing the similar analysis with alternative variables, which may be more informative or important for companies' executives and policymakers than corporate income tax rate itself, such as EMTR or EATR. As one of the options, one should also not forget about the corporate tax base, which is as important part of the corporate tax policy setting as the CIT rate we were focused on.

Bibliography

Altshuler, R. & T. Goodspeed (2015): "Follow the Leader? Evidence on European and U.S. Tax Competition." *Public Finance Review* **43(4)**: pp. 485–504.

Arellano, M. & S. Bond (1991): "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations." *Review of Economic Studies* **58(2)**: pp. 277–297.

Arellano, M. & O. Bover (1995): "Another look at the instrumental variable estimation of error-components models." *Journal of Econometrics* **68(1)**: pp. 29–51.

Beer, S., A. Klemm, & T. Matheson (2018): "Tax Spillovers from U.S. Corporate Income Tax Reform." *IMF Working Paper 18/166*, International Monetary Fund.

Blundell, R. & S. Bond (1998): "Initial conditions and moment restrictions in dynamic panel data models." *Journal of Econometrics* **87(1)**: pp. 115–143.

Blundell, R. & S. Bond (2000): "GMM Estimation with persistent panel data: an application to production functions." *Econom teric Reviews* **19(3)**: pp. 321–340.

Bräutigam, R., C. Spengel, & K. Stutzenberger (2017): "The Development of Corporate Tax Structures in the European Union from 1998 to 2015 - Qualitative and Quantitative Analysis." *Technical Report 17-034*, ZEW - Centre for European Economic Research Discussion.

CEPII (2019): "Cepii geographical distance database." Data accessed on 2019-02-15, `http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=6`.

Chalk, N., M. Keen, & V. Perry (2018): "The Tax Cuts and Jobs Act: An Appraisal." *IMF Working Paper 18/185*, International Monetary Fund.

Cobham, A. & P. Janský (2015): "Measuring Misalignment - The Location of Us Multinationals' Economic Activity Versus the Location of Their Profits." *ICTD Working Paper 42*, The International Centre for Tax and Development (ICTD).

Cobham, A. & P. Janský (2017): "Global distribution of revenue loss from tax avoidance." *WIDER Working Paper 2017/55*, United Nations University World Institute for Development Economic Research.

Crivelli, E., R. de Mooij, & M. Keen (2016): "Base Erosion, Profit Shifting and Developing Countries." *FinanzArchiv (FA)* **72(3)**: pp. 268–301.

Devereux, M., R. Griffith, & A. Daniel Klemm (2002a): "Corporate income tax reform and international tax competition." *Economic Policy* **17**: pp. 449–495.

Devereux, M., R. Griffith, & A. Klemm (2002b): "Corporate income tax reforms and international tax competition." *Economic Policy* **17(35)**: pp. 449–495.

Devereux, M. P., B. Lockwood, & M. Redoano (2008): "Do countries compete over corporate tax rates?" *Journal of Public Economics* **92(5-6)**: pp. 1210–1235.

Devereux, M. P. & S. Loretz (2012): "What do we know about corporate tax competition?" *Working Paper 12/29*, Oxford University Centre for Business Taxation.

Dharmapala, D. & N. Riedel (2012): "Earnings shocks and tax-motivated income-shifting: Evidence from European multinationals." *Journal of Public Economics* **97**: pp. 95–107.

Dowd, T., P. Landefeld, & A. Moore (2017): "Profit shifting of u.s. multinationals." *Journal of Public Economics* **148**: pp. 1 – 13.

Exbrayat, N. (2016): "Does trade liberatization trigger tax competition? Theory and evidence from OECD countries." *Technical Report ffhalshs-01328769*, HAL.

Fuest, C., C. Spengel, K. Finke, J. H. Heckemeyer, , & H. Nusser (2013): "Profit Shifting and 'Aggressive' Tax Planning by Multinational Firms: Issues and Options for Reform." *ZEW Discussion Paper 13-078*, Centre for European Economic Research (ZEW).

Genschel, P. & P. Schwarz (2011): "Tax competition: a literature review." *Socio-Economic Review* **9(2)**: pp. 339–370.

Gordon, R. & W. Li (2009): "Tax structures in developing countries: Many puzzles and a possible explanation." *Journal of Public Economics* **93(7-8)**: pp. 855–866.

Group, T. W. B. D. D. (2019): "World bank open data." Data accessed on 2019-04-01, `https://data.worldbank.org/`.

