Assessing the Effectiveness of Bilateral Tax Information Exchange Agreements

An Empirical Analysis of Tax Information Exchange Agreements and its Impact on Foreign Direct Investments of Multinational Enterprises in Tax Havens

Y.Y Than[*]

Supervisors:

A.M. Lejour (CPB)
M. van 't Riet (CPB)
H. Vrijburg (EUR)

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Abstract

In this paper, the following research question is addressed: with which countries do tax havens ratify bilateral tax information exchange agreements and what is the impact of these agreements on foreign direct investments of multinational enterprises in tax havens? I use a unique hand collected data sample consisting of 19,040 country pair observations covering a time period between 2000-2013. By applying a cross sectional probit approach, I conclude that the larger the economic link between an OECD country and tax haven, the lower the probability that a tax information exchange agreement exists between the country pair. Subsequently, by applying a propensity score matching approach, I conclude that tax information exchange agreements have a negative impact on bilateral foreign direct investments of multinational enterprises in tax havens. Based on these results, I find empirical evidence that bilateral tax information exchange agreements are not an effective instrument to tackle tax evasion and avoidance. In order to improve tax transparency in tax havens, I suggest that (i) tax information exchange should also include the exchange of information on multinational enterprises' worldwide activities, (ii) tax information exchange should be implemented on a worldwide basis and (iii) blacklisting should contain hard, well defined and objective criteria that cannot be avoided easily.

Keywords: Bilateral Tax Information Exchange Agreements, Tax Haven Blacklisting, Tax Transparency, Bilateral Foreign Direct Investments, Probit Analysis, Propensity Score Matching Methods

[*] MSc student Fiscale Economie, student ID: 369481, contact information: yingyithan35@hotmail.com, Erasmus School of Economics.

Foreword

This master thesis is written in accordance with the requirement for the degree of Master of Science in Economics of Taxation (in Dutch: Fiscale Economie). The total process of the research took approximately seven months and was started in January, 2016. During the research process, I have received many support from my university supervisor, CPB colleagues and my family. In this foreword, I would like to express my gratitude to them.

I would like to express my most sincere gratitude to my university supervisor Hendrik Vrijburg. Starting from the third year of my bachelor, I was already keen on his way of teaching Economics of Taxation. In my view, Hendrik is a great supervisor (and teacher) who puts a lot of time in guiding his students. Next to the good communication and feedback, he also knows how to motivate and encourage his students. Because of Hendrik, I have learned a lot of econometrics. Furthermore, I would also want to thank him for providing me the opportunity to write this thesis at the CPB.

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At last, I want to thank my girlfriend Rene for her love and support in the past six years.

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1 Introduction

In the past decade, countering harmful tax practices by improving transparency in tax matters has been one of the main priorities of the Organization for Economic Co-operation and Development (hereafter: OECD), European Union (hereafter: EU) and the United States (hereafter: U.S.). Countries that facilitate tax evasion and tax avoidance by offering low tax rates and a high degree of non-transparency (i.e. tax havens[1]) have therefore been facing enormous political pressure. Starting in 2000, the OECD created a black list of countries meeting the criteria of a tax haven. Countries listed on the black list are confronted with negative publicity or legal ramifications if laws and sanctions are contingent on that identification (Gravelle, 2015).[2] In order to improve transparency in tax matters, the OECD gave tax havens the opportunity to get delisted if they commit to implement the OECD standards of effective information exchange by signing so called bilateral tax information exchange agreements (hereafter: TIEAs). Under these bilateral agreements, country pairs commit to promote transparency and continue mutual cooperation in tax matters. In the first few years, only a small amount of tax havens has actually started signing TIEAs. However, due to the large political pressure on tax havens after the economic crisis in 2009, tax havens are since then required to have signed at least twelve TIEAs in order to get delisted or to avoid being put on the blacklist again. This pressure shows results: whereas only 50 TIEAs had been ratified at the beginning of 2008, more than 800 TIEAs had been ratified by 2013 (OECD, 2013).

The large number of ratified bilateral TIEAs seems to suggest that more transparency in tax matters has been achieved. However, given the recent revelation of the Panama Papers by the International Consortium of Investigative Journalists on April 4, 2016, one may have doubt about this. The purpose of this paper is to assess the effectiveness of bilateral TIEAs empirically. In order to do so, two questions are of special interest: (i) with which countries do tax havens ratify TIEAs and (ii) do TIEAs also affect foreign direct investments (hereafter: FDI) of multinational enterprises (hereafter: MNEs) in tax havens? The first question is interesting to analyze since tax havens might have the incentive to undermine the minimum standard of twelve TIEAs by strategically ratifying TIEAs with only irrelevant countries (e.g. countries with no economic link) so that tax avoiding schemes can still exist. The second question is closely linked to the first one and it is interesting to analyze because it can provide empirical evidence whether the investment decisions of MNEs in tax havens are also affected by TIEAs. While there is a large number of empirical studies showing that TIEAs have an

[1] In this paper, I define 'tax havens' as the countries that are on the list of tax havens as classified by the OECD in 2000. This list is provided in table B1 of the Appendix.

[2] For example, French firms have to prove that transactions that are executed with firms located in a blacklisted jurisdiction are indeed real. If this is not the case, then interest, royalty or dividend payments are not tax deductible. Additional implications such as a withholding tax rate of 75 percentage points is also present (BDO, 2016).

impact on investment decisions of (wealthy) individuals,[3] only a few have actually analyzed the impact of TIEAs on the investment decisions of MNEs in tax havens. The central research question of this paper is therefore:

With which countries do tax havens ratify bilateral Tax Information Exchange Agreements and what is the impact of these agreements on Foreign Direct Investments of multinational enterprises in tax havens?

This paper contributes to the existing literature in several ways. First, this paper starts off with an extensive review of the development of tax haven blacklisting and TIEAs. Second, the empirical analysis is based on a unique hand collected data sample consisting of 19,040 country pair observations covering a time period between 2000-2013. Third, to the best of my knowledge, this paper is the first to attempt to analyze the impact of TIEAs on the investment decisions of MNEs in tax havens by using FDI data. Finally, this paper concludes with some policy recommendations to foster tax transparency of tax havens based on the results of the empirical analysis. Although the empirical analysis of this paper is solely based on TIEAs, these agreements do provide the best possible experimental setting to analyze how the investments of MNEs and the level of non-transparency of tax havens are in general related compared to other tax information exchange instruments. The reason for this is that TIEAs are mostly ratified with tax havens only. Furthermore, TIEAs are mostly ratified bilateral. This means that these agreements will only affect some MNEs in one signatory country with investments in the opposite signatory country (a tax haven) while leaving all other MNEs unaffected. Therefore, by exploiting the passage of TIEAs as a shock on non-transparency, I can analyze how the investment decisions of MNEs are affected by the increased level of tax transparency in tax havens.

This paper is organized as follows. Chapter 2 provides background information and descriptive statistics about the development of tax haven blacklisting and TIEAs. Chapter 3 discusses the empirical literature. Chapter 4 discusses the theoretical model. Chapter 5 derives the hypotheses to be tested. Chapter 6 discusses the data. Chapter 7 describes the methodology. Chapter 8 presents the results of the empirical analysis and a number of robustness checks. Chapter 9 concludes.

[3] See for example Johannesen and Zucman (2014). In their paper, the authors study the impact of TIEAs on bank deposits of individuals. Their analysis shows that recent TIEAs have led to a significant shift in non-bank deposits, indicating that tax evaders moved their deposits to other tax havens that have no TIEA ratified with their respective home country.

2 Tax havens blacklisting and Tax Information Exchange Agreements

This chapter consists of two sections and it provides background information about the development of tax havens blacklisting and TIEAs. Next to the background information, several descriptive statistics are also presented.

2.1 The development of tax haven blacklisting[4]

The OECD has been fighting tax havens, as part of the project against harmful and unfair tax practices of its Committee on Fiscal Affairs (hereafter: CFA), for a long time now. At the very beginning, blacklisting was one of the strategies used against tax havens. Blacklisting, also called the naming and shaming of uncooperative countries, has been imposed by the OECD in 2000. The OECD initially examined 47 jurisdictions to see which of those jurisdictions met the criteria of a tax haven. Although there is no global precise definition of a tax haven, the criteria defined by the OECD are viewed as the most prominent ones. According to these criteria, a jurisdiction is a tax haven if it cumulatively has (i) no or low tax rates, (ii) lack of effective exchange of information, (iii) lack of transparency and (iv) no requirement of substantial activity (OECD, 1998). Given these criteria, 41 of the 47 jurisdictions were qualified as a tax haven. These jurisdictions were as follows: Andorra, Anguilla, Antigua & Barbuda, Aruba, Bahamas, Bahrain, Barbados, Belize, Bermuda, British Virgin Islands, Cayman Islands, Cook Islands, Cyprus, Dominica, Gibraltar, Grenada, Guernsey, Isle of Man, Jersey, Liberia, Liechtenstein, Maldives, Malta, Marshall Islands, Mauritius, Monaco, Montserrat, Nauru, Netherlands Antilles, Niue, Panama, Saint Kitts & Nevis, Saint Lucia, Saint Vincent & the Grenadines, Samoa, San Marino, Seychelles, Tonga, Turks & Caicos Islands, US Virgin Islands and Vanuatu.

Although 41 jurisdictions were qualified as a tax haven, only 35 jurisdictions actually appeared on the very first OECD black list in 2000. This was because six of the 41 jurisdictions (Bermuda, Cayman Islands, Cyprus, Malta, Mauritius and San Mario) immediately made commitments to cooperate on information exchange. Over time, some new jurisdictions have also been added to the list. But as more tax havens signed agreements to exchange tax information, the black list became shorter. It is important to note that the OECD has three lists: a white list of jurisdictions implementing an agreed-upon standard of information exchange, a gray list of jurisdictions that have committed to such a standard, and a black list of jurisdictions that have not committed (Gravelle, 2015). In order to move from the gray to the white list, jurisdictions have to sign at least twelve TIEAs with other countries. An interesting question is how the OECD has come up with that number in 2009. According to

[4] There exist several lists of tax havens. In this paper, I only discuss and refer to the OECD black list. Although not unimportant to mention, many criticisms have been made by a range of commentators that the OECD have overlooked many potential tax havens. Many jurisdictions that have been mentioned are the United States (Delaware, Nevada and Wyoming), United Kingdom, the Netherlands, Denmark, Hungary, Iceland, Israel, Portugal and Canada. For an extensive review on this matter, see Gravelle (2015).

experts of the OECD's CFA and the Global Forum, there can be no 'hard and fast' line on how to measure progress in the implementation of TIEAs. These experts have suggested that at that point in time (year 2009), a good indicator of progress is whether a country has signed twelve TIEAs. Therefore, the twelve TIEA threshold is completely arbitrary chosen. Not unimportantly to mention, the OECD does not solely look at whether a country has passed the twelve TIEA threshold. While reviewing the threshold, the OECD also takes into account (i) the countries with which the TIEAs are signed[5], (ii) the willingness of a country to continue to sign TIEAs even after it has reached the threshold and (iii) the effectiveness of implementation (OECD, 2016).

By 2007, the OECD had reported that 33 jurisdictions made commitments to exchange tax information, while five jurisdictions (Andorra, Liechtenstein, Monaco, Liberia and Marshall Islands) remained on the black list. The OECD had also announced that three jurisdictions (Barbados, Maldives and Tonga) should no longer be considered as tax havens, leaving 38 of the 41 identified in 2000 which are still considered as tax havens by the OECD (Tax Justice Network, 2007). On April 7, 2009, the three last remaining jurisdictions (Andorra, Liechtenstein and Monaco) have also been removed from the black list (OECD, 2016). As a result, no jurisdiction is currently listed on the black list anymore.

On March 1, 2016, only four jurisdictions (Bahrain, Nauru, Panama and Vanuatu) remained on the grey list (Central America Data, 2016). However, according to the OECD press release of May 9, 2016, these four jurisdictions have confirmed to join the OECD automatic exchange of tax information starting from 2018 onwards (OECD, 2016). Therefore, these jurisdictions have also been moved to the white list. As a result, no jurisdiction is currently listed on the grey list anymore.

The latest OECD developments regarding blacklisting have been announced on July 12, 2016. In response to the G20 leaders' call to establish a new list with objective criteria to identify non-cooperative jurisdictions w.r.t. tax transparency after the Panama leak, the OECD has announced to create a new blacklist with other criteria than the ones used before. Under the new blacklisting rules, a jurisdiction will not be considered as an uncooperative jurisdiction (and hence will not be listed on the new blacklist) if it meets *two out of these three* criteria: (i) the jurisdiction is rated as largely compliant w.r.t. exchange of information on request,[6] (ii) the jurisdiction commits to implement Common Reporting Standards (hereafter: CRS), and to begin exchanges of tax information by 2018 at the latest and (iii) the jurisdiction has signed the Multilateral Convention on Mutual Administrative Assistance in Tax Matters (hereafter: MCMAA) (OECD, 2016). It is important to note that the first

[5] The OECD mentions that a tax haven with solely twelve TIEAs ratified with other tax havens would not pass the threshold. However, the OECD allows tax havens to sign TIEAs with each other. This means that tax havens with a relative small amount of TIEAs ratified with other tax havens can also pass the threshold.
[6] Tax information exchange comes in three forms: (i) exchange upon request, (ii) spontaneous exchange and (iii) automatic exchange.

criterion is based on the exchange of information on request, rather than the automatic form of information exchange. This seems somewhat curious as the OECD clearly prefers the automatic exchange of information over the information exchange on request nowadays. The second criterion concerns the implementation of CRS, an automatic tax information exchange standard based on a worldwide approach that is developed by the OECD in the last couple of years. CRS has been already signed by 101 jurisdictions. Of these jurisdictions, 54 have committed to undertake the first exchanges of information in 2017 and 47 have committed to undertake the first exchanges of information in 2018. The legal basis of CRS is either the MCMAA or the CRS Multilateral Competent Authority Agreement (hereafter: MCAA). If jurisdictions do not have signed a MCMAA and a MCAA, then jurisdictions may also rely on a bilateral agreement, such as a double tax treaty (hereafter: DTT) or TIEA (OECD, 2016). In short, CRS calls on countries to obtain information directly from their financial institutions and automatically exchange that information with other countries on an annual basis. The information to be exchanged includes interest and dividends earned, account balances, income from certain products, and sale proceeds from financial assets and other income generated by assets made with respect to a financial account (PwC, 2014). The idea of CRS is based on the so-called Foreign Account Tax Compliance Act (hereafter: FATCA), which was introduced by the US government in 2010. The FACTA aims to ensure effective taxation of the worldwide capital income of all US persons by obliging all foreign financial institutions to exchange information of their US customers. In this way, the CRS is thus very similar to the US FATCA. The third criterion concerns the signing of a MCMAA. The MCMAA was developed jointly by the OECD and the Council of Europe in 1988. This Convention is the most comprehensive multilateral instrument available and it provides a legal basis for all forms of tax co-operation to tackle tax evasion and avoidance. At this moment, 98 jurisdictions are participating in this Convention (OECD, 2016).

