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Can Developing Countries Increase Foreign Investments by Sharing Their Taxation Rights?

An Economic Analysis of Double Taxation Treaties between Countries in Asymmetric Investment Positions

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Abstract

This thesis examines the effects of double taxation treaties on FDI inflows into both developing and developed countries. A gravity model equation is used to first estimate the general effect of the existence of a tax treaty between symmetric and asymmetric country pairs on FDI. Secondly, indices that indicate the proportion of source taxation rights negotiated in a tax treaty are employed in the same gravity equation as predictors. Both the conclusion of tax treaties in general and in particular those with a high share of source taxation are found to be negatively correlated with FDI inflows (-23.05%). A stronger effect could be estimated for FDI inflows into developing countries (-29.53%), indicating that developing countries face a more severe trade-off between the attraction of FDI from MNEs and the generation of tax revenue from business activities rendered in their territory.

With regards to further motivations for developing countries to sign tax treaties, it could be shown that sharing less information with developed countries about their MNEs' taxable business activities increases FDI inflows on average. Nevertheless, an increasing trend in cooperation (both in the sense of information sharing and tax revenue sharing) could be observed over time. This is in line with the game-theoretical solution of repeated games: In the long run, countries conclude mutually beneficial contracts that allow for profit sharing. Finally, it was found that additional motivations to sign treaties apart from the classical trade-off between investments and tax revenue have to be considered in empirical models in future research.

"I hereby declare and confirm that this thesis is entirely the result of my own work except where otherwise indicated. I acknowledge the supervision and guidance I have received from Prof. Dr. Pierre Garello. This thesis is not used as part of any other examination and has not yet been published."

Tabea Krauß, Aix-en-Provence

List of Abbreviations

DTT	Double Taxation Treaty
et al.	et alia (and others)
EU	European Union
EIIW	European Institute for International Economic Relations (*German: Europäisches Institut für Internationale Wirtschaftsbeziehungen*)
FDI	Foreign Direct Investment
HDI	Human Development Index
IBFD	International Bureau of Fiscal Documentation
ICTD	International Centre for Tax and Development
i.e.	it est (this means)
LDC	Least Developed Country
MNE	Multinational Enterprise
n. d.	No date
Obs.	Observations
OECD	Organisation for Economic Co-operation and Development
OECD MC	OECD Model Tax Convention
OLS	Ordinary Least Squares
PE	Permanent Establishment
p.	Page
pp.	Pages
PPML	Poisson Pseudo Maximum Likelihood
SDG	Sustainable Development Goal
UN	United Nations
UN MC	UN Model Tax Convention
US	United States
WHT	Withholding Tax

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1. Introduction

> *SDG 17.1:* "*Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection*" (Min, 2018, Indicator 17.1.1, paragraph 2)

With the 17th Sustainable Development Goal (SDG) of the United Nations, the international community of sovereign states committed themselves to support developing countries in strengthening their tax revenue collection (United Nations, 2013). Correspondingly, economists have emphasized the importance of fiscal capacity for sustainable development and growth given that governmental investments into infrastructure and further public goods can increase economic efficiency (Reinsberg, Kentikelenis, & Stubbs, 2020). Many developing countries thus try to encourage foreign direct investments (FDI) from multinational enterprises (MNEs) due to their expected positive externalities such as productivity spillover effects to domestic enterprises (Herzer, 2010) by concluding double taxation treaties (DTTs).

Yet, by signing tax treaties to attract FDI, developing countries also restrict their taxation rights on taxable business activities in their territory and usually agree to lower tax rates than the ones in their domestic tax codes, thereby losing potential tax revenue. Thus, it largely depends on the objective targeted by a country and the negotiated treaty conditions whether a DTT positively or negatively impacts a developing country.

Approximately 3000 DTTs have been concluded globally; therein between 1000 and 2000 include at least one developing country (Quak & Timmis, 2018). Developing countries

are typically net capital-importing countries while higher developed countries often are net capital exporters and thus generate income in the developing country (Neumayer & Barthel, 2012). Thus, tax treaties between a developing and a developed country are usually characterized by great asymmetry in investment positions which indicates that the attraction of FDI may be one of the main reasons for the developing country to sign the treaty (Neumayer & Barthel, 2012).

By merely studying a static snapshot of the FDI inflows into the least developed countries (LDCs) in 2019, this approach seems to be successful: LDCs that signed DTTs received USD 553.13 million FDI inflows on average in 2019 while LDCs that did not sign DTTs only received USD 297.97 million.[1] Thus, signing DTTs seems to have a positive influence on FDI inflows into developing countries. Quantitative studies were often able to confirm this effect by analyzing the impact of DTTs on FDI empirically; however, qualitative studies that study selected countries more in depth often find that due to the unequal bargaining power of developing and developed countries, DTTs tend to be more beneficial to the country in the stronger bargaining position (Hearson, 2018). However, this largely depends on the particular treaty provisions agreed upon in the negotiations (Hearson, 2018).

This thesis seeks to combine an empirical quantitative approach with a qualitative analysis of specific treaty provisions by separately assessing the treaty provisions' impact on FDI inflows into developing countries. By using a gravity model to predict the impact

[1] Calculated by author based on numbers taken from UNCTAD (UNCTAD, 2021).

on FDI inflows, this thesis shows a negative correlation between signing DTTs and FDI inflows into developing countries. The same effect was found for selected treaty provisions that allocate a high share of taxation rights to the developing country. As similar approaches could not be found in the previous literature, this thesis contributes to the existing research on the economic effects of DTT provisions for treaty partners with asymmetric investment positions.

2. Research Question and Methodology

The present research seeks to analyze the impact of DTTs on FDI inflows resulting from asymmetric investment positions of countries negotiating DTTs.

The existing literature on DTTs can be clustered into studies analyzing the costs of DTTs by using potentially lost tax revenue as a proxy, studies analyzing the economic impacts of signing DTTs with regards to their influence on bilateral investments, and studies analyzing the treaty provisions of selected treaties from a qualitative perspective. This research aims to fill the gap between the two latter approaches by quantitatively determining which treaty clauses have an influence on investments into developing countries and if differences in DTTs signed by two developed countries and DTTs signed by a developing and a developed country can be observed.

Thus, the research question guiding this thesis will be:

Do Double Taxation Treaties (or selected provisions of them) influence FDI inflows into developing countries and can we observe differences for country pairs with asymmetric investment positions?

2.1. Methodology

To answer the question whether DTTs influence FDI inflows into developing countries, an appropriate econometric estimation technique needs to be determined. In coherence with the existing literature, a gravity model equation shall be applied to estimate their impact on bilateral FDI flows. A dummy variable equal to 1 for the existence of a DTT

between a country pair will be employed as the predictor variable of interest and further control variables will be included as independent variables in order to approximate the true effect of DTTs. Both a (traditional) linear regression analysis and a (refined) PPML estimation shall be performed in the statistics program STATA.

For answering the second part of the research question whether differences can be observed for country pairs with asymmetric investment positions, a suitable dataset had to be found. While qualitative studies that aim to analyze specific treaty provisions in depth are usually limited to a small sample of countries, quantitative studies that analyze larger samples of countries are normally limited to looking at only the most important treaty rates such as the WHT rates (Hearson, 2018). Thus, quantitative studies analyzing specific treaty provisions on a large scale for a great number of treaties had been missing for many years. In 2016, the International Centre for Tax and Development (ICTD) has therefore addressed this gap in the existing literature by creating the ActionAid Tax Treaties dataset (ICTD, 2020) that codes selected treaty clauses into four indices by comparing them to international standards[2] (Hearson, 2016).

However, the dataset only includes DTTs signed by developing countries; thus, treaties between two developed countries are missing. Since this research addresses the differences between developing and developed countries with regards to asymmetric investment positions, a comparison with the provisions agreed on by developed countries (symmetric

[2] International standards are tax model conventions which will further be explained in chapter 3.2.

countries) is required. Additional treaty data shall therefore be added to the dataset by the author, adhering to the coding strategy prescribed by the ICTD.

As a first step, indices similar to the existing ones in the ICTD shall be calculated and analyzed descriptively with regards to the differences between symmetric and asymmetric countries. Thereupon, as a second step, the calculated indices shall be used as predictor variables in the gravity model described above to determine the influence of specific treaty provisions on FDI inflows.

2.2. Terminology and Research Scope

DTTs distribute taxation rights for bilateral investments between a residence country, where an MNE is located, and a source country, where the economic activities of that MNE take place (Rixen, 2010). Consequently, the term "source taxation rights" describes the right of the source country to tax the activities and the term "residence taxation rights" describes the taxation rights of the residence country. As developing countries are usually net capital-importers[3], they commonly assume the role of the source country, while developed countries usually export capital and thus more frequently assume the role of the residence country (Rixen, 2010).

Regarding the scope of this thesis, the major challenge was the determination of representative country groups for analyzing the differences in investment asymmetry due to very limited data availability. For the analysis of tax treaty provisions with the

[3] See appendix 1 for a classification of net-capital importers and exporters based on UNCTAD data from 2019.

ActionAid Tax Treaties dataset in chapter 5, a rather broad data availability allowed choosing two very distinct groups for the comparison: Based on the Human Development Index (HDI) by the United Nations, the group of countries with the lowest human development, the 46 least developed countries (LDCs), was contrasted with the 27 EU member countries (as of 2021) that are all part of the highest human development group.

For the extension of the ActionAid Tax Treaties Dataset, treaties between two EU countries consequently had to be added. As EU countries were used as a proxy for developed countries with symmetric investment positions, only net capital-exporting EU countries were considered to ensure equal bilateral investment flows between the treaty partners. Due to the limited scope of this thesis, only DTTs concluded by France with other capital-exporting EU countries were added.

For the gravity model estimation in chapter 4, different proxies for countries with asymmetric investment positions had to be chosen due to a limited data availability of dyadic FDI flow data. Since no FDI inflow data with reported origins of the FDI was found for the LDCs, the countries with available dyadic data were clustered into developing countries and developed countries (also based on the HDI). The dataset used for the gravity model estimation covers panel data of 61 countries in total from 2001 to 2012 and was partly developed by researchers of the University of Wuppertal.[4]

[4] A detailed description of the data and its sources can be found in chapter 4 and the countries are listed in appendix 2.