Heckemeyer, J. H. & M. Overesch (2013): "Multinationals' Profit Response to Tax Differentials: Effect Size and Shifting Channels." *ZEW Discussion Paper 13-045*, Centre for European Economic Research (ZEW).

Heinemann, F., M. Overesch, & J. Rincke (2010): "Rate-cutting tax reforms and corporate tax competition in Europe." *Economics & Politics* **22**: pp. 498–518.

Huizinga, H. & L. Laeven (2008): "International profit shifting within multinationals: A multi-country perspective." *Journal of Public Economics* **92(5-6)**: pp. 1164–1182.

Janský, P. (2019): "The US corporate Income Tax Reform and Its Implications for EU." *IES Occasional Paper 1*, Institute of Economic Studies, Charles University.

Johansson, Å., Ø. B. Skeie, S. Sorbe, C. Menon, J. H. Heckemeyer, , & H. Nusser (2017): "Tax planning by multinational firms: Firmlevel evidence from a crosscountry database." *OECD Economics Department Working Papers 1355*, OECD.

KPMG (2019): "Corporate tax rates table." Data accessed on 2019-02-15, `https://home.kpmg/xx/en/home/services/tax/tax-tools-and-resources/tax-rates-online/corporate-tax-rates-table.html`.

Leibrecht, M. & C. Hochgatterer (2012a): "Tax competition as a cause of falling corporate income tax rates: A survey of empirical literature." *Journal of Economic Surveys* **26(4)**: pp. 616–648.

Leibrecht, M. & C. Hochgatterer (2012b): "Tax competition as a cause of falling corporate income tax rates: A survey of empirical literature." *Journal of Economic Surveys* **26(4)**: pp. 616–648.

Lohse, T. & N. Riedel (2013): "Do Transfer Pricing Laws Limit International Income Shifting? Evidence from European Multinationals." *CESifo Working Paper 4404*.

Markusen, J. (2002): "Multinational Firms and the Theory of International Trade." *Mpra paper*, University Library of Munich, Germany.

Nabben, R. (2017): *Intellectual Property Tax Planning in the light of Base Erosion and Profit Shifting* . Master's thesis, Tilburg School of Economics and Management, Tilburg University, the Netherlands.

OECD (2019): "Oecd economic data." Data accessed on 2019-03-10, `https://data.oecd.org/economy.htm`.

Parente, P. & J. Santos Silva (2011): "A cautionary note on tests for overidentifying restrictions." *Economics discussion papers*, University of Essex, Department of Economics.

Raff, H. (2004): "Preferential trade agreements and tax competition for foreign direct investment." *Journal of Public Economics* **88(12)**: pp. 2745–2763.

Redoano, M. (2014): "Tax competition among European countries. Does the EU matter?" *European Journal of Political Economy* **34**: pp. 353–371.

Roháč, D. (2006): "Evidence and Myths About Tax Competition." *New Perspectives on Political Economy* **2(2)**: pp. 86–115.

Roodman, D. (2009a): "A Note on the Theme of Too Many Instruments." *Oxford Bulletin of Economics and Statistics* **71(1)**: pp. 135–158.

Roodman, D. (2009b): "How to do xtabond2: An introduction to difference and system GMM in Stata." *Stata Journal, StataCorp LP* **9(1)**: pp. 86–136.

Spengel, C., F. Heinemann, M. Olbert, O. Pfeiffer, T. Schwab, & K. Stutzenberger (2017): "Analysis of US Corporate Tax Reform Proposals and their Effects for Europe and Germany." *Zew final report*, Centre for European Economic Research (ZEW).

Tanzi, V. (1995): *Taxation in an Integrating World (Integrating National Economies : Promise and Pitfalls)*. Brookings Institution Press.

Tax Foundation (2019): "Corporate tax rates around the world, 2018." Data accessed on 2019-03-10, `https://taxfoundation.org/corporate-tax-rates-around-world-2018/`.

Tørsløv, T. R., L. S. Wier, & G. Zucman (2018): "The missing profits of nations." *NBER Working Papers 24701*, National Bureau of Economic Research.

Whalley, J. (2002): "Taxes and Trade." *Technical report*, The University of Western Ontario and NBER.

Wooldridge, J. M. (2010): *Econometric Analysis of Cross Section and Panel Data*. Washington, DC: The MIT Press.

Appendix A

Variables overview

Following table serves as an overview of used variables in our models and estimation. In the first column there are variables as they were used when estimating in STATA and also in the Chapter 5 and 6. Second column contains their respective equivalents which we used when we specified the model in the Chapter 4.