2.2 The development of TIEAs

TIEAs are a part of the Agreement on Exchange of Information on Tax Matters (hereafter: the Agreement) grew out of the work undertaken by the OECD to address harmful tax practices. The Agreement was developed by the OECD Global Forum Working Group on Effective Exchange of Information in 2002. The purpose of this Agreement is to promote international co-operation in tax matters through exchange of information. It represents the standard of effective exchange of information and it is presented as both a multilateral instrument and a model for bilateral double tax treaties or agreements. It is important to note that the multilateral instrument is not a ‘multilateral agreement’ in the traditional sense. Whereas any country can be bound with a multilateral agreement in the traditional sense if it wish to be bound, a country can only be bound with a multilateral TIEA if the other participating countries (which are already bounded) approve this. If countries adopt the multilateral TIEA instrument, then all participating countries will have the same bilateral TIEAs ratified. Multilateral instruments could be of particular use to less developed countries eager to take

advantage of increased transparency and exchange of information, but which lack the resources to negotiate a series of bilateral agreements (OECD, 2016). To my knowledge, only the Nordic countries (Greenland, The Faroe Islands, Norway, Sweden, Iceland, Finland and Denmark) have adopted a multilateral approach to sign TIEAs.[7]

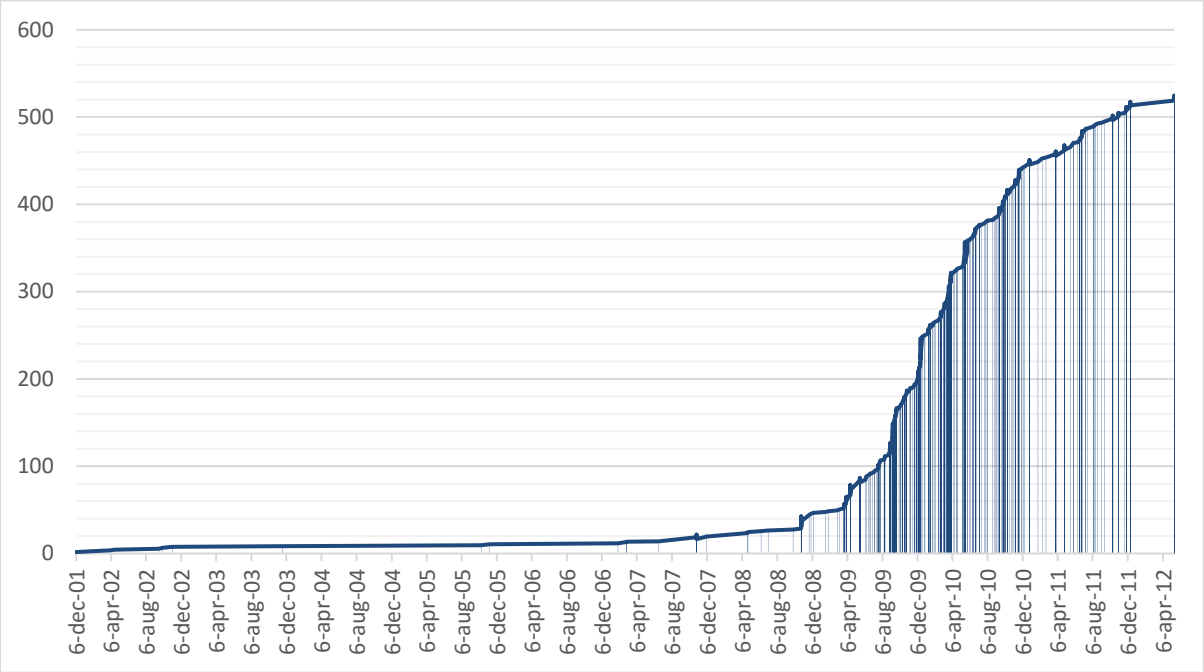
As stated earlier, tax information exchange based on the bilateral model comes in two forms: the bilateral agreements (the bilateral TIEAs) and the bilateral DTT. Countries could thus also meet the OECD standards of information exchange by incorporating an information exchange clause into their DTT.[8] The basis for this is provided in article 26 of the OECD Model Convention. However, it is important to note that TIEAs and DTTs are not the same. The scope of regulation under TIEAs is much narrower than DTTs. Whereas both of them provide a basis for tax information exchange, the main aim of DTTs is to eliminate juridical double taxation. DTTs contain for example methods to eliminate double taxation related to active and passive income, but also special provisions like the non-discrimination and the mutual agreement procedure articles. In contrast to DTTs, TIEAs are agreements that purely focus on tax information exchange.

Information exchange clauses in DTTs provide a basis for all three forms of information exchange. However, for TIEAs this *was* not the case. Initially, TIEAs only contained exchange upon request. But due to the large focus on the automatic exchange of tax information by the OECD in the recent years, countries now have the possibility to extend the scope of their existing TIEAs to also cover the automatic exchange of tax information.[9] By doing so, jurisdictions are then able to base a bilateral competent authority agreement for the purpose of putting in place the automatic exchange of information in accordance with the CRS.[10]

At the very beginning, only a few tax havens have actually started signed TIEAs. However, due to the large political pressure on tax havens after the economic crisis in 2009, the number of TIEAs ratified has increased tremendously. The turning point was the OECD Global Forum meeting in Mexico on 1 and 2 September 2009. During this meeting, the OECD concluded that sixteen tax havens did not have ratified any TIEA and that only seven tax havens have concluded only one TIEA since 2000. This is a striking result given the fact that these tax havens made commitments to engage in tax information exchange years ago. The G20 Leaders have reacted to this matter by urging tax havens to adopt higher standards of tax transparency under the threat of economic sanctions. The OECD Global

[7] This explains why the Nordic countries have the most TIEAs ratified of the sample dataset (see figure A2 of the Appendix).
[8] However, this is not an option for the vast majority of tax havens since these countries do not have DTTs ratified with OECD countries.
[9] This is possible since June 2015.
[10] Recall from section 2.1 that jurisdictions may also use bilateral agreements as a legal basis for the implementation of CRS.

Figure 1: development of the number of ratified TIEAs, sample data 2000-2013



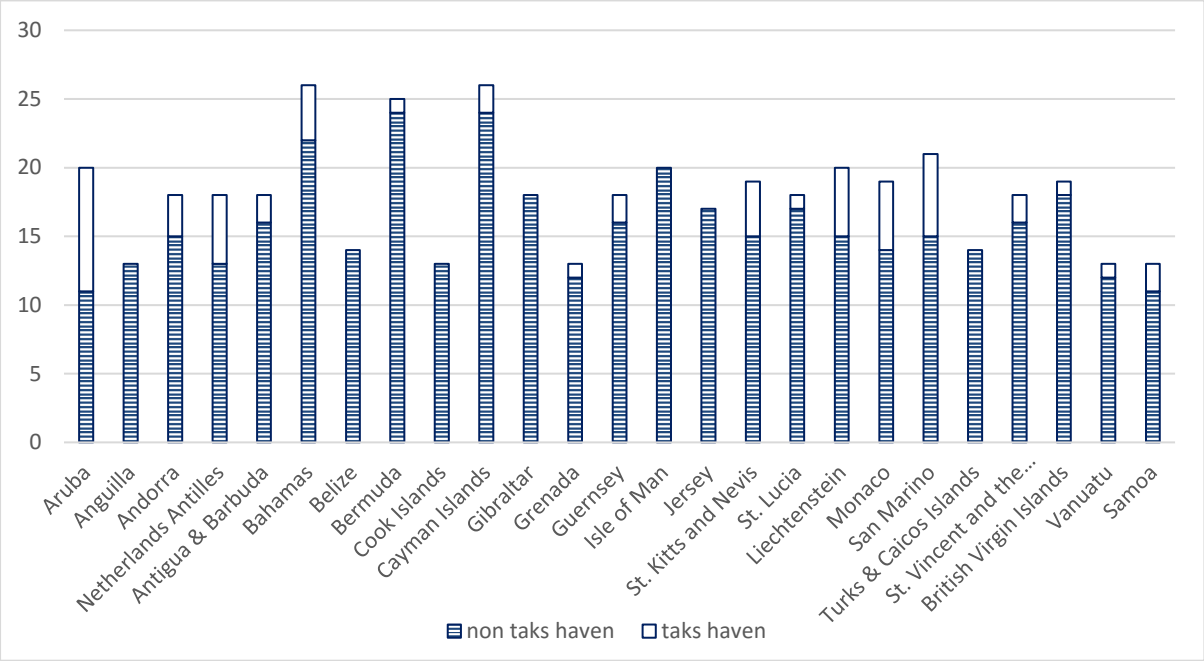
Source: OECD (2016), own illustration

Forum started a three-year procedure to promote the rapid implementation of the standards of tax transparency by conducting peer reviews. Countries that did not meet the standards of tax information exchange as set out by the OECD at that moment (for tax havens: not having twelve TIEAs) were put on the black list (again). This pressure from the OECD and the G20 has led to the ratification of more than 750 TIEAs in the period 2009-2013.

Figure 1 shows the development of the number of ratified TIEAs of the sample dataset. The sample data consists of 525 country pairs that have ratified a TIEA. Among these pairs, 490 are cases where at least one of the two partners is a tax haven, 28 are cases where both partners is a tax haven and 35 are cases where both partners are not a tax haven. The dark area of the figure clearly shows that most of the TIEAs are indeed ratified in the period after the OECD Global Forum meeting in Mexico on 1 and 2 September 2009.

Currently, all jurisdictions examined by the OECD are not listed on the black list anymore, which implies that each of them have committed to conclude the minimum of twelve TIEAs. An interesting question is whether these jurisdictions tried to undermine the threshold of twelve TIEAs by fulfilling the standards just through signing TIEAs between themselves or with non-economic linked countries. Before analyzing the data empirically, a closer look at the descriptive statistics of the data may yield some preliminary insights.

Figure 2: number of TIEAs ratified by tax havens with tax and non-tax havens, sample data 2000-2013[11]



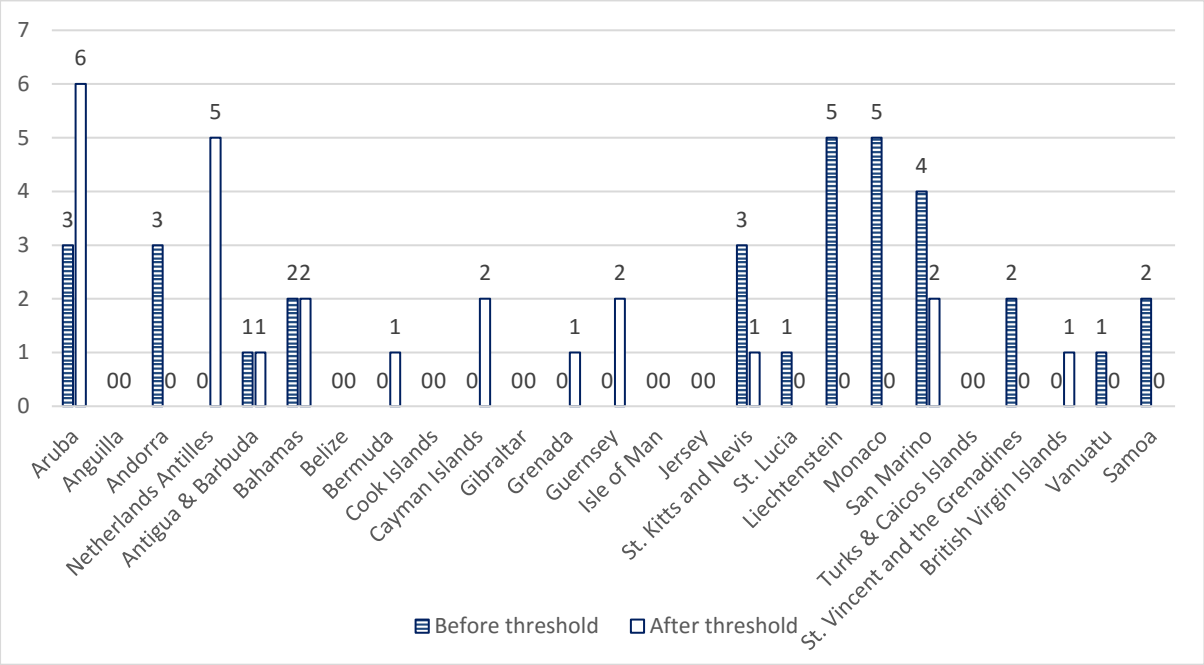
Source: OECD (2016), own illustration

Figure 2 shows the number of TIEAs ratified by the tax havens of the sample data. I have divided the number of TIEAs ratified into two groups: the first group consists of TIEAs ratified between a tax haven and a non-tax haven and the second group consists of TIEAs ratified between tax havens. The majority of the tax havens of the sample data have at least ratified twelve TIEAs. Tax havens with the largest amount of TIEAs ratified are mostly former British colonies, such as the Bahamas (26), Bermuda (25), Isle of Man (20) and the Cayman Islands (26). These jurisdictions are one of the oldest and richest tax havens, offering complete freedom from income tax to investors and very attractive methods of corporate tax income levy, yet they have signed so many TIEAs to comply with the OECD standards for tax information exchange (Nogacki, 2012). Tax havens originating from former British colonies also have relatively less TIEAs ratified with other tax havens compared to other jurisdictions. This might indicate that these jurisdictions are genuinely cooperating with the OECD. An important remark is that almost every British colony has a TIEA ratified with the United Kingdom, indicating that historical links such as being a colony might have an impact on the likelihood of the ratification of a TIEA.

There are also tax havens that have relatively more TIEAs ratified with other tax havens (e.g. Aruba, Liechtenstein, Monaco and San Marino) compared to the British colonies. Besides, figure 2 also shows that 18 out of 25 tax havens of the sample have at least one TIEA ratified with another tax haven. This means that the majority of tax havens have used the possibility to sign a TIEA with other

[11] Due to data limitations, only 33 of the 41 tax havens are included. Data of the following eight tax havens are missing: Cyprus, Dominica, Maldives, Malta, Nauru, Niue, Tonga and the US Virgin Islands.

Figure 3: number of TIEAs ratified between tax havens, pre and post threshold, sample data 2000-2013



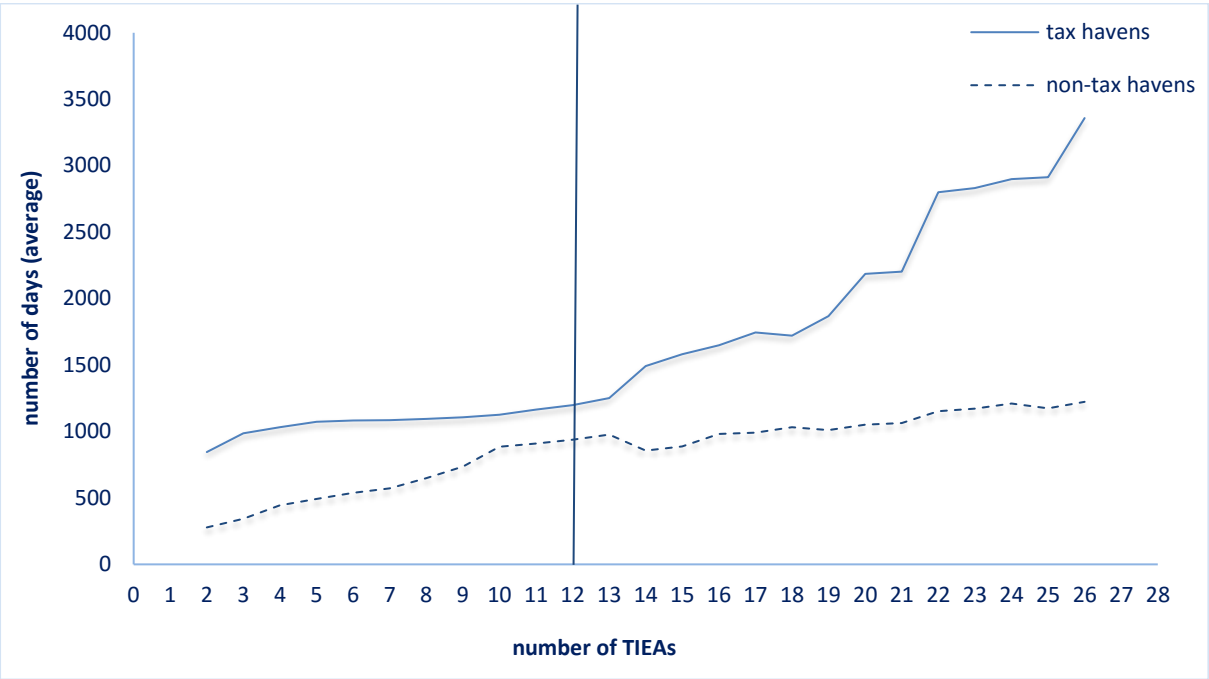
Source: OECD (2016), own illustration

tax havens. This suggests that there are tax havens whose cooperation with the OECD may be only on paper. There are two possible reasons for this: (i) tax havens are simply not willing to provide any relevant tax information in order to protect their independence or (ii) tax havens are not capable to provide such information due to ineffective data collection procedures or a lack of data.