3. Double Taxation Treaties

Despite a large internationalization of economic activity, the competence to tax the latter remains with national states (Rixen, 2010). For cross-border transactions, this often leads to an overlap of the taxation rights of the residence country and the source country since both states have the power to fully tax it and double taxation may occur in consequence (Rixen, 2010).

This is widely regarded as inefficient in economic literature as international investments are disadvantaged compared to national investments which hinders trade (Rixen, 2010). Tax treaties therefore aim to limit the total tax applicable on the generated income to the tax amount that would have been accrued in the jurisdiction with higher tax rates (Smith, 1959).

In order to thus reduce double taxation, governments sign bilateral tax treaties, called double taxation treaties, which distribute taxation rights in case of cross-border business activities and investments. Most DTTs are concluded on a bilateral level (Rixen, 2010); only very few multilateral tax treaties are in force today. Among the multilateral treaties, only three are concluded by developing countries.[5] Research suggests that this is due to asymmetric investment positions of countries as a different investment ratio exists for

[5] Namely the AEUC Multilateral Treaty (1973) concluded between Iraq, Egypt, Arab Rep., Jordan, Libya, Mauritania, Somalia, West Bank and Gaza, Sudan, Syrian Arab Republic, United Arab Emirates, and Yemen; the AMU Multilateral Treaty (1990) concluded between Libya, Algeria, Mauritania, Morocco, and Tunisia; and the WAEMU Multilateral Treaty (2008) concluded between Burkina Faso, Benin, Ivory Coast, Guinea-Bissau, Mali, Niger, Senegal, and Togo (Hearson, 2016).

each country pair (Rixen, 2010). Thus, bilateral bargaining can better react to the specific interests and needs of two potential asymmetric treaty partners than broader multilateral agreements could (Rixen, 2010). Nevertheless, almost all globally concluded DTTs follow one of the two main international model tax conventions which are the OECD model (OECD MC) and the UN model (UN MC) (Hearson, 2016). Both model conventions are non-binding but still have a substantial impact on tax treaties' design since most treaty provisions are closely oriented towards one of the two the model conventions' wording (Rixen & Schwarz, 2009).

One of the general principles of DTTs is the reciprocity of benefits granted by a treaty (Smith, 1959). Lower treaty tax rates and exemptions of certain types of income are applicable in both treaty countries, thus providing equal conditions to investors in both countries (Smith, 1959).

3.1. Allocation of Taxation Rights in Case of Asymmetric Investment Positions

Irrespective of whether countries concluded tax treaties, all countries define unilateral measures to provide foreign tax relief for taxes paid abroad (Rixen, 2010). Thus, countries seem to have a joint interest in avoiding double taxation (Rixen, 2010).

Concerning a country's motivations to still negotiate and sign tax treaties despite the possibility of unilateral tax relief, a distinction has to be made between residence countries and source countries: A residence country will always be interested in limiting source taxation in order to encourage its enterprises to engage in business activities in

the source country (Rixen, 2010). For source countries instead, a further distinction between country pairs with symmetrical and asymmetrical investment flows is necessary: In case of symmetrical investment flows, both countries act as residence country and source country at the same time and thus are interested in low source taxation to encourage (private) trade and investments between them (Rixen, 2010). In contrast, in case of asymmetric investment flows, the capital-importing country has incentives to increase source taxation to increase its tax revenue (Rixen, 2010). This is particularly difficult to achieve in treaty negotiations as tax treaties always limit source taxation compared to a non-treaty situation in which the source country could potentially exercise its full right to tax activities in its territory (Hearson, 2018).

Rixen describes the treaty negotiations as a "coordination game with a distributive conflict" (Rixen, 2010, p. 589) in which the capital-importing country bargains for a share of the tax revenue (Rixen, 2010). Rixen and Schwarz further state that limiting source taxation de facto entails "a [tax] revenue transfer from the net capital importer to the net capital exporter" (Rixen & Schwarz, 2009, p. 446).

This coordination game can be visualized in a welfare graph depicting the tax revenue payoffs from investments for the residence country R on the x-axis and the tax revenue payoffs for the source country S on the y-axis:

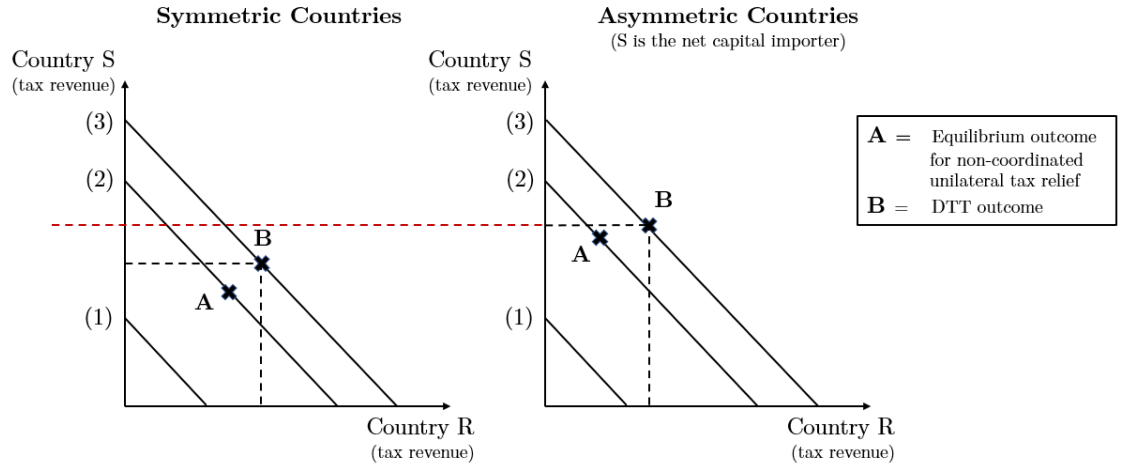

Figure 1: Adapted tax treaty coordination game between symmetric and asymmetric countries (Rixen & Schwarz, 2009, p. 450)

The three welfare levels indicated by the investment budget lines show the difference between (1) a non-treaty situation, (2) non-coordinated unilateral tax relief, and (3) coordinated tax relief via a DTT (Rixen & Schwarz, 2009). In the case of symmetric countries (figure 1), both countries gain equally from providing unilateral tax relief and from concluding a DTT (Rixen & Schwarz, 2009). This is due to increased trade and investments between the countries and the signaling function of treaties with regards to legal certainty (Rixen & Schwarz, 2009). Since both countries are interested in reducing source taxation, the equilibrium is reached in the center, providing equal tax revenue payoffs to both countries (Rixen & Schwarz, 2009). In the case of asymmetric countries, however, the equilibrium outcome in case of unilateral tax relief is tilted towards the capital-importing country (country S) since it is assumed that the source country has sufficient knowledge about an MNE's business activities in its territory to tax them while the residence country lacks the necessary information (Rixen & Schwarz, 2009). Moreover, in case of asymmetric countries, the source country has incentives to increase source taxation; thus, its opposing strategy influence the negotiations in this situation

(Rixen & Schwarz, 2009). Consequently, the expected outcome of the negotiations is more beneficial to country S and the treaty outcome on welfare level (3) is shifted towards country S (Rixen & Schwarz, 2009). Thus, a higher proportion of source taxation is expected for asymmetric countries according to the bargaining model (Rixen & Schwarz, 2009). Consequently, for asymmetric treaty partners, it can be concluded that a higher source taxation proportion results from stronger bargaining of the net capital importer in the treaty negotiations as it managed to pursue its economic interests.

A limitation of the model is the assumption that the amount of investment capital is exogenous (i.e., no additional investment is encouraged by concluding a DTT) which is a common assumption in the literature (Rixen and Schwarz based their game-theoretical model on a mathematical bargaining model constructed by Chisik and Davies who applied the same assumption (Chisik & Davies, 2004)). Whether it is reasonable to apply this assumption will be further examined by the gravity model estimation of potential effects of signing DTTs on FDI (chapter 4). Generally speaking, merely analyzing a fixed amount of FDI can be described as a static analysis as opposed to a dynamic analysis which would take changing FDI flows into account. Chisik and Davies consequently describe their analysis as a snapshot-analysis of a single period (Chisik & Davies, 2004).

3.2. The Structure of DTTs Following the OECD MC

Since most DTTs follow the OECD MC (Pistone & Zagler, 2019), the main treaty provisions will be outlined based on the structure of the OECD MC (OECD, 2017) in this section.

The OECD MC is structured into seven chapters with 32 articles in total: The first one specifies the persons and taxes covered in the scope of the treaty (articles 1 and 2), the second one defines the terminology used such as "residents" (articles 3-5), the third chapter comprises the taxation of income (articles 6-21), the fourth chapter covers the taxation of capital (article 22), the fifth chapter defines the methods applied for the elimination of double taxation (article 23), the sixth one defines special provisions (articles 24-30), and the seventh chapter finally concludes with provisions for the entry into force (article 31) and the termination of the DTT (article 32) (OECD, 2017).

For this research, the chapters three and four are particularly relevant since they contain the articles that allocate the taxation rights between the two treaty countries. Thus, they display the outcome of the treaty bargaining process while other provisions such as the methods of double taxation elimination are set unilaterally by each country. Only the provisions subject to treaty bargaining will be discussed in the following since these provisions will serve as the basis to determine the proportion of source taxation rights in chapter 5.

The types of income comprised by the OECD MC are income from immovable property, business profits, capital gains, income from employment, and other income (Zagler &

Pistone, 2019). For business profits, the articles 5 and 10 to 12 are particularly important as article 5 defines the concept of a "permanent establishment" (PE) and the articles 10 to 12 define withholding tax (WHT) rates which are central instruments of dividing source taxation rights and residence taxation rights.

A PE is a fixed place of business that creates a corporate tax liability in the source country. DTTs thus define a maximum time threshold (12 months in the OECD MC) until which business activities such as construction or installation works can be rendered in the source country without creating a tax liability (OECD, 2017). Certain DTTs also include services such as consulting or management services as an additional PE threshold in article 5.