Table A.1: Variables overview

STATA	Model	Description
corp_inc_tax	$\tau_{i,t}$	Statutory corporate income tax rate (%)
l.corp_inc_tax	$\tau_{i,t-1}$	First lag of statutory corporate income tax rate (%)
corp_inc_tax_usa	$\tau_{USA,t}$	Statutory corporate income tax rate in the USA (%)
gdp_w_inc_tax	$W_{-i}\tau_{-it}$	GDP-weighted corporate income world tax rate (%)
hav_w_inc_tax	$W_{-i}\tau_{-it}$	Haven-weighted corporate income tax rate (%)
corp_inc_tax_usa∗inv_dist	$d_i\tau_{USA,t}$	Interaction term
corp_inc_tax_usa∗gdppc	$g_{it}\tau_{USA,t}$	Interaction term
corp_inc_tax_usa∗cit_i	$i_{it}\tau_{USA,t}$	Interaction term
corp_inc_tax_usa∗op_in	$o_{it}\tau_{USA,t}$	Interaction term
corp_inc_tax_usa∗ln_fdi_usa	$f_{it}\tau_{USA,t}$	Interaction term
gdp	X_{it}	GDP (USD)
gdppc	X_{it}	GDP per Capita (USD)
ln_gdppc	X_{it}	Natural logarithm of GDP per Capita
op_in	X_{it}	Openness index (%)
inf	X_{it}	Inflation (%)
inv_dist	X_{it}	Inverse distance
cit_i	X_{it}	CIT index number
fdi_usa	X_{it}	FDI held by country in USA (mil. USD)
ln_fdi_usa	X_{it}	Natural logarithm of FDI held by country in USA

Appendix B

Results of estimation with the tax haven-weighted world CIT rate

We estimated same regressions as specified in Chapter 4 with an alternative to the GDP-weighted CIT rate used in original ones, haven-weighted CIT rate. We report results (in the shorter form) in the following table:

Table B.1: Strategic Rate Spillovers by groups, estimation using haven-weighted CIT rate

	corp_inc_tax_usa	hav_w_inc_tax	Obs.	Countries	Instruments
(1)	-0.8058414***	2.237414***	3116	169	23
	(0.2265814)	(0.429328)			
(2)	-0.1249611	1.564045***	1664	86	23
	(0.18476)	(0.3780624)			
(3)	-0.8370248**	1.696333***	1452	83	23
	(0.3744903)	(0.5721347)			
(4)	-0.4461822**	1.440909***	1825	149	23
	(0.1983187)	(0.3695636)			
(5)	-0.2272979	0.7643469*	1291	125	23
	(0.2300527)	(0.4258809)			
(6)	-0.8526023	2.119279**	2249	146	23
	(0.3845211)	(0.7488863)			
(7)	0.2077414	0.5797317***	867	34	23
	(0.1414299)	(0.1965503)			

*p<0.1; **p<0.05; ***p<0.01

The results from the one step, system GMM estimation with robust standard errors. Estimated for (1) full sample, (2) geographically closer countries, (3) geographically more distant countries, (4) countries with lower CIT rate, (5) countries with higher CIT rate, (6) non-OECD countries, (7) OECD countries.

Table B.2: Strategic Rate Spillovers with the interaction term, estimation using haven-weighted CIT rate

	corp_inc_tax_usa	interaction term	hav_w_inc_tax	Obs.	Countries	Inst.
(1)	3.112757	-17866.47	0.4570865	3116	169	23
	(2.213648)	(12755.59)	(0.5911513)			
(2)	-0.4626527**	-0.0000828*	1.770564***	3116	169	23
	(0.2288688)	(0.0000448)	(0.4621053)			
(3)	-0.2972028	-0.0116529	1.333646***	3116	169	23
	(0.5290022)	(0.2464988)	(0.1433298)			
(4)	3.737522**	-0.0576798*	2.398493*	3116	169	23
	(1.818662)	(0.023)	(0.4827194)			
(5)	3.323426	-0.6014297	2.305981**	1680	110	23
	(2.876738)	(0.5107871)	(1.033289)			

*p<0.1; **p<0.05; ***p<0.01

The results from the one step, system GMM estimation with robust standard errors. Estimated for the full sample with the interaction term:
(1) corp_inc_tax_usa*inv_dist,
(2) corp_inc_tax_usa*gdppc,
(3) corp_inc_tax_usa*cit_i,
(4) corp_inc_tax_usa*op_in,
(5) corp_inc_tax_usa*ln_fdi.