In order to gain some preliminary insight into the question whether (non-British colonial) tax havens have exploited the possibility to sign a TIEA with other tax havens, I have divided the number of TIEAs ratified between tax havens into two categories: the first category consists of the number of TIEAs ratified before reaching the twelve TIEA threshold (the total amount is 32) and the second category consists of the number of TIEAs ratified after reaching the threshold (the total amount is 24). Figure 3 shows that most of the TIEAs between non-British colonial tax havens are ratified before reaching the threshold, indicating that these tax havens might indeed have used the possibility to sign a TIEA with other tax havens in order to reach the threshold more easily. Figure 3 also shows that the number of ratified TIEAs between tax havens before the threshold is small. This might indicate that tax havens are well aware of the fact that the OECD not only look at whether countries have passed the thresholds, but also with which countries the TIEAs are signed. Although the number of the ratified TIEAs between two tax havens as presented in figure 3 is relatively small, it is unknown why the OECD allows tax havens to sign a TIEA with each other. As the Tax Justice Network frequently mentions, the OECD has scored an own embarrassing goal by allowing this to happen.

Furthermore, figure 2 and 3 also show that nearly all tax havens have much more TIEAs ratified than needed. This can be explained by the fact that the OECD also takes into account the willingness of

Figure 4: average number of days to reach the *n*th TIEA, sample data 2000-2013



Source: OECD (2016), own illustration. Note: in the sample data, only four tax havens have ratified more than 20 TIEAs. This means that the average number of days to reach an additional TIEA of all tax havens with >20 TIEAs are based on a small number of observations.

countries to sign additional TIEAs after the threshold has been reached. Therefore, tax havens may have the incentive to keep signing TIEAs even though the threshold has been reached. An interesting question here is whether there is a difference in treaty partners w.r.t TIEAs signed before and after the threshold. Given the fact that tax havens experience more (time and/or political) pressure during the process of signing the first twelve TIEAs, it might be possible that the first twelve TIEAs are signed with less economic linked countries compared to the TIEAs signed after the threshold. I will re-address this question in the empirical part of this paper because it is hard to give any preliminary conclusions now based on descriptive statistics.

However, given the data availability of the ratification dates (day-month-year) of each TIEA signed by tax havens, some insights can be derived for the question whether the process of signing TIEAs differs before and after the threshold. More specifically, I look at the average number of days needed to reach the *n*th TIEA before and after the threshold. The intuition is that if the average number of days to reach a TIEA before the threshold is lower than after the threshold, then tax havens on average have become more reluctant to sign additional TIEAs after the threshold has been reached. Figure 5 shows that this is indeed the case. For comparability reasons, non-tax havens are also included. Before the threshold, the process of signing TIEAs of tax havens and non-tax havens shows a similar trend. After the threshold, the process of signing additional TIEAs of tax havens slows down and clearly exhibit another trend compared to non-tax havens.

3 Literature

This chapter discusses the empirical literature regarding (i) the exchange of tax information between jurisdictions and (ii) the impact of TIEAs on investment decisions of MNEs in tax havens.

3.1 The exchange of tax information between countries

Back in the 90's, governments did not have the incentive to provide tax information to foreign governments because this makes investment in the country less attractive to foreigners if they avoid taxes at home. Governments also were not obligated to engage in tax information sharing. Nevertheless, there were some countries that engaged in tax information sharing. This observation has led some authors to analyze the possible determinants of countries' incentives to engage in tax information exchange. One of the first papers on this issue is Bacchetta and Espinosa (1995). In this paper, the authors focus on an international mobile capital framework with two countries and set up a two-stage game in which governments of both countries first set the degree of information exchange and second the level of taxes. The authors show that, if governments cannot discriminate between residents and non-residents in tax setting, governments may benefit unilaterally by providing tax information in the first stage because this induces the opposite government to set higher tax rates in the second stage (*the strategic effect*).[12] Although the exchange of information also has a negative effect for the information providing government (in terms of lower foreign inward investments), in equilibrium the strategic effect can dominate this negative effect, thereby leading to partial information sharing.

In their next study, Bacchetta and Espinosa (2000) further analyze the incentives of countries to engage in tax information exchange by exploring repeated interaction among governments. The authors develop a theoretical model with two asymmetric countries and repeated interactions among governments.[13] The authors conclude that countries are less likely to engage in tax information exchange when (i) there is a cost of providing information, (ii) there is only one-way capital flows and (iii) there is a reciprocity requirement.

After the studies of Bacchetta and Espinosa (2000), more studies have been conducted to analyze the willingness of countries to engage in information exchange (to name a few: Tanzi and Zee, 2001; Chisik and Davies, 2004 and Keen and Ligthart, 2006, 2007). However, there are four studies that are especially relevant for this paper. These are the studies of Ligthart and Voget (2009), Elsayyad (2012), Bilicka and Fuest (2012) and Braun and Zagler (2015). These studies are relevant for two reasons. First, two of these studies (Ligthart and Voget (2011) and Elsayyad (2012)) have also applied

[12] The foreign partner government can afford doing this because tax evasion by its residents becomes less attractive due to the information exchange.
[13] See chapter 3 for an extensive discussion of the model.

and extended the model of Bacchetta and Espinosa (2000) in order to analyze the willingness of countries to engage in tax information exchange. Second, three of these studies (Elsayyad (2012), Bilicka and Fuest (2012) and Braun and Zagler (2015)) focus on tax information exchange based on TIEAs, rather than (solely) on DTTs.

Ligthart and Voget (2009) study the determinants of tax information exchange between the Dutch government and foreign governments for income tax purposes. They employ data on tax information exchange on request for a sample of 81 countries covering the period 1992-2005. The authors apply the model of Bacchetta and Espinosa (2000) in order to derive some institutional determinants for their empirical analysis. The authors find that the level of the domestic income tax rate, the size of the marginal cost of public funds, and the share of a country's deposits held abroad have a positive effect on a country's willingness to engage in tax information exchange. The authors also find that size and distance are correlated with the information provision by partner countries, which is in line with standard gravity equation models.

Elsayyad (2012) analyzes the main factors determining the signing of a DTT or TIEA as the outcome of a bargaining process between tax havens and high tax countries. The author extends the mechanism of the model of Bacchetta and Espinosa (2000) by including defensive measures which influence the tax haven's business negatively and allow for bargaining over the share of evaded income that can be taxed domestically due to information exchange. The defensive measures of an OECD country are approximated with a dummy variable which equals one if an OECD country and a tax haven had an agreement in force before 1998. The bargaining power is approximated with the difference of GDP between country pairs. By using a cross sectional random intercept ordered probit estimation, the authors show that the main determinants of treaty signing are a tax haven's bargaining power and good governance. The authors conclude that the perceived success of the OECD pressure in 2009 has been mainly due to the active participation of smaller tax havens and that stronger tax havens have remained non-compliant.

Bilicka and Fuest (2012) analyze with which countries tax havens share tax information. The authors address the question whether tax havens have signed TIEAs with countries to which they have strong economic links or whether they have systematically avoided the twelve TIEA-threshold by just signing TIEAs with irrelevant countries. The authors alternatively use three variables to proxy for the economic link between country pairs: (i) trade, (ii) foreign direct investments (FDI) and (iii) portfolio investments. By using a cross sectional probit regression approach and OECD data on 555 TIEAs signed by tax havens in the time period 2008-2011,[14] the authors find empirical evidence that on average tax havens have signed more TIEAs with countries to which they have stronger economic

[14] The authors note that TIEAs are a recent development and that their data spans a short time period. Therefore, the authors do not use a dynamic panel approach.

links in the form of foreign direct investment and trade. Given these results, the authors suggest that tax havens do not systematically undermine tax information exchange by signing TIEAs with irrelevant countries. Furthermore, the authors also analyze whether the process of signing TIEAs slows down after the twelve TIEA-threshold has been reached. Their findings suggest that this may be the case, but the authors emphasize that more time has to pass to see how robust this result really is.

Braun and Zagler (2015) analyze the factors and patterns that drive the conclusion of both DTTs with an information clause and TIEAs. They set up a simple Nash bargaining model to analyze the supply of tax-related information between two countries. Their model predicts that, when a country pair is asymmetric in the sense that one country is the predominant provider of tax information and the other country the dominant receiver, little to no tax information will be exchanged if average costs of acquiring information are non-negligible. The authors therefore suggest that TIEAs and DTTs should include cost and revenue sharing to succeed in retrieving information. By using a dynamic probit approach based on a panel dataset covering the period 2005 to 2013, they present empirical evidence that TIEAs or DTTs with an information clause are more likely to be concluded between an OECD and a developing country when the developing country is compensated through official development assistance (ODA).[15] However, this does not hold when the opposite country is a tax haven. The authors conclude that political pressure might be the driving force behind the willingness of tax havens to engage in tax information exchange.

3.2 The impact of TIEAs on investment decisions of MNEs in tax havens

The empirical literature regarding the impact of TIEAs on investment decisions of MNEs in tax havens is very scarce. To my knowledge, only two papers have analyzed this matter before. These are the papers of Braun and Weichenrieder (2015) and Bennedsen and Zeume (2015).

Braun and Weichenrieder (2015) analyze whether the conclusion of TIEAs is associated with a lower activity of German MNEs in signature countries compared to activities in tax havens and offshore centers that have not signed a TIEA with Germany. The authors apply a difference-in-difference (hereafter: DiD) approach to compare the number of German affiliates before and after a TIEA is signed. The authors take into account the possible endogeneity of the TIEA variable by using an IV-estimation. Within the DiD set-up, the authors instrument the TIEA variable with a distance variable and estimate a two-stage least-square (hereafter: 2SLS) model.[16] The intuition is that distance affects the likelihood of signing a TIEA, but it does not directly impact the change in a firm's investment position beyond the indirect effect via TIEA-formation. The results of Braun and Weichenrieder (2015) show that the ratification of a TIEA reduces the number of German affiliates in tax havens in

[15] Braun and Zagler (2015) use ODA as an -albeit imperfect- proxy for the compensation for signing a treaty.
[16] Not unimportant to mention, the authors do not estimate a linear model in the first stage, but rather a nonlinear probit model. The distance variable is therefore regressed on the probability that a TIEA is formed.

an economically significant way. The authors conclude their paper by suggesting that TIEAs also might have an impact on FDI.

Bennedsen and Zeume (2015) analyze the tax saving- and entrenchment-related motives for tax haven activities by exploiting TIEAs as a natural experiment. TIEAs provide a good experimental setting to test if a managerial entrenchment motive embodied in MNE's activities in tax havens extends beyond the pure tax-saving motive. The authors argue that under the tax-savings motive on its own, TIEAs would have zero or negative impact on firm value. However, if managers also use tax havens to their own benefits and TIEAs do not impact the ability to save taxes, the authors conjecture that the introduction of TIEAs can increase shareholder value. The authors develop a theoretical model to show how the two main motives for establishing a tax haven subsidiary interact. The model predicts that firms with complex tax haven structures will show a more positive (or less negative) effect from the introduction of TIEAs on shareholder value. Based on a hand-collected firm-level subsidiary dataset which includes 17331 publicly listed firms, the authors find that the ratification of TIEAs between home countries and tax havens increases average shareholder value of affected firms and that this effect is stronger for firms with more complex firm structure within tax havens. Furthermore, the authors also find that some firms respond to TIEAs by engaging in 'haven hopping' by moving their subsidiaries from tax havens that entered TIEAs to tax havens that did not. For these cases, the average shareholder value did not change. These results suggest that tax haven subsidiaries are used for entrenchment activities beyond pure tax savings by managers and that increased transparency is endorsed by shareholders.

4 Theory

This chapter deals with the economics of tax information exchange. I apply the game-theory model of Bacchetta and Espinosa (2000) to theoretically describe the willingness of countries to exchange tax information. The game-theory model is a framework with two asymmetric countries and repeated interactions among governments.

The model

Consider a world with only two countries (home country and foreign country)[17], which are potentially asymmetric and small in world markets. Each country has a continuum of representative individuals that live for one period.[18] Upon death individuals are being replaced by a new generation, implying a constant population size. Each individual is endowed with one unit of savings at time *t*, which can be either invested abroad or at home. Either way, the after-tax return of the investment will be used for consumption. The individual also enjoys the use of public goods and his or her utility function is therefore:

$$U(c_t, g_t) = u(c_t) + v(g_t). \quad (1)$$

If the individual eventually decides to invest abroad, then net transaction costs σ^- are involved. These net costs are a continuous and convex function of the amount of foreign investments i_t, which is:

$$\sigma^-(i_t),\ \sigma^{-\prime}(i_t) > 0,\ \sigma^{-\prime\prime}(i_t) > 0, \text{ and } \sigma^-(0) = \sigma^{-\prime}(0) = 0.^{19} \quad (2)$$

The domestic government can perfectly monitor all domestic investments, but can only monitor a (fixed fraction) of the foreign investments i_t made by its own residents. The fraction of the investments that cannot be monitored is denoted by $0 \leq k \leq 1$ for the home country and $0 \leq k^* \leq 1$ for the foreign country. Those who invest abroad are assumed not to report their foreign income to their home government. Without assistance from the foreign government, this means that the domestic government needs to put a lot of effort to identify these taxable incomes. However, the foreign government can transmit a proportion of tax information ξ_t^* on tax evaders' income to the government of the home country. It is assumed that information transmission is costless.

In the home country, domestic investments of individuals are subject to the domestic income tax rate τ_t. If an individual invest abroad, then the income derived from this investment is subject to the non-

[17] All foreign country variables are denoted with an asterisk.

[18] The model is made dynamic in order to explicitly control for the fact that a government has to consider the future reaction of other governments and individuals to its choice of tax rates and behavior concerning information transmission.

[19] However, these net costs do not necessarily have to be positive. While foreign investments bear certain mobility and controlling costs, it may also provide benefits such as diversification of investment risk in the presence of uncertainty.

resident withholding tax t_t^* in the foreign country. However, in accordance with the residence principle, the government of the home country can also fully tax the monitored foreign investment income at rate τ_t. Potential juridical double taxation ($\tau_t + t_t^*$) can thus exist when an individual of the home country derives foreign investment income. To avoid this, the government of the home country gives an a percentage tax credit for the non-resident withholding tax t_t^* paid in the foreign country. Non-monitored investments are only subject to the non-resident withholding tax t_t^*.

Given the abovementioned, the consumption function of a representative individual in period t can be written as:

$$c_t = 1 + (1 - \tau_t)r(1- i_t) + (1 - \tau_t - (1 - a)t_t^*)((1 - k(1 - \xi_t^*))ri_t + (1 - t_t^*)k(1 - \xi_t^*)ri_t - \sigma(i_t) \qquad (3)$$

where r is an exogenous variable indicating the world interest rate, a is the proportion of tax credit given by the government towards monitored foreign investments subject to the non-resident withholding tax t_t^* in the foreign country, $(1 - k(1 - \xi_t^*)$ is the proportion of monitored foreign investment and hence $k(1 - \xi_t^*)$ represents the proportion of tax evasion.

Intuitively, consumption is equal to the initial endowment of one unit, plus the after-tax return of domestic investments $(1 - \tau_t)r(1- i_t)$, plus the after-tax return of foreign monitored investments $(1 - \tau_t - (1 - a)t_t^*)((1 - k(1 - \xi_t^*))ri_t$, plus the after-tax return of foreign non monitored investments $(1 - t_t^*)k(1 - \xi_t^*)ri_t$ and minus the net transaction costs σ. It is assumed that $\tau_t - t_t^* > (1 - k(1 - \xi_t^*)(\tau_t - at_t^*)$ and $\tau_t^* - t_t > (1 - k^*(1 - \xi_t)(\tau_t - at_t)$ so that it pays off for individuals to evade domestic income taxes.[20]

Subsequently, assuming that individuals maximize their utility function given their budget constraint and that public spending per capita g_t is decided by the government, the optimal cross-border investments i_t in period t can then be derived by taking the first derivative of c_t w.r.t. i_t. This yields the following:

$$i_t = [r(\tau_t - t_t^* - (1 - k(1 - \xi_t^*))(\tau_t - t_t^*))]\,\sigma^{-1}. \qquad (4)$$

The equation shows that a higher degree of tax information exchange between governments ($\xi_t^* \uparrow$) leads to a larger effective tax burden for individuals and subsequently lowers the optimal cross-border investments i_t. Therefore, $\frac{\Delta i}{\Delta \xi}$ is negative.