WHT rates are taxes that are required to be withheld at source when transferring a payment from the source country to the residence country (i.e., the recipient receives only the net amount after tax) (Hearson, 2015). They are usually applied on dividends (article 10), interest (article 11), royalties (article 12), and technical service fees (commonly included in definition of royalties in article 12) (OECD, 2010).

Regarding the allocation of taxation rights, DTT provisions can be split into two main categories[6]: Articles that prevent double taxation by allocating the full taxation rights to one country, and articles that allow the sharing of taxation rights, usually with the additional definition of a maximum threshold for source taxation.

[6] Division inspired by Pistone & Zagler (2019) and adapted by author for the purposes of this thesis.

The first category comprises the articles 7 (as long as no PE is created), 8, 12, 13.3, 13.5, 15.1, 15.2, 18, 19.1A, 19.1B, 19.2A, 19.2B, 21.1, 22.3, and 22.4 (Pistone & Zagler, 2019). Notably, most of these clauses allocate the taxation rights to the residence country instead of the source country by default (Pistone & Zagler, 2019); thus, it can be stated that DTTs generally favor residence taxation over source taxation (Neumayer & Barthel, 2012). The second category entails the articles 10, 11, and 12 for defining WHT provisions plus the articles 13 to 17, 21, and 22 for the specific provisions on the taxation of income and capital, which for instance comprise directors' fees (article 16). These second-category provisions require the definition of a relief method applied by the residence country to avoid double taxation (Pistone & Zagler, 2019).

Therefore, article 23 states the relief method applied on the taxes paid in the other country such as taxes on profits that incurred in connection with a PE (article 5). Some countries fully exempt income that has already been taxed in the source country (exemption rule defined in article 23A), some national tax codes allow to credit the taxes paid towards the tax due in the residence country (credit rule defined in article 23B) (Rixen, 2010), and in some exceptional cases, a partial relief is provided through deduction of the taxes paid from the taxable income in the residence state (deduction rule, not separately defined in the OECD MC) (Findlay, 1986).

Finally, article 25 of the OECD MC contains arbitration provisions that become effective when no agreement on the imposition of taxation rights can be reached by the competent authorities of the two contracting states (Arnold, 2015). Thus, DTTs also define a dispute resolution mechanism and authority, which reveals them as incomplete contracts from a

law and economics perspective since they necessarily involve uncertainty and hence require a certain level of flexibility (Rixen, 2010). The high complexity of international taxation rules leads to a broad range of unforeseen contingencies that could arise in the future (Rixen, 2010). The transaction costs of defining rules for every possible future contingency *ex-ante* would thus be too high, causing a need to incorporate a valid litigation mechanism for *ex-post* negotiations (Rixen, 2010). Article 25 could therefore be regarded as the implementation of an efficient solution to unforeseen contingencies in terms of an opportunity to renegotiate the contractual terms *ex-post* (following the reasoning of Kovac, 2011).

3.3. Motivations to Sign DTTs

Apart from the avoidance of double taxation, DTTs fulfill several further functions: They shall prevent tax evasion, which can occur when countries do not exchange information about their taxpayers and the taxable activities rendered in their territory, attract foreign investments by establishing favorable tax conditions for multinational firms and investors, encourage mutual trade and thus generate additional tax revenue (Braun & Zagler, 2014), and ultimately strengthen the economy by generating jobs and importing technical and scientific knowledge into the country via international project business (Zolt, 2018). Moreover, DTTs fulfill a signaling function by indicating legal certainty and a willingness of the source state to adhere to internationally accepted standards in taxation (Braun & Zagler, 2014).

The relevance of each of these functions in the motivation to sign a tax treaty often depends on the investment positions of countries: Net capital-exporting countries tend to focus on creating a large net of administrative cooperation with other states to encourage their companies to expand to other markets while net capital-importing countries tend to specifically target the attraction of FDI that imply a knowledge and technology transfer and thus increase economic growth (Braun & Zagler, 2014). In addition, it needs to be noted that not only direct economic interests, but also political reasons and competitive pressure may be the main motivations of a country to sign DTTs (Hearson, 2018). As such, a tax treaty can also be part of a deal package that a country accepts to improve the relationship with another country or to attract a specific large-scale project (Pistone & Zagler, 2019).

In the existing literature, this broad range of motivations for developing countries to sign a treaty is often simplified as a decision between the attraction of FDI or the generation of additional tax revenue and most authors try to evaluate whether a DTT is profitable based on one of the two aspects. In the following, the two perspectives shall be discussed including empirical findings from existing studies and shall be extended by a law and economics perspective.

Firstly, the rather classical perspective that regards DTTs as instruments to positively impact the allocation of global resources is introduced (focus on investments). Secondly, a rather Marxian perspective that describes developing countries' tax competition as a "race to the bottom" will be explained (focus on tax revenues). And thirdly, both

countries' incentives to contract will be analyzed by focusing on the aspect of cooperation and information exchange from a law and economics perspective.

3.3.1. The Classical Perspective: Efficient Allocation of Resources

According to Friedrich Hayek, an efficient allocation of resources can only be achieved through competition as opposed to central economic planning due to the dispersed distribution of information in the market (Hayek, 1945). Rational decisions can only be made by individuals if they can gain sufficient knowledge about an upcoming situation to form preferences and decide what best increases their utility (Hayek, 1945). Hayek argues that the main mechanism of communicating information between market participants is the price system since prices are constantly adjusted depending on how much consumers value a good in the relevant market and how difficult it is to produce that good (Hayek, 1945). Thus, prices fulfill a signaling function that enhances efficiency (Elkins, 2016).

Elkins applies this logic to international taxation and argues that host countries use taxation rates to attract resources (i.e. investments) from MNEs while MNEs inversely signal their investment preferences by choosing where to locate a cross-border project (Elkins, 2016). Thus, he argues, resources are invested in the countries that value them the highest and hence in the most efficient way (Elkins, 2016).

Finally, according to the classical economic school, free tax competition ensures allocative efficiency and enables the compensation of negative tax treaty effects in host countries (such as lower tax rates) through the simultaneously received investment benefits

(Elkins, 2016). A broad overview on the empirical findings of the influence of DTTs on investments into a country will follow in chapter 4.1.

3.3.2. The Marxian Perspective: The Race to the Bottom

The theory of the "race to the bottom" (Rixen, 2011, p. 201) states that free tax competition does not primarily lead to an efficient allocation of investments but to an undercutting of tax rates between countries in order to attract capital until the tax rates reach an inefficiently low level (Rixen, 2011).

This pressure to undercut competing peer countries' tax rates has its origins in the widely prevailing residence principle of international taxation that generally assigns the taxation rights of business activities to the country in which the respective taxpayer is resident (Keen & Ligthart, 2006). Theoretically, this principle is founded on the Diamond-Mirrlees production-efficiency theorem that states that production decisions need to be left undistorted to generate pareto-efficient outcomes (Diamond & Mirrlees, 1971). Thus, productive efficiency needs to be ensured by taxing capital at the same tax rate in every jurisdiction, thereby eliminating tax-induced distortions in investment localization decisions (Keen & Ligthart, 2006). While this cannot be practically implemented for the source taxation principle since no central authority can dictate taxation rates to sovereign states, it can be established for the residence taxation principle as the application of the credit method allows a residence country to tax foreign-earned income at the same tax rate as domestically earned income (under the presumption that foreign rates are lower) (Xiong, 2018). Consequently, residence countries are in a better bargaining position for

DTT negotiations as they have the initial taxation rights and are less compelled to attract FDI through tax competition.

Neumayer and Rixen describe this disparity in their analysis of their "spatial dependence theory", stating that "practically all DTTs favor residence over source taxation" (Neumayer & Barthel, 2012, p. 645), particularly since DTTs always limit source taxation compared to a non-treaty situation (Hearson, 2018). Neumayer and Barthel thus focus merely on the potential generation of corporate income tax revenues in their analysis. The theory can be regarded as a Marxian perspective on tax competition since it is claimed that less developed countries are economically forced to sign DTTs due to the actions of other countries and a dependence on FDI is assumed.

Since an increase in globally concluded DTTs can be observed, particularly among developing countries in Africa, Neumayer and Barthel argue that the incentives to sign treaties despite their high tax revenue costs are derived from the actions of neighboring developing countries who decided to use DTTs as investment incentives and thus to intensify competition (Neumayer & Barthel, 2012). They find evidence for this expected "spatial dependence" by empirically showing that countries tend to sign more DTTs if peer countries who export the same goods have already signed one (Neumayer & Barthel, 2012). Finally, they conclude that potential treaty partners feel more pressured to sign DTTs if more (neighboring) countries with a similar investment position have already done so up to the point where the capital-importing country assumes a net loss in corporate income tax revenue from the conclusion of a treaty (Neumayer & Barthel, 2012).

Jansky (2018) confirms this finding by estimating the costs of tax treaties by using potential revenue losses from reduced treaty WHT rates compared to the domestic WHT rates that would be applied in a non-treaty situation as a proxy. He determines annual revenue losses of several million US dollars for developing countries in Sub-Sahara Africa and Asia, with the highest approximate estimates found for the Philippines (USD 519 million) and Pakistan (USD 214 million) (Jansky, 2018).

3.3.3. The Law and Economics Approach: Information Sharing

From a law and economics perspective, one of the main reasons for contracting is the sharing of risks and the allocation of goods in a mutually beneficial way (Shavell, 2003). Applying this reasoning to international taxation, two countries sign tax treaties to share potential tax revenue from MNEs in a mutually beneficial way between them and at the same time to also share the risks of not identifying taxable business activities and thus losing tax revenue. DTTs therefore also help to prevent tax evasion by providing a contractual basis between two countries to exchange information about MNEs and their taxable business activities. Thus, DTTs contain provisions on administrative cooperation such as information exchange in article 26 OECD MC and UN MC and the assistance in the collection of tax revenue claims in article 27 OECD MC and UN MC (OECD, 2017, and United Nations, 2011).