Individuals decide how much to invest abroad after the governments have set their taxes. A second-best world is considered in which the public spending per capita of the government g_t equals the revenues of the distortionary taxes on interest income:

$$g_t = \tau_t r(1- i_t) + t_t ri_t^* + [1-k(1- \xi_t^*)](\tau_t - t_t^*)ri_t\,. \qquad (5)$$

[20] The authors mention that this is the case as the model is highly simplified.

The first term of (4) represents the revenues of taxes levied on the domestic investment incomes of residents, the second term represents the tax revenues of the withholding taxes on non-resident investment incomes and the third term represents the revenues of taxes levied on observed foreign investment incomes derived by residents, where the amount of investment incomes observed depends on the amount of tax information shared by the foreign government. Governments choose their income tax rate, non-resident withholding tax rate and whether or not to share tax information in order to maximize social welfare *W*, which is the present value of the utility of present and future individuals. Therefore, the objective function of the domestic government at time *t* can be written as:

$$max \sum_{i=t}^{\infty} \delta^{i-t} W(\tau_t, t_t, \xi_t) \tag{6}$$

where δ is equal to the discount factor which is assumed to be constant over time.

Bacchetta and Espinosa (2000) analyze the incentives to cooperate on tax information sharing given that a DTT is optimal for both countries. In other words, they examine whether the government of the home and foreign country want to cooperate in sharing tax information by adding an information clause in their DTT. As mentioned above, the domestic and foreign government have to set the level of three variables (τ_t, t_t, ξ_t, τ_t^*, t_t^*, ξ_t^*). Given that DTTs do not consider domestic income tax rates, it is plausible to assume that τ_t is always set non-cooperatively. This implies, in an interior solution, that $\frac{\Delta W}{\Delta \tau} = 0$. This yields the following:

$$u'(c)\frac{\Delta c}{\Delta \tau} + v'(g)\frac{\Delta g}{\Delta \tau} = 0. \tag{7}$$

Subsequently, the marginal rate of substitution between consumption of the private and the publicly provided good (*MRS*) is defined as $v'(g)/u'(c)$. The *MRS* represents the relative valuation of consuming *c* and *g* by a representative individual. Rewriting (7) yields:

$$MRS = -\frac{\Delta c/\Delta \tau}{\Delta g/\Delta \tau}. \tag{8}$$

From (3), (4) and (5) it can be concluded that the *MRS* is smaller than one. This means that taxes are distortionary and it takes more than one unit of the private good to increase the public good by one unit. In this model, public money is scarce and the marginal cost of public funds (MCF) is therefore larger than one.[21]

[21] According to most empirical studies, the MCF exceeds one (see e.g. Triest (1990); Ballard and Fullerton (1991) and Allgood and Snow (1998)). The argument for this is that the public spending of governments is financed with distortionary taxes. However, these studies are based on analyses that assume a representative agent. As Jacobs and De Mooij (2009) argue in their article, the assumption of a representative agent is problematic because the costs of distortionary taxes are only taken into account while the benefits of distortionary taxes are overlooked. Subsequently, this indeed leads to a MCF larger than one. However, it is important to realize that a government uses distortionary taxes for a reason: namely for equity reasons. If a

Regarding the two other (treaty) variables t_t and ξ_t, Bacchetta and Espinosa (2000) first derive the condition in which a DTT is actually formed. They study the DTTs which are sustainable in a repeated game in which governments cooperate until one of them deviates.[22] If deviation occurs, then it will trigger a permanent retaliation to the non-cooperative one shot outcome (denoted as *nc*). For simplicity reasons, the authors focus on those equilibria where governments repeat each period their optimal strategy. This implies that the treaty variables (t and ξ) are constant over time and that the time subscript can be omitted.

A treaty is immune to deviations by the home country if and only if the following condition holds:

$$\frac{W(t,\xi,t*,\xi*)}{1-\delta} \geq W(t^d, \xi^d, t^*, \xi^*) + \frac{\delta W(t(nc),\xi(nc),t*(nc),\xi*(nc))}{1-\delta}. \quad (9)$$

This condition simply states that the present value of welfare obtained when complying with the DTT (left-hand term) has to be larger than the present value of welfare of deviating from the DTT (the two right hand terms). More explicitly, the first right hand term represents the domestic welfare when the government of *H* uses its best response (t^d, ξ^d), given that the foreign government has not reacted yet and therefore complies with the terms of the DTT. The deviation subsequently triggers a permanent retaliation to the non-cooperative one shot outcome; the present value of this outcome is captured by the second right hand term.

By assuming that a DTT is optimal for both countries, it can be concluded that the non-resident withholding tax t is set cooperatively. Therefore, Bacchetta and Espinosa (2000) examine whether countries want to cooperate in ξ and ξ^* given that they cooperate in t and t^*. As in (9), the sustainability conditions for information sharing between countries by adding a tax information clause in a DTT is as follows:

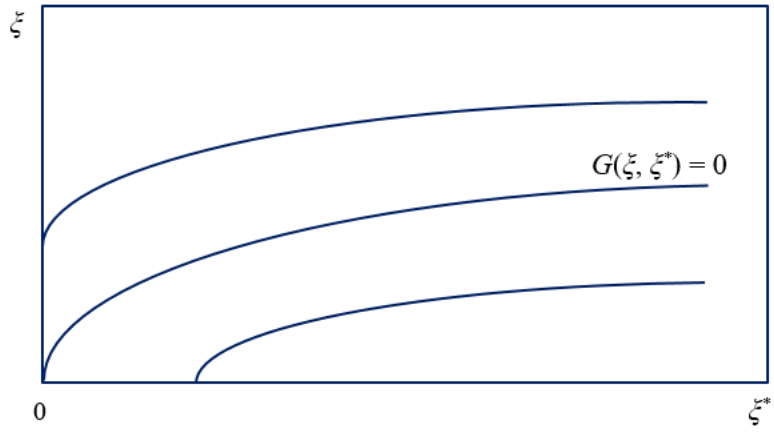
$$\frac{W(\xi,\xi*)}{1-\delta} \geq W(\xi^d, \xi^*) + \frac{\delta W(\xi(nc),\xi*(nc))}{1-\delta}. \quad (10)$$

To keep the analysis simple, it is assumed that if a country deviates from information sharing, then the other country can punish the cheating country by abstaining from information provision as well. Furthermore, one-off gains from deviating from tax information sharing are not possible because it is assumed that the private sector cannot react immediately to a change in ξ before the government does. For example, when the government of the home country deviates from tax information sharing, then it

government does not value equity, then it would simply levy a non-distortionary lump sum tax to finance its spending. Therefore, the benefits of distortionary taxes are the benefits related to an increase in social equity arising from redistributing income from the rich to the poor. But in a world with only representative agents, there is no equity motive for a government to use distortionary taxes since all individuals are assumed to be the same. Therefore, the benefits of distortionary taxes do not play a role in such cases and the MCF subsequently exceeds one.

[22] These types of repeated games are also known as Nash reversion games.

Figure 5: iso-*G* curves of the domestic country



Source: own illustration

will be punished by the foreign government by not providing tax information as well from the following period onwards.[23] If the foreign private sector cannot react immediately to a change in ξ by increasing investment (i^*) to the home country, then there is no direct gain from deviating from tax information sharing because the government of the home country cannot benefit from an increase in foreign investment in the short run.[24] Therefore, the discount factor δ plays no role and (10) can then be rewritten as:

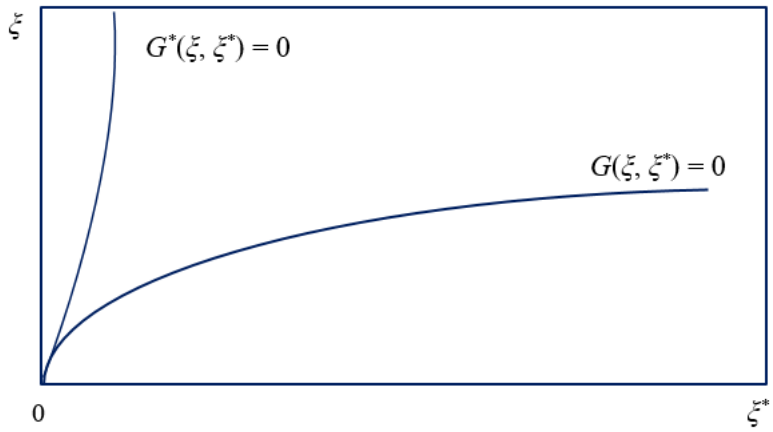
$$W(\xi, \xi^*) \geq W(0, 0). \tag{11}$$

Intuitively, the home country only engages in tax information sharing if it improves the non-cooperative situation $W(0, 0)$. Bacchetta and Espinosa (2000) then subsequently define $G(\xi, \xi^*) = W(\xi, \xi^*) - W(0, 0)$ and $G^*(\xi, \xi^*) = W^*(\xi, \xi^*) - W^*(0, 0)$ to measure the gains from agreeing to (ξ, ξ^*) for respectively the domestic and foreign country. Figure 5 shows the map of iso-*G* indifference curves in the $\xi - \xi^*$ space for the domestic country. These curves are concave under a mild condition on the third derivative of the cost function $\sigma(i)$.[25] The iso-*G* curves for the foreign country can also be depicted in the same $\xi - \xi^*$ space and are convex.

In order to see whether both countries engage in tax information exchange, the position of the indifference curves $G(\xi, \xi^*) = 0$ and $G^*(\xi, \xi^*) = 0$ are only relevant. Both curves crosses the point (0,0) and are depicted in figure 6. In this case, both countries will not engage in tax information exchange. From this figure, it can be easily seen that both countries only engage in tax information exchange when the slope of the indifference curve in (0,0) for the home country is steeper than the slope of the

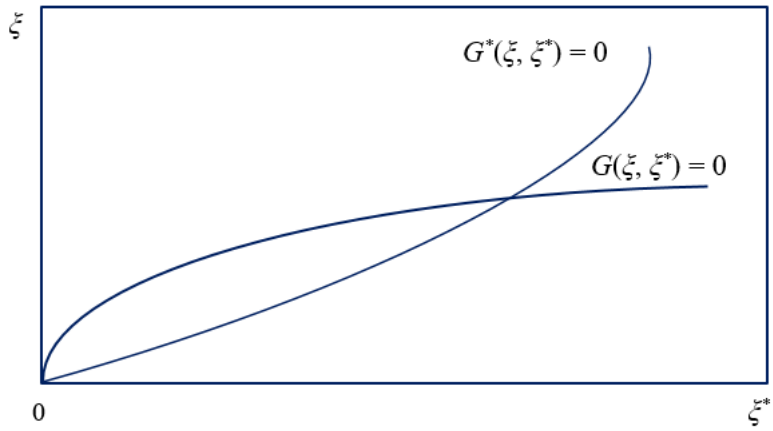
[23] This implies that both countries revert to the one-shot outcome solution forever after.
[24] However, the authors do not mention the possible one-off gain for the cheating government to directly tax the revealed income/wealth of its residents after the cooperative government has shared tax information.
[25] The authors assume that σ'''^{-1} cannot be very large, this implies that $\sigma(i)$ cannot be quadratic.

Figure 6: iso-*G* curves of both countries: no information exchange



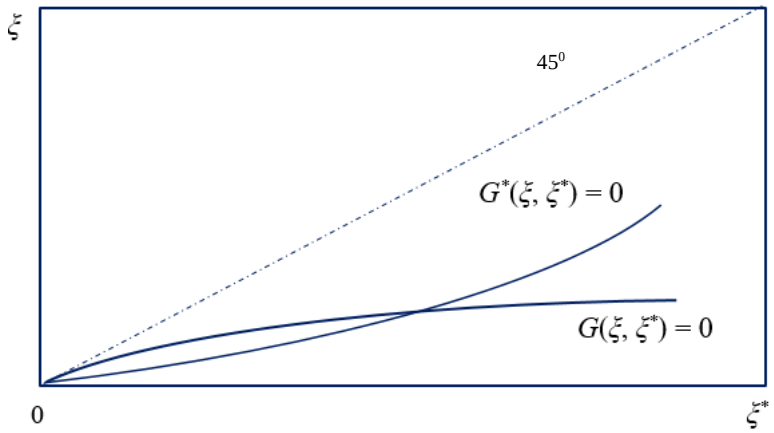
Source: own illustration

Figure 7: iso-*G* curves of the domestic country: information exchange



Source: own illustration

Figure 8: iso-*G* curves of the domestic country: information exchange



Source: own illustration

curve for the foreign country. Figure 7 shows this. Given the setting of this model, it can be derived that both countries are *always* willing to engage in tax information exchange.[26]

To see which factors affect the willingness of the home government to provide tax information, the authors consider the case where the foreign government is willing to share more tax information (i.e. $\xi^* > \xi$). In this context, a sufficient condition for this type of asymmetry is that the slope of the indifference curve of the home country lies below the 45 degree line (see figure 8).[27] This implies:

$$\frac{\Delta g}{\Delta \xi} + \frac{\Delta g}{\Delta \xi *} + MRS \frac{\Delta c}{\Delta \xi *} < 0. \quad (12)$$

If the gains from tax information sharing (the second and third term of (12)) are smaller than the cost from tax information sharing (the first term of (12)), then inequality (12) will hold. In order to see which factors affect the willingness of the home country to engage in tax information exchange, we solve and rewrite (12):

$$t \frac{\Delta i*}{\Delta \xi} - [\tau - (1- k(1 - \xi^*))(t - t^*)] \frac{\Delta i}{\Delta \xi *} + (1-MRS)k(\tau-t^*)i. \quad (13)$$

First, countries with a low non-resident withholding tax rate t and a high income tax rate τ are more willing to engage in tax information exchange. The intuition is as follows: a country will only engage in tax information exchange if the additional revenue a country gets from taxing the foreign investments exceeds the loss of revenue due to the reallocation of non-resident investments to other 'information free' countries. If a country has a low t, then the reallocation loss of sharing tax information can be relatively small and vice versa. If a country has a high τ, then the additional benefits of sharing tax information can be relatively high and vice versa. In most empirical studies, this 'tradeoff' is called the 'tax gap' and it is measured as the difference between the highest income tax rate and the non-resident withholding tax rate of a country. If this tax gap is large, a country will be more willing to engage in tax information exchange since the benefits will likely exceeds the losses.

Second, countries are more willing to engage in tax information exchange when foreign inward investment flows i^* are less sensitive to information exchange compared to domestic outward investment flows i.

Third, according to the third term of (13), countries with a large share of cross-border investments are more willing to engage in tax information exchange. The intuition is as follows: if a country has a

[26] The mathematical proof is provided in Appendix C.

[27] In mathematical terms: $(\frac{\Delta \xi}{\Delta \xi *})_{G(0,0)=0} < 1$.

large share of cross-border investments, then the direct tax base gain of tax information exchange will be relatively large and vice versa.

Fourth, the third term of (13) also shows that the lower the *MRS*, the larger the willingness of a country will be to engage in tax information exchange. Intuitively, when the *MRS* is low, this means that the value of public money is relatively larger than private money and that a government hence derives a larger benefit from the direct tax base gain of receiving tax information compared to a government in a country with a high *MRS*. However, it is important to note that the *MRS* normally does not affect the willingness of information exchange directly. The *MRS* does only matter in cases where information exchange strikes a balance between extra tax revenues and extra efficiency costs. In this model, the information exchange causes extra efficiency costs in terms of lower investments due to the higher effective tax rate ($\frac{\Delta c}{\Delta \xi *}$ <0). Countries with a low *MRS* are therefore more willing to engage in tax information exchange in order to generate more tax revenues.

Fifth, the willingness of tax information sharing also depends on the countries' ability to monitor foreign investments. If a country has a high ability to monitor the foreign investments made by its own residents (a small *k*), the willingness to engage in tax information sharing of such a country is relatively small because it can then obtain most of the information by itself.

Bacchetta and Espinosa (2000) also mention that country size plays a role in determining the willingness of tax information sharing. According to (13), if the country size tends to zero, the last two terms also tend to zero. As the first term is negative ($\frac{\Delta i*}{\Delta \xi} < 0$), the condition of (12) holds as the home country becomes smaller. Therefore, small countries are less likely to engage in tax information exchange compared to large countries. The intuition is that the small countries' tax base of residents is small compared to foreign investments.

5 Hypotheses

In the preceding chapters, the empirical literature and theory regarding tax information exchange and the impact of TIEAs on investment decisions of MNEs in tax havens are discussed. In this chapter, I derive some testable hypotheses based on these discussions.

5.1 Hypothesis 1

The first part of this paper concerns the question with which countries tax havens ratify TIEAs. Although the model of Bacchetta and Espinosa (2000) discusses the cooperation on information exchange by adding an additional clause in a DTT, the authors note that the theoretical implications of their model are also valid for other forms of tax information exchange. If I apply these implications to the willingness of tax havens to engage in tax information exchange by signing a TIEA, than I expect that this willingness will be low because in general (i) the tax gap of tax havens is low, (ii) the foreign inward investment flows into tax havens are more sensitive to information exchange compared to its domestic outward flows, (iii) the cross-border investments of tax havens are small and (iv) tax havens are small (overseas) countries.

However, due to the formal commitments to comply with the standards of the OECD, tax havens are forced to sign at least twelve TIEAs. This means that tax havens have to engage in tax information exchange. The next question is then: with whom do tax havens then engage in tax information exchange? The model of Bacchetta and Espinosa (2000) does not take the formal commitment of tax information exchange into account, but the implications of the model can provide me some insights into this matter. Given that the willingness of tax havens to engage in tax information is low, I therefore expect that tax havens will try to comply the minimum standard of twelve TIEAs by just signing TIEAs with countries with whom they are less economic linked. This leads to the first hypothesis of this paper:

Hypothesis 1: *tax havens ratify TIEAs with less economic linked countries.*

5.2 Hypothesis 2

The second part of this paper concerns the impact of TIEAs on FDI of MNEs in tax havens. However, no appropriate theoretical model could be found for this matter. But based on the discussed empirical literature in chapter 3, I can still derive some preliminary insights into this matter.

The studies of section 3.2 show that TIEAs not only can affect investment decisions of individuals, but also investment decisions of MNEs in terms of decreasing amount of subsidiaries. Although these studies offer no special attention to the impact of TIEAs on FDI, it is not implausible to hypothesize

that if a tax haven has ratified a TIEA with an OECD country, the FDI inflow of that OECD country to the tax haven will decrease. The second hypothesis of this paper is therefore:

Hypothesis 2: *if a tax haven ratifies a TIEA with an OECD country, then this will have a negative influence on the FDI inflow from the OECD country to the tax haven.*

6 Data

This chapter discusses the relevant data used in this paper. In the first section, the data collection procedure and the various data sources are discussed.[28] In the second section, summary statistics are presented.

6.1 Data collection procedure[29]

The data sample is an unbalanced panel consisting of 19,040 observations and it is formed by 74 countries (34 OECD countries and 40 tax havens) from 2000 to 2013. The dataset contains information on bilateral FDI stocks, bilateral trade (export), country types (OECD or tax haven), bilateral treaties, geographical elements, governance elements, (withholding) tax rates and several other macro-economic factors. These data come from different data sources and are merged together into one dataset.[30] It is important to note that the observations are in pairs. This means that each observation consists of a parent and a host country.[31] The data sample is constructed in such a way that the parent country is always an OECD country and the host country is always a tax haven.

Data on bilateral FDI stocks are collected from the OECD. I use FDI stocks over flows for various reasons. The European Central Bank (2013) has performed a study whether FDI flow or stock variables perform better in empirical settings. Overall, they find that FDI stock is a decent proxy for MNEs' activities, but this also depends on the research question. FDI stocks perform better in cross-country studies relatively to panel studies, because FDI stocks are relatively persistent and will hence need more time to completely adjust. FDI flows are in contrary more appropriate when it comes to empirical studies that want to evaluate quick effects of a policy change, especially when the time dimension of the panel is short and the FDI stock have not completely responded yet to the policy change. Using a static model combined with fixed effects is in this case appropriate. However, FDI flows are very volatile. This means that flow variables are particularly a weak measure for MNEs real economic activities since flow variables will overreact as a first impulse after the policy change. Therefore, FDI stocks are preferred over FDI flows in this paper.

Data on bilateral trade flows are collected from the International Monetary Fund (hereafter: IMF). The Direction of Trade (hereafter: DOT) bulk database of the IMF provides data on the country and area distribution of countries' exports and imports by their partners. For the empirical analysis, the natural

[28] The links to the data sources are provided in table B1 of the Appendix.
[29] The whole data collection procedure is also documented in a Stata do-file. This file can be provided upon request.
[30] The data of the different sources are merged together based on the country codes of the country pair and the year. The country codes are based on the Codes Country list as provided by the OECD.
[31] Variables of the parent country are denoted with '_her'. Variables of the host country are denoted with '_bes'. For example, *GDP_her* indicates the gross domestic product of the parent country.

logarithm of bilateral export has been used (*ln_trade*) as a proxy for the economic link between countries.

Data on the type of country are collected from the OECD. For the empirical analysis, it is crucial to know whether a country is a tax haven, a member of the OECD or none of both. As stated earlier, this paper defines a tax haven as a country that is on the black list of tax havens as classified by the OECD in 2000. Subsequently, the OECD also provides a list of its members. Based on these data, I have constructed two variables: (i) a dummy indicating whether a country is a tax haven (*taxh*) and (ii) a dummy indicating whether a country is an OECD country (*OECD*).

Data on bilateral treaties can be separated into TIEAs and DTTs. Data on TIEAs are collected from the information of TIEAs as provided on the OECD website. These data include information about which country pair has a TIEA ratified and the moment of ratification (day-month-year). Based on these data, I have constructed three explanatory variables: (i) a dummy variable indicating whether a country pair has a TIEA ratified (*dum_TIEA*), (ii) a variable to capture the amount of TIEAs of a country (*sum_TIEA*) and (iii) a dummy variable indicating whether a country has passed the twelve TIEA-threshold (*TIEA_tres*). The data for the DTTs have been taken from the United Nation Conference on Trade and Investment (hereafter: UNCTAD) database. Based on these data, a dummy variable has been constructed to indicate whether a country pair has a DTT ratified (*dum_DTT*).

Data on geographical elements are taken from the CEPII database. CEPII provides a 'square' gravity dataset for all world country pairs. From this dataset, I have used the following two variables: (i) the log of distance between the country pair (*ln_dist*) and (ii) a dummy indicating whether there is a colonial link between countries (*colony*). Due to multicollinearity of the distance and GDP variable, only one of two variables is used during the analysis.

Data on governance elements are collected from the Worldwide Governance Indicators database (hereafter: WGI). This database provides six governance indicators of 216 countries from 1996-2013. The indicators are as follows: (i) voice and accountability, (ii) political stability and absence of violence, (iii) government effectiveness, (iv) regulatory quality, (v) rule of law and (vi) level of corruption. Interpolation has been applied to the year 2001 because of missing observations. Due to multicollinearity reasons, only the level of corruption is used in the empirical analysis (*corrupt*).

Data on tax rates consist of personal income taxes, corporate income taxes and withholding taxes on interest income. Data on personal and corporate income taxes for OECD countries in the period 2000-2013 are available in the OECD database, but unfortunately not for tax havens. Data on tax rates of tax havens are only available for the year 2013 and are retrieved from the Trading Economics database. For the analysis, it is assumed that the tax rates of tax havens are constant over time. Data on withholding taxes on interest income are from Deloitte's Double Tax Treaty database and are only

available for the year 2013. For the analysis, it is assumed that the withholding taxes on interest income are also constant over time. This seems a reasonable assumption because renegotiation of DTTs does not often take place, which leaves the withholding tax rates in DTTs constant over time. For years in which there is no DTT, I assume that the withholding tax rates of the parent countries apply. Based on these data, three variables have been constructed: (i) the highest personal income tax rate minus the withholding tax rate on interest income (*taxgap*), (ii) the squared difference between the two countries' corporate tax rate (*corptax_diffsq*) and (iii) the squared difference between the two countries' personal income tax rate (*pit_diffsq*).

Data on other macro-economic factors (GDP, GDP per capita and inflation) are retrieved from World Bank's World Development Indicators. Based on these data, I have generated two variables: (i) the natural logarithm of the sum of the country pairs' real GDP (*ln_sum_gdp*) and (ii) the natural logarithm of the squared difference between the two countries' real GDP (*ln_gdp_diffsq*). These variables come from the standard gravity equations that are widely used in the empirical literature to explain bilateral FDI flows. The inflation data are used to take inflation into account by deflating the FDI and trade variables to prices of the year 2000 (in US dollars).

6.2 Summary statistics

Table 1 presents the summary statistics of the variables used in the empirical analysis. Next to the usual statistics (amount of observations, mean, standard deviation, minimum and maximum), I also have included statistics regarding the variation of each variable. These are the overall variation, between variation and within variation. The within variation is the variation due to differences within group means (i.e. due to time) and the between variation is the variation due to differences among the group means (cross sectional differences). These statistics are particular useful to determine whether a cross sectional or panel data analysis (fixed and random effects models) is appropriate. A fixed effects model for example does not work well with data for which within variation is minimal or for slow changing variables over time. I will discuss this more in depth in the next chapter (methodology).

Table 1: summary statistics, 2000-2013

Variable	Obs	Mean	SD	Min	Max	Overall var.[32]	Between var.	Within var.
FDI (billion USD)	9,601	775	8,951	-4,416	304,524	8,951	7,433	5,319
ln_FDI	9,499	1.21	2.37	-3.28[33]	12.36	2.37	2.10	1.16
ln_trade	10,232	14.81	3.13	2.89	23.46	3.13	3.17	1.19
dum_TIEA	19,040	0.08	0.27	0	1	0.27	0.13	0.23
sum_TIEA_bes	15,708	15.24	6.01	1	26	6.91	6.01	0
TIEA_thres_bes	19,040	0.63	0.48	0	1	0.48	0.48	0
dum_DTT	19,040	0.09	0.28	0	1	0.28	0.28	0.05
ln_dist	16,660	8.88	0.69	5.44	9.88	0.69	0.69	0
corrupt_her	19,040	-1.32	0.81	-2.59	0.71	0.81	0.80	0.16
corrupt_bes	14,688	-0.49	0.72	-1.85	1.36	0.72	0.68	0.24
corptax_diffsq	13,804	311.47	356.30	0	1780.84	356.30	336.37	117.94
taxgap_her	18,483	23.70	18.72	-29.22	60	18.72	18.32	3.88
taxgap_bes	10,472	10.37	15.30	-14.5	59	15.30	15.30	0.39
PIT_her	19,040	43.10	9.14	15	62.28	9.14	8.33	3.78
PIT_bes	15,232	18.36	15.48	0	59	15.48	15.49	0
CIT_her	19,040	25.96	6.79	8.5	42.2	6.79	5.87	3.40
CIT_bes	13,804	14.84	11.91	0	33	11.91	11.92	0
ln_gdp_diffsq	12,410	53.08	3.28	36.75	60.90	3.28	3.20	0.71
ln_sum_gdp	12,410	26.61	1.53	22.48	30.45	1.53	1.50	0.33

Source: own illustration

[32] Note that the overall variance equals the standard deviation.

[33] I am well aware of the presence of the negative values of *FDI*. In the empirical analysis, all missing and negative values of FDI are dropped.

7 Methodology

This chapter discusses the applied econometrics. To test the first hypothesis (i.e. whether tax havens ratify TIEAs with less economic linked countries), a cross sectional probit model is used. To test the second hypothesis (i.e. the impact of TIEAs on FDI to tax havens), propensity score matching is applied. Below, both methods are discussed more in depth.

7.1 Cross sectional probit model

7.1.1 The econometric model

To test the first hypothesis, I estimate a model where the dependent variable is a dummy which takes the value 1 if there is a TIEA ratified between an OECD country *i* and a tax haven *j*, and 0 otherwise. However, the dependent variable is binary (i.e. it only has two values (0, 1)), which means that ordinary least squares (hereafter: OLS) estimators of the regression parameters are biased and inconsistent. By applying OLS (in this case called linear probability modelling), the usual error term assumptions cannot hold anymore. The dependent variable only takes two values, implying that the error term also takes only two values, so that the usual 'bell-shaped' curve describing the distribution of errors does not hold. This means that the errors are not homoscedastic, so the usual formula for the variance of the OLS estimator is incorrect. Furthermore, another problem associated with the linear probability model is that predicted values can fall outside the (0, 1) interval, meaning that their interpretation as probabilities does not make sense. This also means that some of the estimated variances of the error term may be negative (Hill et al, 2012).

To overcome these problems, I apply a nonlinear maximum likelihood estimation procedure called probit. The two types of observations that we observe (no TIEA ratified=0, TIEA ratified=1) are then generated by the latent variable $TIEA_{ij}^{*}$ crossing the zero threshold or not crossing that threshold. The probability that a TIEA is ratified can be defined as:

$$\mathrm{P}(TIEA_{ij}) = \begin{cases} 1 \; if \; TIEA\mathrm{ij} * \geq 0 \\ 0 \; if \; TIEA\mathrm{ij} * < 0 \end{cases} \tag{14}$$

where the latent variable $TIEA_{ij}^{*}$ is defined as:

$$TIEA_{ij}^{*} = \alpha + \beta ECLINK_{ij} + \gamma X_{ij} + \theta X_i + \eta X_j + \varepsilon_{ij} \tag{15}$$

where $ECLINK_{ij}$ captures the economic link between an OECD country and a tax haven, X_{ij} is the vector of the characteristics of the country pair, X_i is the vector of characteristics of an OECD country, X_j is the vector of characteristics of a tax haven, α is the intercept and ε_{ij} is the error term.

For the empirical analysis, I use the natural logarithm of exports from an OECD country into a tax haven (*ln_trade*) as a proxy for the economic link. This choice is based on the belief that *ln_trade* is

the most exogenous variable, given the data availability. I also have considered to use the natural logarithm of FDI (*ln_FDI)* as a proxy for the economic link, but in that case specification (15) suffers from endogeneity. This problem arises because FDI captures tax avoidance behavior of MNEs, whereas trade does not. This implies that a TIEA is more likely to be ratified if FDI is substantial. However, at the same time a TIEA may also have an impact on FDI (see hypothesis 2). In order to avoid this reverse causality problem, I have only chosen *ln_trade* as a proxy for the economic link. Based on the model of Bacchetta and Espinosa (2000), I expect that the coefficient of this variable is negative (i.e. the first hypothesis holds).

The choice of the other explanatory variables is primarily based on the theoretical model of Bacchetta and Espinosa (2000) and the discussed literature. First, I include the *taxgap* variables of the OECD countries (*taxgap_her*) and tax havens (*taxgap_bes*) and the squared difference between the two countries' corporate tax rate (*corptax_diffsq*) to control for countries' tax motives to conclude TIEAs. Based on the model of Bacchetta and Espinosa (2000), I expect that the coefficient of *taxgap_her* and *corptax_diffsq* is positive. However, *taxgap_bes* might be insignificant because tax havens do not have tax motives to engage in tax information exchange.

Second, I include a dummy variable that equals 1 if a country pair has a DTT ratified (*dum_DTT*) and two variables capturing the level of corruption of OECD countries (*corrupt_her*) and tax havens (*corrupt_bes*). Given that DTTs already have an information sharing clause (article 26 of the treaty), I expect that the coefficient sign of this variable is negative. However, most OECD countries do not have DTTs ratified with tax havens, so this dummy might also be insignificant. For the variables capturing the level of corruption, I expect that the sign of the coefficients is negative because it is reasonable to assume that it is not attractive to sign a TIEA with a country that has a low quality of institutional governance.

Third, I include a dummy variable that equals 1 if a tax haven has more than twelve TIEAs ratified (*TIEA_thres_bes*) and a variable capturing the sum of TIEAs of tax havens (*sum_TIEA_bes*). As mentioned earlier in chapter 2, an interesting question is whether there is a difference in treaty partners w.r.t TIEAs signed before and after the threshold. Given the fact that tax havens experience more (time and/or political) pressure during the process of signing the first twelve TIEAs, it might be possible that the first twelve TIEAs are signed with more less economic linked countries compared to TIEAs signed after the threshold. In order to analyze this empirically, I interact the economic link variable with the threshold variable (*ln_trade*TIEA_thres_bes*). In another specification, I also interact the economic link variable with the sum of TIEAs of tax havens (*ln_trade*sum_TIEA_bes*).