Countries are generally assumed to be profit-maximizers (Paolini, Zagler, Pistone, & Pulina, 2014). Thus, they only share information with other countries voluntarily if they financially profit from it. It is generally assumed that source countries have more detailed information about the taxable income generated by MNEs since the activities are usually

provided to customers resident in the source country, while it is possible for MNEs to hide investments abroad from their national tax authority in their residence country (Paolini, Zagler, Pistone, & Pulina, 2014). Consequently, information sharing is not necessarily mutually beneficial for two countries: Since taxpayers pay taxes on their global income in their state of residence (residence principle), additional information on a company's business activities abroad provided by the source country mostly benefits the residence country (Keen & Ligthart, 2006). Thus, different incentives to share information can be assumed for countries depending on their capital balance.

For the sake of simplicity, two major effects from the provision of information can be observed for source countries: Providing information to foreign tax authorities can decrease FDI as information-providing countries are usually less attractive to foreign investors who have incentives not to report all income generated abroad (Keen & Ligthart, 2006). However, in case of reciprocity, this effect may be outweighed by the additional tax revenue gained from a broader base of taxable income of the abroad-investing MNEs for which the residence country had missed the information on taxable business activities (Keen & Ligthart, 2006). This second effect of information sharing exists for both developing and developed countries since most countries worldwide face the issue of wealthy residents depositing undeclared capital abroad (Keen & Ligthart, 2006). However, based on a country's net FDI balance, one of the two effects usually outbalances the other effect. Thus, broadly speaking, developed countries have more incentives to conclude reciprocal agreements to share information since they require

information about their resident investors while the attraction of FDI usually prevails for developing countries (Keen & Ligthart, 2006).

However, from a law and economics perspective, there is an incentive-sharing solution to this issue that could also be described as "offering [...] a carrot rather than a stick" (Keen & Ligthart, 2006, p. 87). Drawing on information sharing theories, revenue sharing by the residence country in exchange to information sharing by the source country can create a mutually beneficial exchange between the two states since incentives in terms of additional tax revenue are provided to developing countries when the provision of information is treated like a service to the developed country (Paolini, Zagler, Pistone, & Pulina, 2014).

Considering a non-cooperative single-staged game in which decisions must be made simultaneously by both treaty partners, the developing country S (source country) is presented with a prisoner's dilemma:

		Country R	
	Strategies	**Low Source Tax.**	**High Source Tax.**
Country S	**Not Sharing Information**	30, 30 ←	100, -10
	Sharing Information	-10, 100 ←	60, 60

Figure 2: Adapted presentation of Keen & Ligthart's (2006) reasoning as a Prisoner's Dilemma of information sharing and the distribution of source and residence taxation rights

If country S chooses to share information but country R simultaneously tries to reduce treaty rates and thus tries to reduce the proportion of source taxation rights in the DTT, the worst outcome is obtained by country S (-10), but the highest payoffs are received

by country R (100), resulting in a total payoff of 90. In a single-stage game, both countries would merely act in their own direct interest (country S does not share information and country R bargains for low source taxation rights) and the lowest potential sum of payoffs would be obtained (60).

However, in a two-staged game by playing repeated games or cooperating in the treaty bargaining process, a mutually beneficial situation can be obtained in which country S shares information and country R is therefore incentivized to agree to more source taxation rights in the treaty. Thus, in the long run, information sharing and tax revenue sharing are expected to be the dominant strategies based on the theoretical model.

4. The Gravity Model of Trade – An Empirical Analysis of the Influence of DTTs on FDI

The gravity model of international trade was created to predict dyadic trade flows between two countries by controlling for their economic sizes and both geographical and political distance between them (Tinbergen, 1962, as cited in Baier, 2020). Thus, it is a widely used tool for modeling the economic effects of policies in international trade (Shepherd, 2016).

The name "gravity model" is derived from Newton's gravitation law which states that the force of attraction of particles to one another is proportional to the product of their masses and inversely proportional to the square of the distances between their centers (Encyclopaedia Britannica, 2021). Economic gravity models apply this rationale by using countries' economic sizes (as masses) and the distance between their capital cities or most populated cities to estimate trade flows (in goods or services) or monetary flows such as FDI between the two countries (Shepherd, 2016), assuming that countries that are economically larger and closer to each other interact to a higher degree (i.e. trade more). The variables in the gravity model are thus suitable as control variables for estimating a policy's effect on FDI (Baier, 2020).

4.1. Literature Review of Influence of DTTs on FDI

Many empirical studies have assessed whether and to which extent an influence of DTTs on FDI inflows into countries can be determined; however, their findings are inconsistent (Hearson, 2018).

Neumayer et al. (2010) find a positive correlation of DTTs and FDI stocks by using panel data of 30 source countries and 106 residence countries from 1974 to 2004. They conclude that on average, a 27.3% increase in FDI stocks can be expected by a source country by signing a DTT (Barthel, Busse, & Neumayer, 2010). A slightly lower increase of 22% on average could be found by Neumayer in the analysis of US FDI outbound stocks (Neumayer, 2007), whereas Petkova et al. find an 18% increase in FDI for DTTs by taking into account that MNEs may also use the DTTs of intermediate countries for investments[7] (Petkova, Stasio, & Zagler, 2020). Lejour also considers the possibility of treaty shopping and determines a 16% increase in FDI through DTTs in general and a 21% increase for recently concluded DTTs by using bilateral FDI stocks of OECD countries from 1985 to 2011 (Lejour, 2014).

In contrast, other studies have found a negative correlation of DTTs and FDI that may be explained by increased information sharing of the treaty partners through DTTs which could interfere with strategies of MNEs to evade taxes by investing abroad (Blonigen & Davies, 2002). Bloningen and Davies, who use panel data from 1982 until 1992 on OECD countries and FDI stocks, find a non-significant negative effect of DTT formation on FDI, suggesting that a treaty's function to avoid tax evasion may be more relevant than its function to promote investments into a country (Blonigen & Davies, 2002). Egger et al. confirmed this negative correlation of DTTs and FDI by finding a significant negative

[7] This practice is called "treaty shopping" and refers to the strategic redirection of FDI through third countries due to more favorable investment treaties (Petkova, Stasio, & Zagler, 2020).

effect of DTTs on bilateral outward FDI stocks of OECD countries (Egger, Larch, Pfaffermayr, & Winner, 2006).

Finally, there are also studies that could not find a statistically significant effect of DTTs on FDI: Coupé et al. did not find consistent effects by analyzing FDI flows from OECD countries to transition economies from 1990 to 2001 and explain this inconsistency with the different estimators applied (Coupé, Orlova, & Skiba, 2009). Baker instead concludes that no effect could be determined in his econometric model since residence countries have already implemented unilateral double taxation relief mechanisms, thus eliminating tax reasons for their MNEs' investment location choices (Baker, 2014).

In conclusion, different results were obtained by researchers depending on the chosen country sample and availability of FDI data. Further research in this field is thus still required for complementing the stock of knowledge on DTTs.

4.2. Model Specification and Data

The present research paper uses a gravity model dataset prepared in cooperation with the European Institute for International Economic Relations (EIIW) at the Schumpeter School of Business and Economics at the University of Wuppertal (Germany). Bilateral FDI flows are based on data taken from UNCTAD (UNCTAD, 2021), gravity variables as control variables were obtained from CEPII (CEPII, 2021), data on bilateral investment treaties was received from the World Bank (World Bank Group, 2021), and additional political indicators ("World Governance Indicators") as control variables were also provided by the World Bank (Kaufmann & Kraay, 2020).

Due to the limited availability of dyadic FDI flow data, the present research assesses the effect of the conclusion of a DTT on FDI based on data of 61 countries which had available bilateral inflow and outflow data (listed in appendix 2) from 2001 to 2012. The FDI inflows have been determined by compilating inflows and their reported origins by researchers of the EIIW. For the LDCs, only unilateral FDI inflows are available on UNCTAD (without sufficient information on its origins), which do not allow to analyze the effects of bilateral tax treaties with a gravity model due to its dyadic structure. Thus, the 61 countries with available data were clustered into higher developed countries and developing countries based on the HDI to assess differences between developing and developed countries. Year fixed effects were used to control for variables that are constant across countries but vary over time. The inclusion of time fixed effects is a common technique applied for panel datasets (Shepherd, 2016). Country fixed effects were not applied due to a small, expected variance between the variables in the rather short period of time (compare to reasoning of Fischer (2010)).

As the dataset also included negative FDI flows (which can result for example from reinvested earnings if paid out dividends are greater than the recorded income (OECD, 2008)), these negative flows have been coded as zero since the estimators intended to be used cannot take negative values into account and dropping them could have led to a larger bias (Baier & Welfens, 2018). Missing values have further been excluded.

Subsequently, the OLS estimator could not be used for a regression with the dataset since the dependent variable is log transformed for OLS regressions and zero values would consequently not be taken into account (Shepherd, 2016). While an OLS regression may

still be suitable for datasets with merely few zero values and can be preferred for robustness (Baier, 2020), using the Poisson Pseudo Maximum Likelihood (PPML) estimator in log-linearized form is preferable for the present dataset which includes 69.67% zero values for FDI flows and thus requires an estimator that is resilient to large proportions of zero values (Tenreyro & Santos Silva, 2011). Besides its strong performance in datasets with many zero values, another major advantage of the Poisson regression is its consistency regardless of the data distribution (Shepherd, 2016). As independent variables are log transformed in Poisson models, they can be interpreted as simple elasticities as opposed to semi-elasticities for non-log transformed variables (Shepherd, 2016).

However, for the sake of comparability, a linear regression with the OLS estimator shall be run in addition to the PPML estimation. Thus, a second dataset has been created in which infinitesimal values were added to the FDI inflow data, thus eliminating zero values. This technique to assign small numbers to zero values is a common solution to missing data in OLS estimations (Baier & Welfens, 2018).

Particularly the PPML estimator, which was developed by Silva and Tenreyro in 2006 (Silva & Tenreyro, 2006), is a popular estimator choice for gravity models in the literature (Bobkova, 2012) as it allows to include two important estimation options to reduce biases in the results: It automatically includes the "robust" command that ensures the robustness of standard errors to heteroscedasticity, and it allows to specify clusters in the data in order to take correlated standard errors within specific groups into account (Shepherd, 2016). In gravity models, country pairs are likely to have highly correlated

standard errors since dyadic trade or capital flows are estimated. Thus, it is common to use the distance variable for clustering since the distance between two countries is identical in both directions and unique to a country pair; consequently, it enables the identification of unique groups (Shepherd, 2016).