Finally, I include gravity factors (*ln_sum_gdp* and *ln_gdp_diffsq*) in the probit model following Elsayyad (2023), Bilicka and Fuest (2012), Braun and Zagler (2015).

The baseline cross sectional probit model can then be written as:

$$P(TIEA_{ij}) = \begin{cases} 1 \; if \; TIEAij* \geq 0 \\ 0 \; if \; TIEAij* < 0 \end{cases} \quad (16)$$

where the latent variable $TIEA_{ij}^{*}$ is defined as:

$$TIEA_{ij}^{*} = \alpha_{ij} + \beta_1 ln\_trade_{ij} + \beta_2 ln\_trade_{ij} * TIEA\_thres\_bes_j + \gamma_1 ln\_sum\_gdp_{ij} + \gamma_2 ln\_gdp\_diffsq_{ij} + \gamma_3 dum\_DTT_{ij} + \theta_1 taxgap\_her_i + \theta_2 corrupt\_her_i + \eta_1 taxgap\_bes_j + \eta_2 corrupt\_bes_j + \eta_3 sum\_TIEA\_bes_j + \eta_4 TIEA\_thres\_bes_j + \varepsilon_{ij} \quad (17)$$

7.1.2 Panel versus cross section probit model

In order to analyze data correctly, it is crucial to know and apply the appropriate model during the empirical analysis. For my research, I have chosen a cross sectional rather than a panel probit model for the following reasons:

First, as mentioned in section 6.2, I have applied the '*xtsum*' command in Stata to look at the within and between variation of the variables.[34] The between variation is larger than the within variation for all explanatory variables. Furthermore, 5/18 variables have a zero within variation (and hence are time-invariant). This shows that the cross-sectional dimension of the data is much larger, which subsequently means that a cross sectional analysis might be more appropriate to analyze the data. A panel model with fixed effects for example will not work well in this case because the fixed effects models assume that unobserved characteristics are time-invariant so that any changes in the dependent variable must be due to influences of the time-variant explanatory variables. But if the explanatory variables are also nearly time-invariant (i.e. small within variation), then there is no use to apply a fixed effects model.

Second, although a cross sectional probit model is more appropriate, I also have estimated a panel probit model.[35] The estimation results show that the coefficients of the year dummies are relatively large compared to the coefficients of the explanatory variables. Furthermore, the coefficients of the year dummies are also increasing upwards step by step. This should not be the case if the year dummies are relevant for the analysis.

Third, given that most of the TIEAs are signed in the period 2009-2010, there is no meaningful longitudinal variation in this measure from a statistical perspective. Besides, I am interested *with*

[34] See section 6.2, table 1, page 30.
[35] See table B3 of the Appendix.

whom tax havens ratify TIEAs and not *when* TIEAs will be ratified. Therefore, time should not play a role (or at most a minimum role) in the empirical analysis.

Given the abovementioned reasons, I believe that a cross sectional probit model is more appropriate to test the first hypothesis of this paper.

7.1.3 Probit model interpretation

In general, we cannot interpret the coefficients directly from the output of a probit regression. We need to interpret the marginal effects of the regressors. This means that we are interested in the effect of a one-unit change in x on the (conditional) probability of the outcome variable while holding all other regressors constant. This is different from OLS where we are directly interpreting the estimated coefficients. This is possible because in the linear regression case, the regression coefficients are the marginal effects. This can be shown as follows:

In simple OLS regressions, the regression function can be defined as:

$$E\,(\,y|x\,) = \beta_1 + \beta_2 x \tag{18}$$

In order to derive the marginal effects, we take the derivative of (16) w.r.t. x:

$$\frac{\triangle E\,(y|x)}{\triangle x} = \beta_2 \tag{19}$$

We see that the derived marginal effect is exactly the same as the coefficient of x in (18).

For the probit regression, this is not the case. In statistics, a probit model that expresses the probability P that y takes the value 1 can be defined as:

$$P(\,y{=}1|\,x\,) = \Phi(\beta_1 + \beta_2 x) \tag{20}$$

where Φ is the cumulative distribution function that is also used to compute normal probabilities. In this model we can examine the marginal effect of a one-unit change in x on the probability that $y = 1$ by taking the derivative of P w.r.t. x:

$$\frac{\triangle P\,(y{=}1|x)}{\triangle x} = \frac{\triangle \Phi\,(\beta 1 + \beta 2x)}{\triangle(\beta 1 + \beta 2x)} \frac{\triangle(\beta 1 + \beta 2x)}{\triangle x} = \phi(\beta_1 + \beta_2 x)\,\beta_2 \tag{21}$$

where ϕ is the standard normal probability density function evaluated at $(\beta_1 + \beta_2 x)$. From (21), we see that the regression coefficient of the probit model is not the marginal effect, because $\phi(\beta_1 + \beta_2 x)\,\beta_2 \neq \beta_2$. Therefore, there is an additional step of computation needed in the probit regression to obtain the marginal effects.

Econometric software provide various methods to compute marginal effects once the probit regression fit is computed. However, rather than evaluating the marginal effect of an explanatory variable while

holding the other variables constant at the zero value, researchers often evaluate the marginal effect 'at the means' (hereafter: MEMs). MEMs basically tell us the marginal effect of an independent variable (say X_1) on the dependent variable (say Y), while holding the other independent variables (say X_2, $X_{3.....}X_n$) constant at their mean values. To interpret MEMs, it is therefore necessary to know the mean values of the independent variables of the data sample that is used during the analysis. MEMs are widely used by researchers because they are easy to interpret. Even though I am more interested in the sign and statistical significance rather than the substantive significance of the results during the analysis, I also apply MEMs for illustrative purposes.

7.2 Propensity Score Matching

7.2.1 Propensity score matching procedure

There are various empirical methods to analyze the effects of a new ratified treaty on FDI. In the empirical literature, several studies have analyzed the effects of DTTs on FDI by using a propensity score matching (hereafter: PSM) approach (see Egger et al. (2006), Lejour (2014) and Lejour and Salfi (2015)). The PSM approach analyses the effects of a new treaty on FDI by comparing the FDI stocks of country pairs which have ratified a new treaty (the treatment group) with those which have not (the control group). PSM can help strengthen causal arguments in quasi-experimental studies by matching observations of the treated with observations of the control group based on propensity scores which are calculated based on the characteristics of the observations. PSM also isolates time-invariant unobserved effects (Lejour, 2014). Furthermore, by collapsing the panel observations into two observations before and after the treatment for each country pair, problems with serial correlation which could have a downward bias on the standard errors of the estimators in panel regressions are also avoided (Bertand et al, 2004).

To analyze the effects of new ratified TIEAs on FDI stocks to tax havens, I also apply a PSM approach. I compare the levels of bilateral FDI stocks two years before and two years after a TIEA is signed (*d22_FDI*) and analyze whether there is a statistical significant difference in the change in FDI stocks between the treatment and control group. I restrict the initial data sample by dropping each observation that reports a missing or a negative value for *d22_FDI*. Given the lack of FDI data for tax havens, this restriction unfortunately leads to a low amount of observations for the PSM analysis: 40 treated and 797 controlled observations. The matches are based on the following characteristics: (i) the natural logarithm of the sum of the country pairs' real GDP (*ln_sum_gdp*), (ii) the natural logarithm of the squared difference between the two countries' real GDP (*ln_gdp_diffsq*) and (iii) the double tax treaty dummy (*dum_DTT*). For robustness reasons, I also include the log of distance (*ln_dist*), corruption variables (*corrupt*) and tax variables (*PIT* and *CIT*) as matching characteristics.

The matching is made one by one (a so called 1-1 matching). This means that one of the observations in the control group has to match as closely as possible one observation in the treatment group. As a robustness check, I also apply a 5-1 and 9-1 matching. I conduct PSM in Stata[36] and I choose for the "nearest neighbor method". This method matches a country pair with a TIEA to a country pair with no TIEA that is closest in terms of a distance measure.[37] However, a caveat of this method is that it is not possible to conclude whether TIEAs actually reduce the total amount of FDI outflow of the OECD country or that these agreements just simply change the route of FDI to other 'information free' tax havens. Another caveat of this method is that I cannot control for the possibility that the FDI that leaves the treatment group moves to the control group. This potential problem of haven hopping within the data sample can bias the coefficients of interest.

7.2.2 Endogeneity of the treatment variable

This section addresses the potential endogeneity problem which may occur in the PSM analysis. As mentioned before, the endogeneity problem may arise because FDI captures tax avoidance behavior of MNEs which implies that a TIEA is more likely to be ratified if FDI is substantial. However, at the same time a TIEA may also have an impact on FDI. In other words: the explanatory variable (*dum_TIEA*) may be correlated with the regression error term.

In practice, researchers often apply an instrumental variable (hereafter: IV) approach to circumvent this problem. To carry out such an approach, an instrumental variable is required that does not belong in the initial specification itself and that is correlated with the endogenous variable, but that is uncorrelated with the error term. However, such variables are very difficult to obtain. Given the data availability of this research, an IV approach is not feasible. As a second best alternative, I simulate the existence of a TIEA by forecasting the probabilities that a TIEA is ratified for all country pairs by using the probit model as discussed in section 7.1. This can be done in Stata by using the '*predict*' command after the probit model is estimated. Subsequently, I replace the obtained nonlinear predicted/fitted values with 1 if these values exceed 0.30 and 0 otherwise.[38] At last, I re-run the PSM procedure by using the forecasted TIEA values (*pr(dum_TIEA)*) as the (more) exogenous treatment variable to see whether the initial results still hold.

[36] The Stata command '*teffects psmatch*' is applied.
[37] During the PSM analysis, I choose logit as the distance measure.
[38] Please note that this method is imperfect. A cut-off point of 0.50 would be more ideal. The cut-off point of 0.30 is chosen to get at least the same amount of treatment observations as in the initial PSM set-up.

8 Analysis

8.1 Results probit analysis

This section presents the results of the probit analysis. The following hypotheses are tested:

H_0: $\beta_1 < 0$ (i.e. the larger the economic link, the lower the probability that a TIEA exists between country pairs)

H_a: $\beta_1 > 0$ (i.e. the larger the economic link, the larger the probability that a TIEA exists between country pairs)

8.1.1 Baseline results

Table 2: Benchmark results baseline model

Dependent variable: dum_TIEA	[1] *+ tax variables*	[2] *+ corruption variables*	[3] *+ gravity factors*	[4] *+ dum_DTT*	[5]	[6]
ln_trade	0.0035***	-0.0001	-0.0123***	-0.0121***	-0.0110***	-0.0156***
	(0.0013)	(0.0013)	(0.0018)	(0.0018)	(0.0040)	(0.0038)
*ln_trade*TIEA_thres_bes*					0.0038	
					(0.0040)	
*ln_trade*sum_TIEA_bes*						0.0004**
						(0.0002)
taxgap_her	0.0013***	0.0005**	0.0006***	0.0006***	0.0007***	0.0007***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
taxgap_bes	0.0001	-0.0008***	-0.0013***	-0.0013***	-0.0009***	-0.0009***
	(0.0002)	(0.0002)	(0.0002)	(0.0003)	(0.0002)	(0.0002)
corptax_diffsq	$2.27*10^{-5}$**	$3.42*10^{-6}$	$1.29*10^{-5}$	$1.26*10^{-5}$	$-2.83*10^{-6}$	$-7.11*10^{-6}$
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
corrupt_her		-0.0469***	-0.0522***	-0.0524***	-0.0459***	-0.0458***
		(0.0060)	(0.0062)	(0.0064)	(0.0063)	(0.0062)
corrupt_bes		-0.0971***	-0.1016***	-0.1016***	-0.0698***	-0.0683***
		(0.0087)	(0.0089)	(0.0089)	(0.0121)	(0.0119)
ln_sum_gdp			0.0612***	0.0612***	0.0667***	0.0655***
			(0.0153)	(0.0153)	(0.0155)	(0.0146)
ln_gdp_diffsq			-0.0124*	-0.0124*	-0.0179**	-0.0173***
			(0.0068)	(0.0068)	(0.0071)	(0.0066)
dum_DTT				-0.0011	0.0121	0.0130
				(0.0110)	(0.0112)	(0.0113)
sum_TIEA_bes					0.0019	-0.0042
					(0.0014)	(0.0029)
TIEA_thres_bes					-0.0028	0.0453**
					(0.0681)	(0.0231)
observations	5645	5213	5155	5155	5155	5155
pseudo R^2	0.018	0.087	0.129	0.129	0.149	0.151

Note: ***p<0.01, **p<0.05, *p<0.1. Standard errors in parentheses. The reported coefficients are marginal effects. Coefficient of interest (*ln_trade*) is underscored. See table B4 of the Appendix for the mean values of the restricted sample.

Table 2 presents the results of the baseline probit model. For illustrative purposes, I also show the step-by-step estimation procedure of the baseline cross sectional probit model (denoted as model [5]). Next to the baseline model, I also have estimated a model in which the variable of interest (*ln_trade*) is interacted with the *sum_TIEA_bes* variable (denoted as model [6]). Due to numerous missing variables, the initial data sample consisting of 19,040 observations is now restricted to 5,155 observations. It is important to note that the mean values as presented in section 6.2 come from the initial data sample. To interpret the MEMs correctly, I refer to the mean values of the restricted sample as presented in table B4 of the Appendix.

The baseline regression results of both models show that *ln_trade* has a statistical significant negative impact on the probability that a TIEA exists between an OECD country and a tax haven. The estimated MEMs are -1.10 and -1.56 percentage points, respectively. This finding can be interpreted

as an indicator that tax havens indeed have tried to undermine the threshold of twelve TIEAs by fulfilling the standards just through signing TIEAs with non-economic linked countries. The next question is whether there is a difference in treaty partners w.r.t TIEAs signed before and after the threshold. The interaction term *ln_trade*sum_TIEA_bes* of model 2 has a statistical significant positive effect, thereby suggesting that the more TIEAs a tax haven has, the more likely that it ratifies TIEAs with economic linked countries. However, I cannot show whether this effect only occurs after the twelve TIEA threshold as the interaction term *ln_trade*TIEA_thres_bes* of model 1 is not statistical significant.

The tax gap variables are statistical significant in both models. The coefficients of the tax gap of the OECD countries (*taxgap_her*) are positive, which means that the larger the difference between the top income tax rates and the interest withholding tax rates, the larger the probability that a TIEA is ratified for these countries. This finding is in line with the implications of the theoretical model of Bacchetta and Espinosa (2000). However, for tax havens this is not the case as the coefficients of the tax gap variables for these countries are negative.

The coefficient of the variable capturing the squared difference of the corporate tax rates between an OECD country and a tax haven (*corptax_diffsq*) is not statistical significant and therefore it cannot be interpreted. In further (robustness) analyses, this variable is dropped.

The coefficient of the corruption variables are statistical significant and negative. The rationale for this finding is that countries do not want to ratify TIEAs (or other kinds of treaties) with countries that have a high level of corruption.

The sum and squared differences of GDP (*ln_sum_gdp* and *ln_gdp_diffsq*) also show a significant impact on the existence of a TIEA between an OECD country and tax haven. The positive sign of the coefficient of the sum of GDP indicates that a TIEA is likely to be ratified between wealthy country pairs. The negative sign of the coefficient of the difference of GDP indicates that TIEAs are likely ratified between countries with the same economic size.

The DTT dummy is not statistical significant and therefore it cannot be interpreted. As suggested before, the reason for its insignificance might be caused by the fact that there is a relative low amount of DTTs ratified between OECD countries and tax havens. In further (robustness) analyses, this variable is dropped as well.

The variables capturing the amount of TIEAs and the twelve TIEA-threshold are not statistical significant (except for *TIEA_thres_bes* in model 2). However, since these variables act as the main effects in both models (because of the interaction terms), it is necessary to include both variables in the model.