The gravity model developed for this research is formalized as:

$$lnFDIinflows_{ij} = ß_0 + ß_1 DTTexistence_{ij} + ß_2\ ln\_dist_{ij} + ß_3\ lnGDP\_T_i + ß_4\ lnGDP\_O_j + ß_5\ contig_{ij} + ß_6\ comlang\_off_{ij} + ß_7\ colony_{ij} + ß_8\ BIT_{dummyij} + ß_9\ RegQuality\_T_i + ß_{10}\ RuleOfLaw\_T_i + ß_{10}\ CorruptControl\_T_i + u_{ij}$$

where $ß_1$ measures the effect of the dummy variable for the existence of a DTT in the specific year (*DTTexistence*) on the log transformed FDI. The model controls for the log transformed distance between the countries (*ln_dist*), the countries' log transformed GDPs (*lnGDP_T* and *lnGDP_O*), contiguity between the two countries (*contig*), an official common language (*comlang_off*), whether the two countries ever had a colonial relationship (*colony*), the existence of a bilateral investment treaty (BIT_{dummy}) between the countries, the level of corruption in the target country T (*CorruptControl_T*), the regulatory quality in the target country T (*RegQuality_T*), and the rule of law in country T, which describes the quality of contractual enforcement, property rights, the crime rate and the reliability of the country's executive and judicative forces (*RuleOfLaw_T*). It should be noted that the FDI inflows and all gravity model-related variables describe a bilateral relationship between the two countries while the governance control variables unilaterally refer to the target country T.

In line with the research question presented in chapter 2 ("*Do Double Taxation Treaties (or selected provisions of them) influence FDI inflows into developing countries and can we observe differences for country pairs with asymmetric investment positions?"),* the model will be used to test whether a significant effect of *DTTexistence* on FDI inflows can be determined. The hypotheses are consequently formalized as:

H_0: $\beta_1 = 0$

H_1: $\beta_1 \neq 0$.

The effects of the indices developed for this research on FDI inflows will similarly be tested in the following chapter by using the same gravity model equation with the indices as predictor variables.

4.3. Empirical Findings

In order to provide a comprehensive view on the estimated effects and to compare the traditional regression method for a gravity model with the improved PPML estimation, both regression types were run in STATA. The following table shows the found estimates for a linear regression using year fixed effects (for which the dummies are not displayed here for reasons of space):

Linear Regression With Fixed Effects

Number of obs = 40,260
F(11, 40238) = 1325.04
Prob > F = 0.0000
R-squared = 0.2538
Adj R-squared = 0.2534
Within R-sq. = 0.2495
Root MSE = 7.3024

		Robust				
lnFDI	Coef.	Std.Err.	t	P>t	[95%Conf.	Interval]
DTTexistence	-0.275	0.100	-2.750	0.006	-0.471	-0.079
ln_dist	-2.417	0.048	-50.390	0.000	-2.511	-2.323
lnGDP_O	1.597	0.021	76.810	0.000	1.556	1.637
lnGDP_T	0.851	0.022	38.790	0.000	0.808	0.894
contig	0.605	0.239	2.530	0.011	0.136	1.073
comlang_off	1.627	0.180	9.040	0.000	1.274	1.980
colony	2.327	0.282	8.260	0.000	1.775	2.879
BITdummy	0.183	0.153	1.200	0.232	-0.117	0.484
RegQuality_T	2.384	0.112	21.270	0.000	2.165	2.604
RuleOfLaw_T	-2.552	0.174	-14.630	0.000	-2.894	-2.210
CorruptControl_T	0.070	0.127	0.550	0.584	-0.180	0.319
_cons	-17.885	0.597	-29.960	0.000	-19.055	-16.715

Absorbed degrees of freedom:

Absorbed FE	Categories	-	Redundant	=	Num.	Coefs
year	11		0		11	

Table 1: Linear regression with time fixed effects in STATA

A negative effect of -0.275 could be estimated for the existence of a DTT which was also statistically significant at the 0.01 significance level (α=1%). This indicates that the existence of a DTT between two countries decreases FDI inflows by about 24%[8] on average, ceteris paribus.

Notably, all gravity-related predictors and the governance variables rule of law and regulatory quality were statistically significant at the 5% level (or better) and showed positive estimates. However, the geographical distance between two countries and the rule of law were negatively correlated with FDI inflows, indicating that FDI inflows

[8] The coefficients of non-log transformed regressors have to be interpreted as semi-elasticities: $e^{-0.275}-1 = -0.2404$ (Shepherd, 2016).

decrease with increasing distance between a source country and an investor, and also with increasing quality of a source country's institutions. The latter finding implies that investors prefer unstable countries for investments, possibly indicating a preference for countries with less formalized taxation systems.

As heteroscedasticity could be observed in the dataset by performing a Breusch-Pagan test in STATA, the PPML estimator is advised to be used since it is consistent in the presence of heteroscedasticity. Thus, the choice of the PPML estimation technique has been confirmed by the heteroscedasticity test for the given model (Silva & Tenreyro, 2006).

The following table shows the found results of the PPML estimation:

PPML Estimation With Fixed Effects

FDIinflows	Coef.	Std.Err.	t-value	p-value	[95% Conf	Interval]	Sig
DTTexistence	-.262	.067	-3.91	0	-.393	-.13	***
ln_dist	-.825	.043	-19.18	0	-.909	-.741	***
lnGDP_O	.643	.029	22.49	0	.587	.699	***
lnGDP_T	.471	.037	12.68	0	.398	.544	***
contig	-.517	.106	-4.88	0	-.725	-.309	***
comlang_off	.82	.09	9.10	0	.643	.997	***
colony	.687	.127	5.42	0	.438	.935	***
BITdummy	-1.087	.097	-11.23	0	-1.277	-.897	***
RegQuality_T	.938	.126	7.43	0	.691	1.186	***
RuleOfLaw_T	-.74	.168	-4.41	0	-1.069	-.411	***
CorruptControl_T	.225	.12	1.88	.061	-.01	.46	*
Constant	-2.689	.687	-3.92	0	-4.035	-1.344	***

Mean dependent var	309.374	SD dependent var	2332.255
Pseudo r-squared	0.500	Number of obs	40260
Chi-square	5819.266	Prob > chi2	0.000
Akaike crit. (AIC)	39006111.551	Bayesian crit. (BIC)	39006214.788

*** $p<.01$, ** $p<.05$, * $p<.1$

Table 2: PPML estimation with time fixed effects in STATA

As for the OLS estimator, a statistically significant negative effect could be estimated (-0.262) with the PPML estimator for the existence of a DTT. The result of the refined

estimation technique is thus very similar to the linear regression result and only indicates a slightly smaller effect of about -23%. Again, negative significant effects were found for the rule of law and the distance between two countries and additionally also for the existence of a bilateral tax treaty and contiguity between two countries.

By reducing the scope to DTTs that involve at least one developing country, a positive significant effect at the 1% level of 0.647 could be estimated in a linear regression, indicating a 90.98% increase in FDI inflows for the existence of a DTT, while a negative significant effect at the 1% level of -0.35 was found with the PPML estimator.[9] The linear OLS estimator assumes homoscedastic error terms since all observations should be included with equal weight. However, if heteroscedasticity is present, the observations with larger variance are weighted more heavily and thus distort the result.

Consequently, as the linear regression is expected to produce biased estimations due to heteroscedasticity, the negative effect obtained from the PPML estimation is assumed to be the true effect observed. Thus, a stronger negative effect of having signed a DTT could be found for FDI inflows into developing countries (-29.53%) compared to the effect found for FDI inflows in general (-23.05%).

Finally, H_0 could be rejected as significant negative effects at the 1% significance level could be found both for all countries in the dataset and for DTTs with developing countries in particular.

[9] Output tables from STATA are shown in appendix 4 and 5.

4.4. Limitations

Somewhat counterintuitively as a fixed effects model for panel data has been employed, omitted variable bias may be a limitation of this research. Omitted variable bias occurs when not all independent variables that significantly influence the dependent variable are included in the model and can be regarded the central limitation of nonexperimental studies (Hill, Davis, Roos, & French, 2020). In this case, the resulting estimates are biased due to a correlation of the independent variables with the error term (Hill, Davis, Roos, & French, 2020).

Although the control variables in the presented gravity model have been selected carefully and with due consideration of previous studies, it cannot be ruled out that further factors that are correlated with both the variable of interest (*DTTexistence*) and the dependent variable (*lnFDIinflows*) were missing in the model and thus changed the estimates obtained. Generally speaking, fixed effects models are used to minimize omitted variable bias by reducing overall variation as the variation between units (in the given research: time) is eliminated (Hill, Davis, Roos, & French, 2020). However, there may still be variation within the groups (as no country fixed effects were employed) such as FDI-discouraging changing legislation that could not be included in the model due to data availability.

Another important limitation to consider for this research is sample selection bias. Due to a limited availability of bilateral FDI flow data that could be used for building the dataset, only very few low developed countries could be included in the estimation,

particularly only two LDCs (Myanmar and the Lao People's Democratic Republic) were included. Thus, as most countries in the dataset (75.41%) belong to the highest developed cluster of the HDI categorization, the external validity of the model may be limited for comparative approaches between developed countries and developing countries. Including a greater number of developing countries, particularly LDCs, in the sample in order to allow for a broader generalization of the found effects would be interesting for future research. Especially with regards to the estimation of the effect of the indices presented in chapter 5, a dataset with a great number of developing countries could be a valuable instrument for confirming or opposing the effects found in this research.

5. The Impact of Selected Treaty Provisions on FDI

The following analysis of the impact of selected tax treaty provisions on FDI uses both the ActionAid Tax Treaties dataset created by academic researchers of the ICTD (ICTD, 2020) and the gravity model equation introduced in chapter 4. The proportion of source taxation rights shall first be analyzed with regards to the treaty partners' asymmetry of investment positions in a descriptive statistical analysis and then be contrasted with the findings from the gravity model estimation.