8.1.2 Robustness results

Table 3: Benchmark results robustness analysis

Dependent variable: dum_TIEA	[1]	[2]	[3]	[4]	[5]	[6]
	Excluding *corptax_diffsq* & *dum_DTT*	Excluding *corptax_diffsq* & *dum_DTT*	*Excluding Nordic countries*	*Excluding Nordic countries*	*2013 data only*	*2013 data only*
ln_trade	-0.0109***	-0.0150***	-0.0078**	-0.0078**	-0.0506**	-0.0472**
	(0.0040)	(0.0038)	(0.0038)	(0.0038)	(0.0203)	(0.0193)
*ln_trade*TIEA_thres_bes*	0.0038		0.0059		0.0551***	
	(0.0040)		(0.038)		(0.0207)	
*ln_trade*sum_TIEA_bes*		0.0004**		0.0002		0.0027***
		(0.0002)		(0.0002)		(0.0010)
taxgap_her	0.0007***	0.0007***	0.0004*	0.0004*	0.0031**	0.0030**
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0013)	(0.0002)
taxgap_bes	-0.0009***	-0.0009***	-0.0007***	-0.0007***	-0.0008	-0.0007
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0028)	(0.0028)
corptax_diffsq			$-6.91*10^{-6}$	$-8.90*10^{-6}$	0.0001	-0.0001
			(0.0000)	(0.0000)	(0.0001)	(0.0001)
corrupt_her	-0.0474***	-0.0474***	-0.0267***	-0.0269***	-0.1633***	-0.1618***
	(0.0061)	(0.0061)	(0.0057)	(0.0058)	(0.0309)	(0.0308)
corrupt_bes	-0.0722***	-0.0720***	-0.0599***	-0.0611***	-0.0609	0.0356
	(0.0117)	(0.0114)	(0.0127)	(0.0126)	(0.0824)	(0.0792)
ln_sum_gdp	0.0660***	0.0652***	0.0569***	0.0607***	-0.1136	-0.0420
	(0.0155)	(0.0146)	(0.0138)	(0.0129)	(0.1270)	(0.1122)
ln_gdp_diffsq	-0.0176**	-0.0172***	-0.0174***	-0.0190***	0.0581	0.0234
	(0.0071)	(0.0066)	(0.0062)	(0.0057)	(0.0589)	(0.0514)
dum_DTT			-0.0083	0.0076	0.0440	0.0483
			(0.0150)	(0.0150)	(0.0677)	(0.0670)
sum_TIEA_bes	0.0015	-0.0045	0.0014	-0.0026	0.0166**	-0.0225
	(0.0011)	(0.0028)	(0.0014)	(0.0028)	(0.0079)	(0.0156)
TIEA_thres_bes	0.0016	0.0534**	-0.0257	0.0618**	-0.7990**	0.0227
	(0.0675)	(0.0208)	(0.0658)	(0.0239)	(0.3626)	(0.1174)
observations	5155	5155	4279	4279	357	357
pseudo R^2	0.149	0.150	0.150	0.150	0.272	0.272

Note: ***p<0.01, **p<0.05, *p<0.1. Standard errors in parentheses. The reported coefficients are marginal effects. Coefficient of interest (*ln_trade*) is underscored.

To see how robust the initial results are, I have conducted three robustness checks for both models. The results of these checks are presented in table 3.

The first performed robustness check excludes two variables (*corptax_diffsq* and *dum_DTT*) from the baseline models to see whether this affects the coefficient of the variable of interest. As mentioned before, these variables are not statistical significant (probably due to the low variation of the data) and may be perceived as not relevant. The exclusion of the variables does not lead to a change of the initial results: the coefficient of *ln_trade* still has a statistical significant negative sign. Furthermore, the coefficients are also nearly equivalent.

The second performed robustness check restricts the initial data sample by excluding Nordic countries from the analysis. As discussed before, these countries are the only ones that have adopted a multilateral approach to sign TIEAs. These countries are also the ones that have the most TIEAs ratified. In order to be sure that the initial results are not driven by these countries, I have therefore excluded these from the analysis. The exclusion of these countries also does not lead to a change of the initial results: the coefficient of *ln_trade* still has a statistical significant negative sign. However,

the size of the coefficients is reduced. This seems to imply that Nordic countries on average have ratified more TIEAs with non-economic linked countries.

The third performed robustness check restricts the initial data sample even further by only using data of one specific year. The rationale for this check is that it could be argued that the time series data of a country pair should not be treated as if these are different cross sectional observations. Therefore, it can be useful to re-run the analysis by using data of one specific year only in order to test the robustness of the initial results. I choose to re-run the analysis by using data of the year 2013 only since the data of this year are the most up to date. Although some control variables have turned insignificant, the coefficients of *ln_trade* still has a statistical significant negative sign. The size of the coefficients also has increased (-5.06 and -4.72 percentage points). Furthermore, both interaction terms also have turned significant.

8.1.3 Conclusion 1

Given the results of the baseline and robustness analysis, I conclude that the larger the economic link between an OECD country and tax haven, the lower the probability that a TIEA exists between the country pair. Therefore, the null hypothesis of this analysis is accepted.

The analysis provides empirical evidence that tax havens might indeed have tried to undermine the threshold of twelve TIEAs by fulfilling the standards just through signing TIEAs with non-economic linked countries. However, I could not find empirical evidence that there is a difference in treaty partners w.r.t TIEAs signed before and after the threshold as the coefficients of the interaction terms are not robust across all specifications.

8.2 Results PSM analysis

This section presents the results of the PSM analysis. The following hypotheses are tested:

H_0: *dum_TIEA / pr(dum_TIEA)* < 0 (i.e. a TIEA has a negative impact on the FDI outflow from OECD countries to tax havens)

H_a: *dum_TIEA / pr(dum_TIEA)* < 0 (i.e. a TIEA has a positive impact on the FDI outflow from OECD countries to tax havens)

8.2.1 Baseline results

Table 4 presents the baseline results of the PSM analysis. The baseline results show that the treatment variable *dum_TIEA* has a highly statistical significant negative impact on the levels of bilateral FDI stocks two years before and two years after a TIEA is ratified (*d22_ln_FDI*). Similar results are found for the analysis with the simulated TIEA dummy. To interpret the coefficients in an economic way, I have used the coefficients of table 4 to calculate the cumulative changes of bilateral FDI stocks of the

Table 4: Benchmark results PSM analysis

Dependent variable: d22_ln_FDI	[1]	[2]
simulated treatment variable?	*No*	*Yes*
dum_TIEA	-2.346***	
	(0.901)	
%FDI	-83.2%	
pr(dum_TIEA)		-3.879**
		(2.083)
%FDI		-93.2%
matching	1-1	1-1
observations	837	768

Note: ***p<0.01, **p<0.05, *p<0.1. Standard errors in parentheses. Nearest neighbourhood matching is applied. Treatment model: logit. The matching variables are as follows: *ln_sum_gdp, ln_gdp_diffsq dum_DTT*. *Pr(dum_TIEA)* is the simulated treatment variable. *%FDI* indicates the cumulative changes of bilateral FDI stocks in the *d22* period compared to the average FDI stock of country pairs without a TIEA.

country pairs with a TIEA compared to the country pairs without a TIEA. The calculated FDI changes are presented in table 4 as *%FDI*. Considering model [1], I find a huge decrease of 83.2 percentage points in bilateral FDI stock for country pairs with a TIEA in the *d22* period compared to country pairs without a TIEA. The decrease in bilateral FDI stocks is even larger (-93.2 percentage points) if I use the simulated TIEAs as the treatment variable. These results indicate that a TIEA has a negative impact on the FDI outflow from an OECD country to a tax haven.

8.2.2 Robustness checks

In order to see how robust the initial PSM results are, I have conducted five robustness checks in total. In all five robustness checks, I have extended the matching characteristics with five extra variables. The results are presented in table 5.

In the first performed robustness check, I have estimated the same PSM model as in the baseline analysis of section 8.2.1 (model 1 of table 4), but this time with more matching characteristics (see model 1 of table 5). Subsequently, this model has been re-estimated by using a 5-1 matching (see model 2 of table 5) and a 9-1 matching (see model 3 of table 5). In all three specifications, the coefficient of the treatment variable still has a highly statistical significant sign. The size of the coefficients is also nearly equivalent. The percentual changes of bilateral FDI stocks vary in between -82.7 and -92.0 percentage points, which are also similar to the percentual changes found in the baseline analysis.

Table 5: Robustness results PSM analysis

Dependent variable: d22_ln_FDI	[1]	[2]	[3]	[4]	[5]
Treatment variable: dum_TIEA					
simulated treatment variable?	*No*	*No*	*No*	*Yes*	*Yes*
dum_TIEA	-2.827***	-2.749***	-3.222***		
	(1.009)	(0.592)	(0.716)		
%FDI	-82.7%	-86.1%	-92.0%		
pr(dum_TIEA)				-4.339***	-3.732***
				(1.217)	(1.149)
%FDI				-95.2%	-95.2%
matching	1-1	5-1	9-1	5-1	9-1
observations	749	749	749	768	768

Note: ***p<0.01, **p<0.05, *p<0.1. Standard errors in parentheses. Nearest neighbourhood matching is applied. Treatment model: logit. The (extended) matching variables are as follows: *ln_sum_gdp*, *ln_gdp_diffsq*, *dum_DTT, corrupt_her*, *corrupt_bes*, *ln_dist*, *PIT_her* and *CIT_her*. *Pr(dum_TIEA)* is the simulated treatment variable. *%FDI* indicates the cumulative changes of bilateral FDI stocks in the *d22* period compared to the average FDI stock of country pairs without a TIEA.

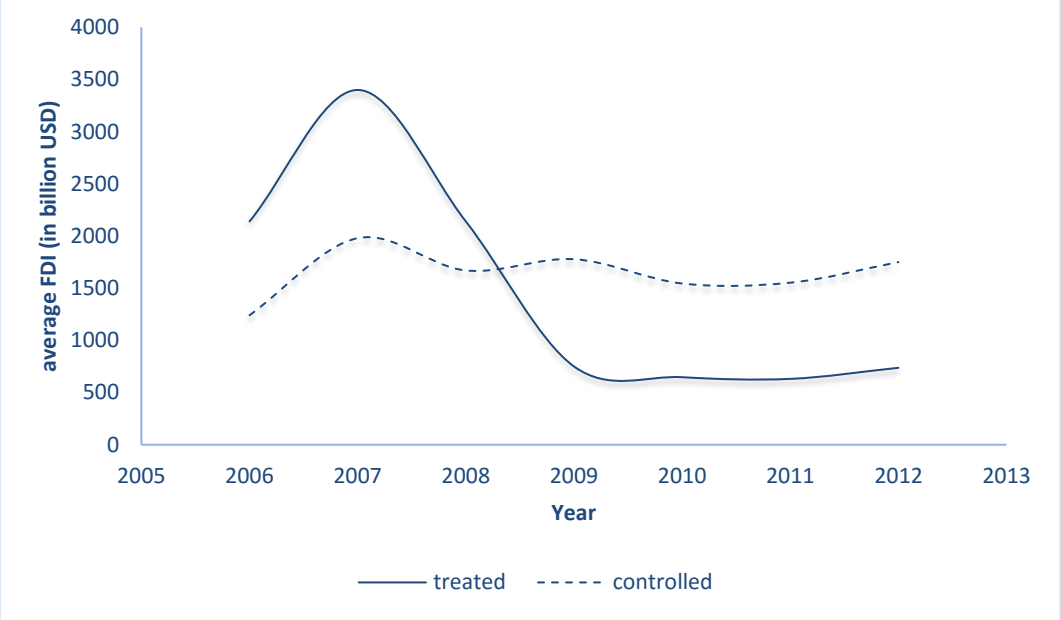
I find similar results in the robustness checks conducted for the simulated TIEA variable (5-1 matching and 9-1 matching with extended matching variables, see model 4 and 5 in table 5). In both models, the estimated cumulative change of bilateral FDI stocks amounts -95.2 percentage points.

8.2.3 Conclusion 2

Given the results of the baseline and robustness PSM analysis, I conclude that TIEAs have a negative impact on bilateral FDI stocks from OECD countries to tax havens. The estimated percentual changes of bilateral FDI stocks vary in between -81.7 and -95.2 percentage points. Therefore, the null hypothesis of this test is accepted.

Although the treatment dummy has a statistical negative sign in all specifications, the estimated FDI percentual changes are somewhat large. In order to determine that the analysis has been performed correctly, I have plotted the development of FDI stocks of country pairs with a TIEA (treated) and country pairs without a TIEA (controlled) of the sample data that is used during the PSM analysis in figure 9. Given that most of the TIEAs are ratified in 2009/2010, it can be argued that the *d22* period for most country pairs is in between 2007-2012. In this period, it can be seen that the FDI stocks of the treated have decreased enormously compared to the controlled observations. This might explain the findings of table 4 and 5. Furthermore, the rather stable line of the controlled observations indicates that it is unlikely that the FDI that leaves the treatment group has moved to the control group. The problem of haven hopping within the data sample seems therefore not to be present.

Figure 9: average FDI outflow from OECD countries to tax havens (in billion USD), PSM sample data.



Source: own illustration

However, it is important to keep in mind that the number of treated observations (40) in the PSM analysis is low. This low amount of observations might lead to a large volatility of the mean values of the FDI stocks for the treated group, which subsequently can affect the PSM results. Therefore, the results of the PSM analysis w.r.t. the size of the impact should be interpreted with caution.

9 Policy implications

9.1 Summary analysis

In the past decade, improving transparency in tax matters has become one of the main objectives of international taxation. Tax havens that facilitate tax evasion and tax avoidance by offering low tax rates and a high degree of non-transparency have therefore been facing enormously political pressure. In 2009, the OECD announced that each tax haven have to sign at least twelve TIEAs in order to avoid being put on the black list (again). This paper assesses the real effectiveness of these TIEAs by empirically analyzing with whom tax havens ratify TIEAs and whether these agreements also have an impact on FDI of MNEs in tax havens.

The empirical analysis is based on an unique hand collected data sample consisting of 19,040 country pair observations covering a time period between 2000-2013. By using a cross sectional probit approach, I have analyzed whether tax havens ratify TIEAs with stronger or weaker economic linked OECD countries. Based on the probit results, I conclude that the larger the economic link between an OECD country and tax haven, the lower the probability that a TIEA exists between the country pair. This finding provides empirical evidence that tax havens might indeed have tried to undermine the threshold of twelve TIEAs by fulfilling the standards just through signing TIEAs with non-economic linked countries. However, I could not find empirical evidence that there is a difference in treaty partners w.r.t TIEAs signed before and after the threshold.

Subsequently, I have analyzed whether TIEAs have a positive or negative impact on bilateral FDI of MNEs in tax havens by using a PSM approach. The baseline PSM results show that the FDI inflow from OECD countries to tax havens is lower when country pairs have a TIEA ratified compared to country pairs without a TIEA. However, these results might suffer from endogeneity caused by the reverse causality of the treatment variable. In order to circumvent this problem, I have simulated the treatment variable by forecasting the probabilities that a TIEA is ratified for all country pair observations. The forecasting has been done by using the same cross sectional probit model as discussed above. The results obtained with the simulated treatment variable are similar to the baseline results. I therefore conclude that TIEAs have a negative impact on bilateral FDI of MNEs in tax havens.

9.2 Policy recommendations

Taking all results into account, it can be concluded that TIEAs have not been an effective instrument for more tax transparency in tax havens. Tax havens could easily fulfil the tax transparency standards of the OECD by signing TIEAs with non-economic linked countries or even tax havens. Furthermore, TIEAs also seems to have a negative impact on the investment decisions of MNEs in tax havens in

terms of lower FDI. In this section, I will try to generalize these results in order to provide some policy recommendations to foster tax transparency in tax havens.

While there is a large number of empirical studies showing that TIEAs have an impact on investment decisions of individuals, this paper provides empirical evidence that investment decisions of MNEs are also affected. This finding is in line with the two studies discussed in the literature section. As Braun and Weichenrieder (2015) already noted in their study, this might indicate that MNEs invest in tax havens not only for the low tax rates but also for the secrecy these jurisdictions offer. For example, MNEs that are engaged in tax avoidance may wish to hide their activities as much as possible by investing in tax havens so that most of the corporate transactions cannot be traced. This prevents high-tax countries from detecting these tax avoidance schemes, making it more difficult to react by adjusting tax legislation. While exchange of tax information is usually motivated by the fear of tax evasion by individuals, this paper show that it is also important to acknowledge the (possible) use of tax havens by MNEs to obscure activities. From a policy perspective, this means that countries should also engage in (albeit automatic) exchange of information on MNEs' worldwide activities. The recent implementation of Country-by-Country (hereafter: CbC) reporting provides a good basis for this. CbC-reporting is an initiative of the OECD and it is part of the Base Erosion and Profit Shifting (hereafter: BEPS) action plan 13. The CbC-reporting requires MNEs to report annually and for each tax jurisdiction in which they do business the amount of revenue, profit before income tax, income tax paid and accrued, total employment, capital, retained earnings and tangible assets. Finally, it requires MNEs to identify each entity within the group doing business in a particular tax jurisdiction and to provide an indication of the business activities each entity engages in.