The ActionAid Tax Treaties dataset encodes the treaty provisions of 519 DTTs signed by African and Asian developing countries into quantitative measures and was developed to allow researchers and policymakers to make more informed decisions about their detailed treaty terms (Hearson, 2016). 17 out of 28 clauses in total that are subject to treaty bargaining have been encoded into categorical variables based on a binary coding scheme ("YES" and "NO"), and 11 clauses defining treaty rates (such as the articles 10-12) have been encoded as continuous variables. Based on these encoded clauses, four main indices taking values between 0 and 1 have been calculated in order to enable comparisons of treaty sections.[10] The indices thereby describe the negotiated treaty provisions clustered by their content (for example, all clauses relevant to the creation of a PE form the "*PEindex*"). Each of the indices displays the average of the clauses it contains without an additional weighting of certain clauses. A higher index indicates a higher share of taxation rights remaining in the source country, thus indicating

[10] See appendix 6 for the coding strategy of the indices.

comparably strong negotiations of the capital-importing country (that is more likely to be the source country). In addition to the four indices referring to the negotiations about the splitting of taxation rights, one additional index has been calculated to describe the amount of cooperation in terms of information exchange between the treaty partners (*INFOEXindex*). The following table illustrates the indices' contents and their descriptive statistics:

Index	Description	Obs.	Mean	Std. Dev.	Min	Max
SOURCEindex	Average of *PEindex*, *WHTindex* & *OTHERindex*	8704	.49	.152	.09	.81
PEindex	Thresholds for the PE creation	8704	.46	.133	0	.76
WHTindex	Average of WHT rates	8704	.52	.265	.05	.95
OTHERindex	Capital gains, directors' fees, shipping, and other income	8704	.48	.186	0	1
INFOEXindex	Level of cooperation through information exchange	8704	.11	.213	0	1

Table 3: Indices calculated by author based on the ICTD dataset (ICTD, 2020)

As all indices range between 0 and 1, they can also be interpreted as percentages. Thus, the *SOURCEindex* for instance displays the percentage of source taxation in a DTT.

For this research, the dataset was extended by 14 DTTs signed by two EU countries to enable a comparison between the treaty provisions in

1. DTTs between two EU countries (symmetric investment positions)
2. DTTs between an LDC and an EU country (asymmetric investment positions)
3. DTTs between two LDCs (rather symmetric investment positions).

Previously, the dataset did not include any treaties signed by two developed countries, so a comparison of their treaty provisions would not have been possible. As explained in the methodology in chapter 2.1., only DTTs concluded between France and 14 further net capital-exporting EU countries have been included in the dataset due to restrictions in time (instead of all DTTs concluded between capital-exporting EU countries). France was considered a particularly interesting treaty partner due to its high number of DTTs concluded with both LDCs and EU countries.

Based on the analysis of Rixen and Schwarz (2009) in chapter 3.1, one would assume all four indices to be the highest for treaties concluded between EU countries and LDCs due to the asymmetry of their investment positions. Moreover, the indices are expected to be slightly lower for treaties between two EU countries than for treaties between two LDCs since only capital-exporting EU countries have been included in the dataset (who have incentives to decrease source taxation) while almost all LDCs[11] are net capital importers

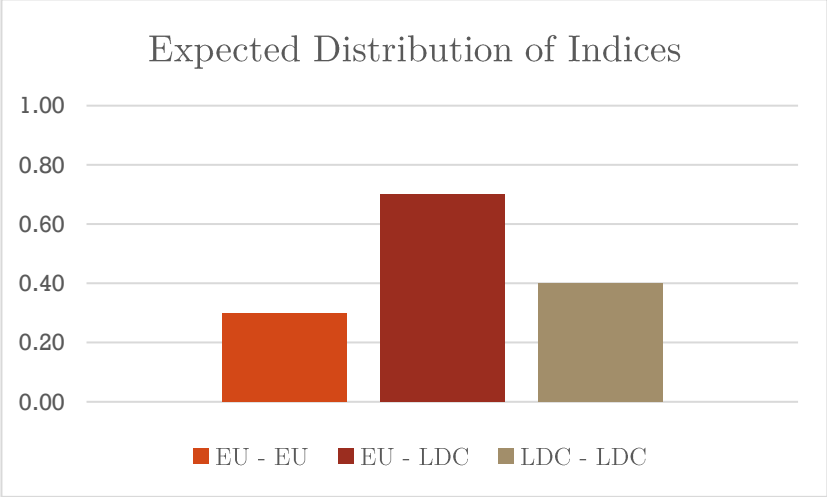

Figure 3: Theoretically expected distribution of indices based on the analysis of Rixen and Schwarz (2009) in chapter 3.1.

[11] Only Zambia and Madagascar are net capital exporting LDCs (see appendix 1).

and thus are expected to negotiate higher source taxation. Hence, the expected distribution of index rates could be proportionally visualized as displayed in figure 3.

The expected index distribution could only be partially confirmed by the empirical data (figure 4[12]):

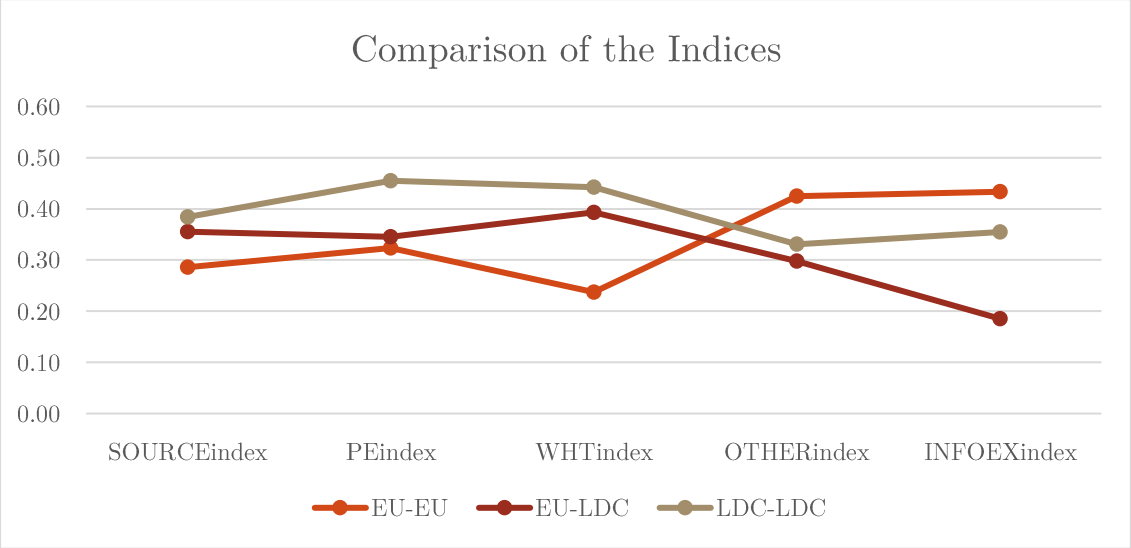

Figure 4: Comparison of calculated indices, showing a particularly high percentage of source taxation for LDCs in general and notable differences for other treaty provisions and information exchange

As expected, treaties between two EU countries show a particularly low average *PEindex* (32%) and *WHTindex* (24%) which led to a low overall *SOURCEindex* (29%). This substantiates Rixen and Schwarz's theoretical model for countries with symmetric investment positions as described in chapter 3.1. (Rixen & Schwarz, 2009). The *OTHERindex*, however, displays the highest average values for DTTs between two EU countries (43%), indicating that symmetric treaty partners do not necessarily try to ensure a low proportion of source taxation in a DTT but rather focus on specific types

[12] All following figures are based on the ActionAid Tax Treaties Dataset by the ICTD (ICTD, 2020).

of taxable income that may be taxed in the source country. Also, EU countries show more cooperation in terms of information exchange compared to the other two groups.

The five indices will be explained in detail in the following subchapters including potential qualitative explanations for differences to theoretical expectations.

The subsequent gravity model estimation will be conducted with the following equation:

$$lnFDIinflows_{ij} = ß_0 + ß_1 SOURCEindex_{ij} + ß_2\ ln\_dist_{ij} + ß_3\ lnGDP\_T_i + ß_4\ lnGDP\_O_j + ß_5\ contig_{ij} + ß_6\ comlang\_off_{ij} + ß_7\ colony_{ij} + ß_8\ BIT_{dummyij} + u_{ij}$$

The *WHTindex*, *PEindex*, *OTHERindex*, and *INFOEXindex* will be used as predictor variables respectively.

5.1. The Ratio of Source Taxation Rights Index (*SOURCEindex*)

The *SOURCEindex* shows the average of the *PEindex*, the *WHTindex*, and the *OTHERindex* and thus takes all the clauses that are subject to treaty bargaining into account without assigning a weighting factor to any of the indices. It shows the overall level of source taxation in a DTT and can thus be interpreted as a measure for the success of the source country in the treaty negotiations.

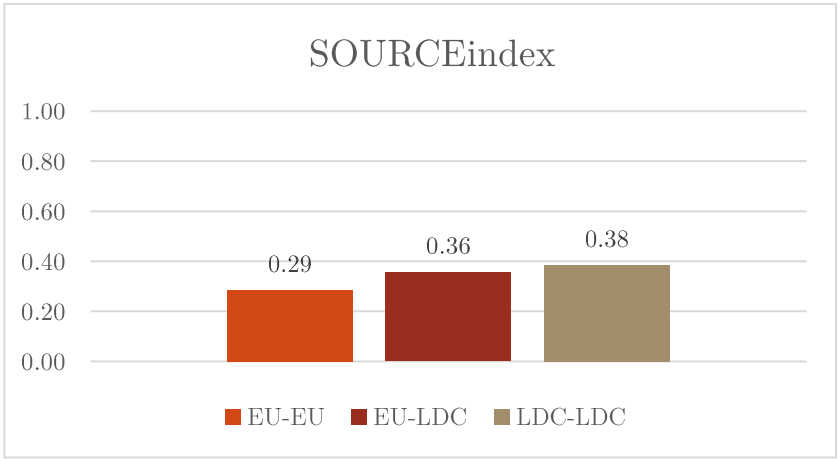

Figure 5: Comparison of the average *SOURCEindex* for country pairs with different investment positions

The average *SOURCEindex* rates observed are rather similar and small for all three situations in scope, with the highest average percentage of source taxation (38%) found between two LDCs. Thus, LDCs negotiated a higher share of taxation rights remaining in the source country compared to negotiations between two EU countries (29%) or an LDC and an EU country (36%). This contradicts the theoretical assumption of Rixen and Schwarz (2009) that countries in asymmetric investment positions agree on higher source taxation on average. However, the low average share of source taxation found for two EU countries confirms the assumption that symmetrical capital-exporting countries agree on low source taxation in general.