This paper shows that TIEAs reduce the FDI outflow of OECD countries to tax havens. However, it is important to mention that a caveat of this study is that it is unclear whether TIEAs actually reduce the total amount of FDI outflow of the OECD country or that these agreements just simply change the route of FDI to other 'information free' tax havens (haven hopping). One way or another, an effective tax information exchange instrument should prevent the possibility of haven hopping by individuals and MNEs. From a policy perspective, the only way to achieve this is to adopt a worldwide approach in tax information exchange. The OECD also acknowledges this and therefore has introduced CRS. However, even in the presence of a complete worldwide network of tax information exchange, it would be necessary to have reliable data on the efficiency of the exchange of information. Although CbC-reporting and CRS are both likely leading to more information exchange, the important question is whether national tax authorities can (efficiently) handle such a large amount of information. From a policy perspective, it might be necessary to implement domestic law instruments prescribing the way national tax administrations should handle the received information.

At last, something can be said about the recent plans of the OECD to create a new black list covering uncooperative jurisdictions in response to the Panama leak. Recall from section 2.1 that a jurisdiction will not be considered as uncooperative (and hence will not be listed on the new blacklist) if it meets *two out of these three* criteria: (i) the jurisdiction is rated as largely compliant w.r.t. exchange of information on request, (ii) the jurisdiction commits to implement CRS and (iii) the jurisdiction has signed the MCMAA. While CRS is about to become the most powerful and comprehensive tax information exchange standard to tackle tax evasion and avoidance, it is curious to see that a jurisdiction can avoid the new black list even if it decides to not implement CRS. Thus, the problem of the new criteria as suggested by the OECD is that they do not bite. As shown in this paper, a black list should be based on hard, well defined and objective criteria, or else tax havens will find their ways to avoid the hard standards of tax transparency (in the case of TIEAs: signing the agreements with non-economic linked countries or other tax havens). From a policy perspective, the OECD should give more weight to the second criterion (i.e. whether jurisdictions have implemented CRS) to determine the cooperativeness of jurisdictions.

9.3 Further research

The policy relevancy of TIEAs will start to decline if CRS is in force. Further research on TIEAs is therefore restricted. However, TIEAs may still provide a good experimental setting to analyze the possible effects of an increased level of tax transparency in tax havens. This paper shows that the ratification of TIEAs leads to lower investments, thereby suggesting that tax transparency in general has a negative impact on MNEs' investments in tax havens. Although this finding is in line with other empirical studies, it might be useful to confirm the results by using more sophisticated econometric methods to counter the reverse causality problem.

Although 101 countries have committed to implement CRS, the actual exchanges of information start by 2017 at the earliest. At this moment, the effectiveness of CRS therefore cannot be assessed yet. However, given the fact that CRS is very similar to the US FATCA, some lessons may be learned by empirically analyzing the US FATCA as well.

As international tax transparency is an important topic in international taxation, there are likely more developments to come in these years. The possibilities of further analysis on this topic (whether it is empirical or not) are therefore endless.

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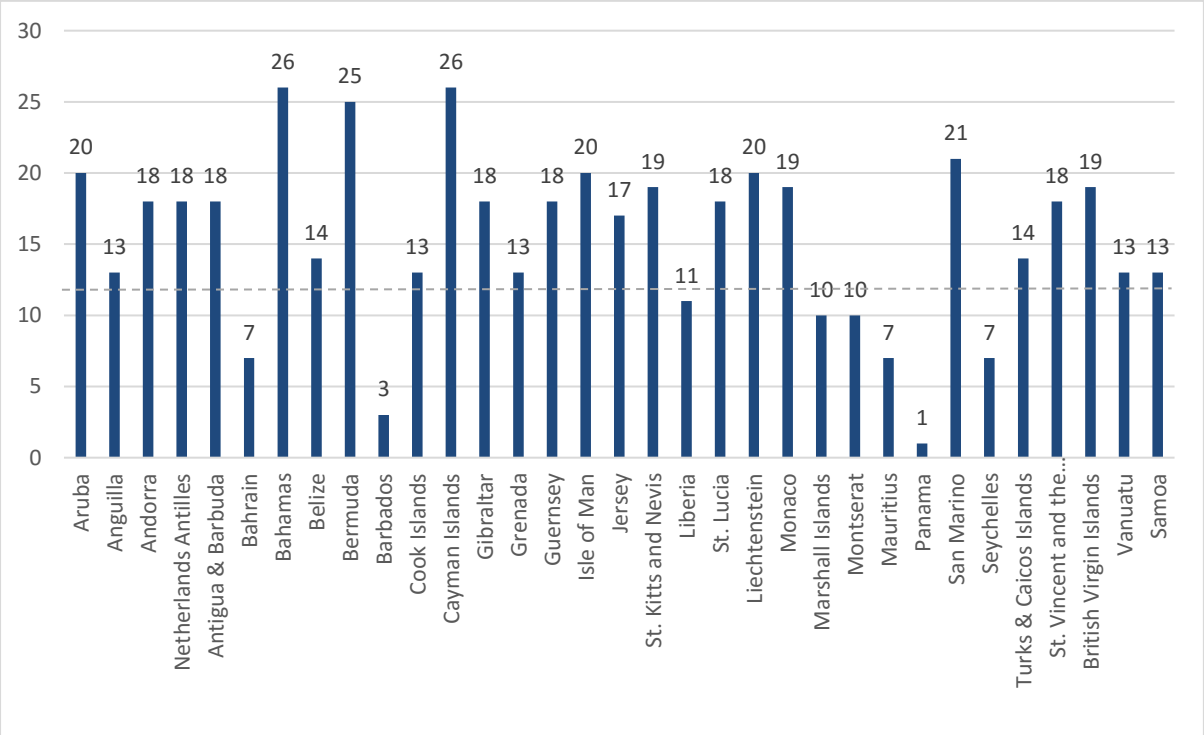
Appendix

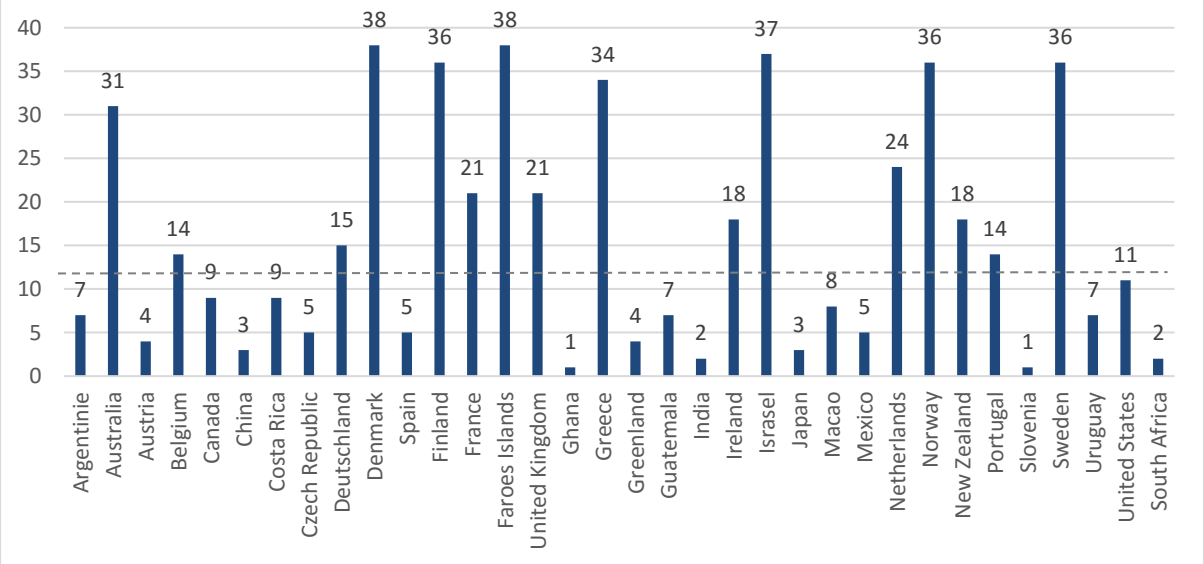
A. Figures

Figure A1: number of TIEAs ratified by tax havens, sample data 2000-2013



Source: OECD (2016), own illustration

Figure A2: number of TIEAs ratified by non tax havens, sample data 2000-2013



Source: OECD (2016), own illustration

B. Tables

Table B1: OECD's original black list of tax havens in 2000

Andorra	The Republic of the Maldives
Anguilla – Overseas Territory of the United Kingdom	The Republic of the Marshall Islands
Antigua and Barbuda	The Principality of Monaco
Aruba – Kingdom of the Netherlands[a]	Montserrat – Overseas Territory of the United Kingdom
Commonwealth of the Bahamas	The Republic of Nauru
Bahrain	Netherlands Antilles – Kingdom of the Netherlands[a]
Barbados	Niue – New Zealand[b]
Belize	Panama
British Virgin Islands – Overseas Territory of the United Kingdom	Samoa
Cook Islands – New Zealand[b]	The Republic of the Seychelles
The Commonwealth of Dominica	St Lucia
Gibraltar – Overseas Territory of the United Kingdom	The Federation of St. Christopher & Nevis
Grenada	St. Vincent and the Grenadines
Guernsey/Sark/Alderney – Dependency of the British Crown	Tonga
Isle of Man – Dependency of the British Crown	Turks & Caicos – Overseas Territory of the United Kingdom
Jersey – Dependency of the British Crown	US Virgin Islands – External Territory of the United States
Liberia	The Republic of Vanuatu
The Principality of Liechtenstein	

a) The Netherlands, the Netherlands Antilles, and Aruba are the three countries of the Kingdom of the Netherlands.
b) Fully self-governing country in free association with New Zealand.

Source: http://www.oecd.org/ctp/harmful/2090192.pdf

Table B2: data sources

Data	Sources
FDI data	- http://stats.oecd.org/index.aspx, choose Globalisation, Foreign Direct Investment Statistics
Trade data	- http://www.imf.org/en/Data, choose Direction of Trade Statistics (DOTS)
Country types	
- Tax havens	- http://www.oecd.org/ctp/harmful/2090192.pdf, see page 17.
- OECD countries	- http://www.oecd.org/about/membersandpartners/list-oecd-member-countries.htm
Bilateral treaties	
- TIEAs	- http://www.oecd.org/tax/exchange-of-tax-information/taxinformationexchangeagreementstieas.htm
- DTTs	- http://unctad.org/en/Pages/DIAE/International%20Investment%20Agreements%20(IIA)/Country-specific-Lists-of-DTTs.aspx
Geographical elements	- http://www.cepii.org/CEPII/en/welcome.asp
Governance elements	- http://info.worldbank.org/governance/wgi/index.aspx#home
Tax rates	
- Personal and corporate income tax rates (OECD)	- http://www.oecd.org/tax/tax-policy/tax-database.htm
- Personal and corporate income tax rates (non-OECD)	
- Withholding tax rates on interest income	- http://www.tradingeconomics.com/indicators - https://dits.deloitte.com/#TaxTreatySubMenu
Several other macro-economic factors	- http://data.worldbank.org/indicator

Source: own illustration

Table B3: panel probit model

Dependent variable: dum_TIEA	[1]
Explanatory variables	*Coefficients*
ln_trade	-1.1340
	(1.5619)
*ln_trade*TIEA_thres_bes*	1.3169
	(1.7070)
*ln_trade*sum_TIEA_bes*	
taxgap_her	0.084
	(0.084)
taxgap_bes	0.012
	(0.036)
corptax_diffsq	0.0021
	(0.0028)
corrupt_her	-3.8918
	(3.8671)
corrupt_bes	0.6274
	(2.0617)
ln_sum_gdp	0.8771
	(3.0232)
ln_gdp_diffsq	-0.0361
	(1.315)
dum_DTT	1.6202
	(2.2017)
sum_TIEA_bes	0.4500
	(0.4802)
TIEA_thres_bes	-16.1528
	(22.8671)
Year	
2000	empty
2001	-27.2690
	(30.7735)
2002	-27.9194
	(31.3509)
2003	-24.2594
	26.5377
2004	-22.6133
	(25.6770)
2005	-21.6994
	(24.6504)
2006	-20.0296
	(23.5772)
2007	-20.0723
	(23.6623)
2008	-18.0514
	(22.5304)
2009	-17.1442
	(21.8928)
2010	-8.9990
	(8.6679)
2011	-1.8091
	(1.1432)
2012	0.0162
	(0.0108)
2013	Omitted
observations	4,799
Number of groups	409
Min. number of groups	1
Avg. number of groups	11.7
Max. number of groups	13

Note: ***p<0.01, **p<0.05, *p<0.1. Robust standard errors in parentheses. Random effects and period fixed effects are applied.

Table B4: mean values of the baseline probit model sample

Variable	**Obs**	**Mean**
ln_trade	5,155	14.72
*ln_trade*TIEA_thres_bes*	5,155	9.18
taxgap_her	5,155	24.75
taxgap_bes	5,155	6.55
corrupt_her	5,155	-1.14
corrupt_bes	5,155	-0.74
ln_sum_gdp	5,155	26.78
ln_gdp_diffsq	5,155	53.36
sum_TIEA_bes	5,155	13.94
TIEA_thres_bes	5,155	0.66
dum_DTT	5,155	0.11
corptax_diffsq	5,155	283.69

Source: own illustration

C. Mathematical proof (as in Bacchetta and Espinosa (2000))

Given the setting of the model, both countries are always willing to engage in tax information exchange. To see this, we have to prove that the slope of the indifference curve in (0,0) for the home country is steeper than the slope of the curve for the foreign country; i.e. $\left(\frac{\Delta\xi}{\Delta\xi_*}\right)_{G(0,0)=0} > \left(\frac{\Delta\xi}{\Delta\xi_*}\right)_{G^*(0,0)=0}$. Rewriting this inequality yields:

$$\left(-\frac{\Delta G/\Delta\xi}{\Delta G/\Delta\xi_*}\right)_{G(0,0)=0} > \left(-\frac{\Delta G*/\Delta\xi}{\Delta G*/\Delta\xi_*}\right)_{G^*(0,0)=0} \qquad \text{(C1)}$$

This implies:

$$(MRS\frac{\Delta c}{\Delta\xi_*} + \frac{\Delta g}{\Delta\xi_*})\,(MRS^*\frac{\Delta c*}{\Delta\xi} + \frac{\Delta g*}{\Delta\xi}) - \frac{\Delta g}{\Delta\xi}\frac{\Delta g*}{\Delta\xi_*} > 0 \qquad \text{(C2)}$$

Solving (C2) yields:

$$(1 - MRS)(1 - MRS^*)(\tau - at^*)(\tau^* - a^*t)ii^* - (1 - MRS^*)(\tau - (1 - k(1 - \xi^*))(\tau - at^*))k^*(\tau^* - a^*t)i^*\frac{\Delta i}{\Delta\xi_*}$$

$$- (1 - MRS)(\tau^* - (1 - k^*(1 - \xi))(\tau^* - a^*t)k(\tau - at^*)i\frac{\Delta i*}{\Delta\xi}$$

$$+ [(\tau - (1 - k(1 - \xi^*))(\tau - at^*))(\tau^* - (1 - k^*(1 - \xi))(\tau^* - a^*t)) - \tau\,\tau^*]\frac{\Delta i}{\Delta\xi_*}\frac{\Delta i*}{\Delta\xi} > 0 \qquad \text{(C3)}$$

Given that the $MRS < 1$ and $MRS^* < 1$, $\frac{\Delta i}{\Delta\xi_*} < 0$, $\frac{\Delta i*}{\Delta\xi} < 0$, $\tau - t^* > (1 - k(1 - \xi^*)(\tau - at^*)$, $\tau^* - t > (1 - k^*(1 - \xi)(\tau - at)$ and there is no cost of providing information, (C3) always hold.

Hence, both countries in this model are always willing to engage in tax information exchange.