A second explanation for this distribution of source taxation proportions besides the asymmetry of the countries' investment positions can be provided by looking at the years of treaty conclusion: While the average conclusion year of the selected treaties between two EU countries is 1987, the treaties between two LDCs were on average signed in 1999 and the treaties between an LDC and an EU country were signed in 1997. Thus, the treaties of EU countries are the oldest and those of LDCs are the youngest on average, indicating that DTTs in general become more focused on source taxation over time, most

likely influenced by the standardization of tax treaties through the OECD MC and the UN MC.

This temporal explanation can be confirmed by a linear prediction plot in STATA showing an increasing overall trend for the countries in the dataset over time (figure 7), which can also be observed for DTTs signed by an LDC and an EU country (figure 6).

Figure 7: STATA visualization of the development of the *SOURCEindex* over time - all DTTs in the ICTD dataset

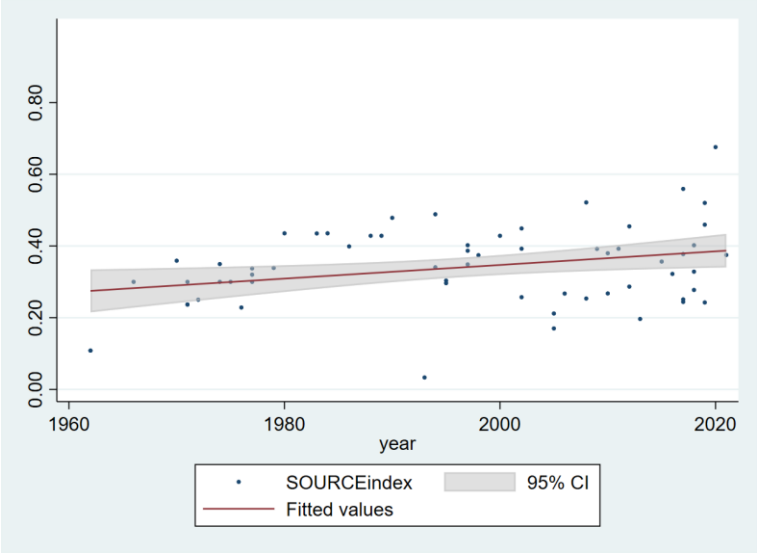

Figure 6: STATA visualization of the development of the *SOURCEindex* over time - EU-LDC DTTs

Thus, LDCs have negotiated better conditions in the most recent DTTs on average compared to older ones and a general trend towards more source taxation can be observed for all countries in scope. The trendline also shows the 95% confidence interval (grey area around the linear trendline) that indicates the area in which the "true values" could be found with a 95% likelihood, assuming that the amount of source taxation shows a linear increase over time in reality.

Nevertheless, the gravity model-based estimation of the effect of the *SOURCEindex* on FDI inflows showed surprising results: A statistically significant negative coefficient of -1.299 was found for all countries in the dataset (at the 5% significance level) and a significant negative coefficient of -1.991 was found for DTTs involving at least one developing country (at the 1% level).[13] Thus, the results indicate that FDI inflows decrease with an increasing share of source taxation and a stronger negative correlation was found for DTTs with developing countries. It can thus be concluded that countries, especially developing countries, face a trade-off between attracting investments and getting a larger share of the taxation rights for taxable business activities of MNEs in their territory.

It is further interesting to note that almost all explanatory variables showed a positive significant effect at the 1% level on FDI inflows except for the distance variable which is negatively correlated with FDI. This indicates that a higher GDP of both the source country and the residence country, a common language, and a former colonial

[13] See appendices 7 and 8.

relationship increase FDI inflows on average (ceteris paribus). Only the contiguity variable, which indicates the existence of a shared border between two countries, was not significant for the estimation of all countries in the dataset but significant at the 5% level and positive for DTTs involving a developing country. The dummy variable indicating the existence of a bilateral investment treaty (BIT_{dummy}), however, was omitted in the estimations restricted to DTTs for developing countries. This is due to only two bilateral investment treaties being concluded by the developing countries used in the dataset.[14]

5.2. The Permanent Establishment Index (*PEindex*)

The *PEindex* includes the threshold (in months) for the creation of a construction PE, the threshold for the creation of a service PE, whether a service PE is defined in the treaty in general, and six further elements of PE definitions such as the inclusion of supervisory services. A high index indicates low thresholds for the creation of a PE and thus a large share of taxation rights remaining in the source country. The *PEindex* is

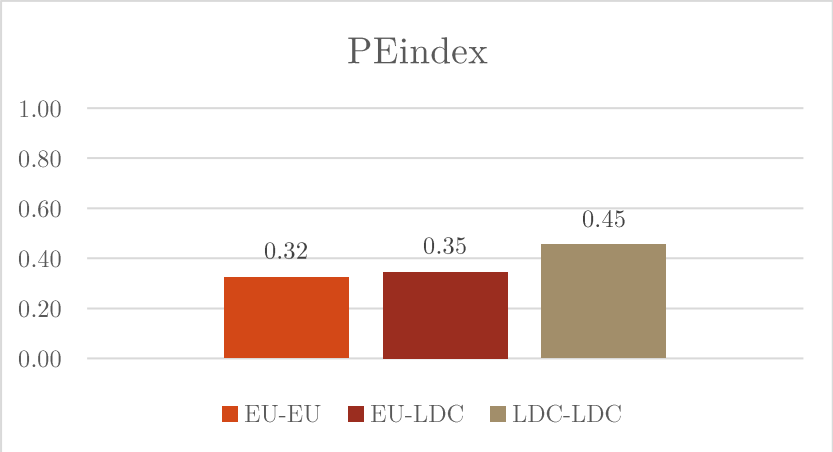

Figure 8: Comparison of the average *PEindex* for country pairs with different investment positions

[14] Only Laos and Myanmar (2007) and Laos and Cambodia (2009) have concluded bilateral investment treaties; thus, the BIT_{dummy} indicates 1 for only for very few observations.

particularly relevant for countries that aim to attract plant construction projects since MNEs have incentives to finish their projects below the PE threshold of a source country to avoid the administrative effort of the registration of a PE. Thus, capital-importing countries need to balance their interests of attracting international project business with high PE thresholds (i.e. a low *PEindex*) and getting a larger share of taxation rights for those project activities.

The highest *PEindex* can be observed for DTTs between two LDCs with 45% compared to only 32% for treaties between two EU countries on average. Thus, PEs are established sooner for international projects between LDCs, which indicates that LDCs are less interested in the attraction of plant construction projects from MNEs from other LDCs compared to EU countries' interest to attract MNEs from other EU countries.

Again, no higher index rates could be observed for the asymmetric situation between an LDC and an EU country, indicating that LDCs failed to negotiate lower PE thresholds that would have been particularly interesting to them due to the expected investments from capital-exporting countries.

Nevertheless, a linear prediction plot of the *PEindex* shows an increasing trend over time, both for the countries in the dataset in general (figure 9) and for DTTs between an LDC and an EU country in particular (figure 10). Thus, a general trend towards lower PE thresholds can be observed. The linear prediction plot therefore suggests that the temporal explanation is also important for the *PEindex* distribution: The year of treaty

conclusion seems to be more relevant for the PE provisions negotiated than the asymmetry of the countries' investment positions.

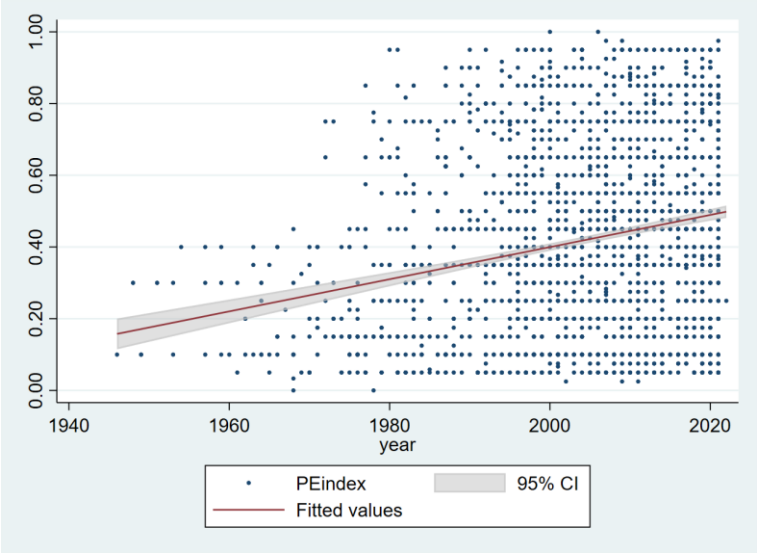

Figure 10: STATA visualization of the development of the *PEindex* over time - all DTTs in the ICTD dataset

Figure 9: STATA visualization of the development of the *PEindex* over time - EU-LDC DTTs

Coherent with the results obtained for the *SOURCEindex*, negative coefficients were found in the PPML estimation of the effects of the *PEindex* on FDI inflows. Both

coefficients estimated were statistically significant at the 1% significance level, with a negative coefficient of -1.539 obtained for all countries in the dataset and a negative coefficient of -1.608 found for DTTs involving at least one developing country.[15] Thus, a stronger negative correlation was found for DTTs involving a developed country. Again, the results indicate that FDI inflows decrease with a an increasing *PEindex*. Therefore, lower PE thresholds (leading to international projects being taxed in the source country sooner) decrease FDI inflows on average (ceteris paribus). This confirms the trade-off described above for the *SOURCEindex*.

5.3. The Withholding Tax Rate Index (*WHTindex*)

The *WHTindex* displays the average WHT rates for qualifying dividends (article 10.2A), portfolio dividends (article 10.2B), interest (article 11.2), royalties (article 12.2), and technical services rendered in the source country (article 12.A) and further takes the presence of provisions for royalties on equipment, copyrights, and technical services in the DTT into account. The rates are thereby calculated as a percentage of the maximum rate found in the total country sample (which also includes further developing countries apart from the LDCs). Thus, the WHT rates are not contrasted with the rates defined in the local tax codes but with rates agreed by other developing countries to ensure comparability.

The comparison in figure 11 shows substantially lower WHT rates for EU countries compared to LDCs, again confirming the assumption that capital exporters try to keep

[15] See appendices 9 and 10.

the proportion of source taxation low. As DTTs involving an LDC show substantially higher average WHT rates, the numbers indicate that LDCs focus more on WHT rates in the negotiations than on PE thresholds as the difference between the asymmetric situation and DTTs among LDCs is smaller for the *WHTindex* (0.05 compared to 0.1 for the *PEindex*).

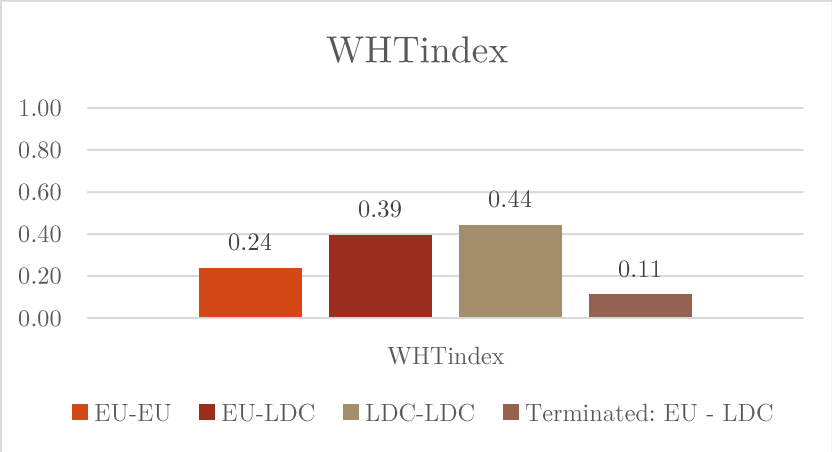

Figure 11: Comparison of the average *WHTindex* for country pairs with different investment positions

This interpretation is strengthened by the notably low average WHT rates negotiated in DTTs that have already been terminated (11%): Some LDCs have presumably decided to cancel DTTs with particularly low WHT rates.[16] To allow for a more detailed interpretation of the *WHTindex*, an additional comparison of treaty rates and non-treaty rates of LDCs has been conducted (figure 12).

The domestic non-treaty rates for the comparison were taken from the International Bureau of Fiscal Documentation (IBFD), while the treaty rates were already included in the ActionAid Tax Treaty dataset (ICTD, 2020).

[16] For example, Malawi has terminated its DTTs with Sweden (1958) and the Netherlands (1964) due to a particularly low share of source taxation rights: 11% and 3%. Both DTTs further stated 0% WHT rates (*WHTindex* of 0).

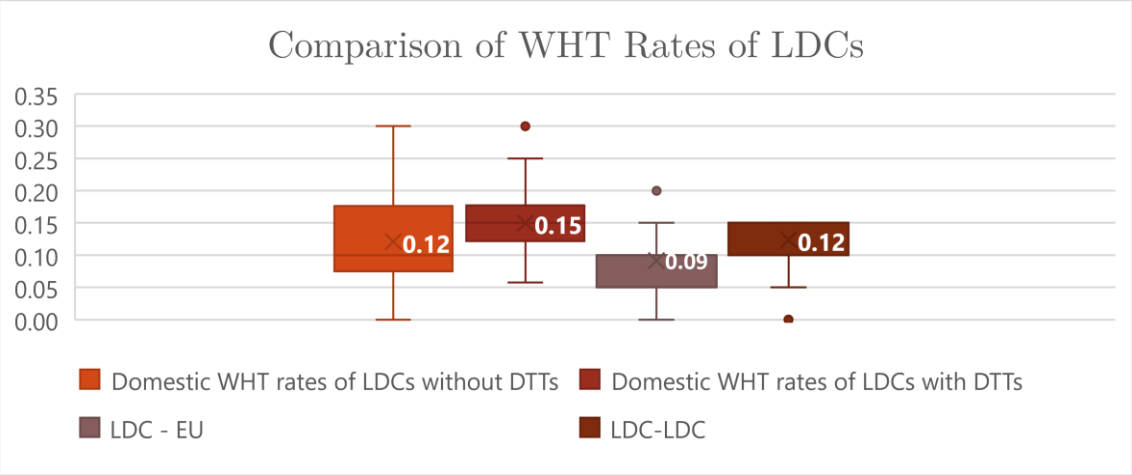

Figure 12: Comparison of WHT rates of LDCs created by author, dispersion shown by box plots

Analyzing the actual WHT rates without the standardization explained above for the calculation of the index confirms the impression that LDCs negotiate higher WHT rates in treaties among each other (median of 12%) compared to DTTs with EU countries (median of 9%). Notably, the median of DTT rates agreed by LDCs among each other (12%) is only slightly lower than the medians of domestic WHT rates of LDCs (12% for LDCs that did not sign any DTTs and 15% for LDCs who signed DTTs). Single outliers (WHT rates that are very different from the other rates found) are indicated by the dots above and below the whiskers of the box plots.

Finally, both the comparison of the *WHTindex* and the comparison of the actual domestic and treaty WHT rates show that LDCs were rather unsuccessful in negotiating favorable WHT treaty rates with EU countries. Yet, some DTTs with particularly low WHT rates have already been terminated.

The linear prediction plots in STATA showed particularly interesting results for the *WHTindex*: Contrary to the trends identified for the *SOURCEindex* and the *PEindex*, WHT rates in DTTs remained rather on the same level over time, even showing a slightly decreasing trend both for all countries in the dataset (figure 13) and for DTTs between an EU country and an LDC (figure 14).

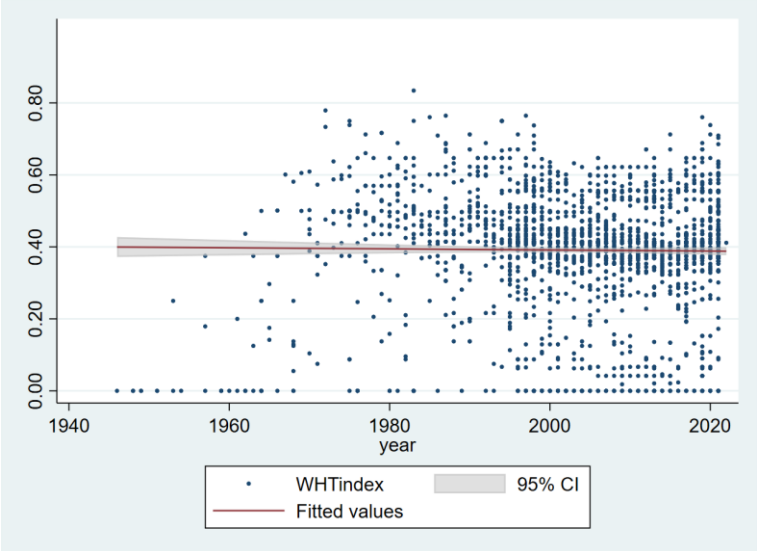

Figure 14: STATA visualization of the development of the *WHTindex* over time - all DTTs in the ICTD dataset

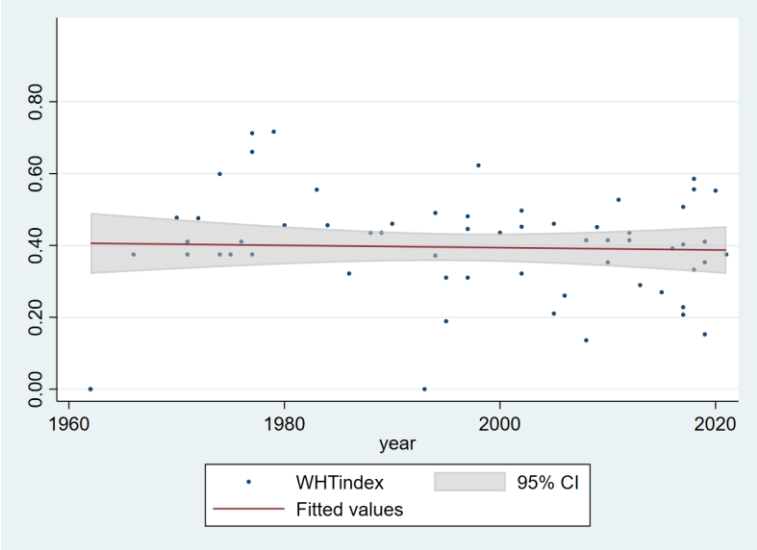

Figure 13: STATA visualization of the development of the *WHTindex* over time - EU-LDC DTTs

Thus, the trend towards more source taxation does not include WHT rates which may be due to their second main function apart from the sharing of taxation rights: WHT on dividends and technical services also discourage MNEs from transferring revenue back to their residence countries via these payments and consequently encourage reinvestments in the source country (Hearson, 2015). Thus, the comparatively low WHT rates in treaties with LDCs and the decreasing trend over time could be due to a focus of residence countries on repatriated profits from their MNEs foreign subsidiaries.

In the gravity model estimation with the *WHTindex* as a predictor, a positive effect was found for all countries in the dataset and a negative effect was determined for DTTs signed by an LDC and an EU country. However, both effects were not statistically significant[17] and will therefore not be further interpreted here.

5.4. The Index for Other Provisions (*OTHERindex*)

The *OTHERindex* includes provisions for capital gains, income from independent personal services, the treatment of managers' and directors' fees, other income, and the

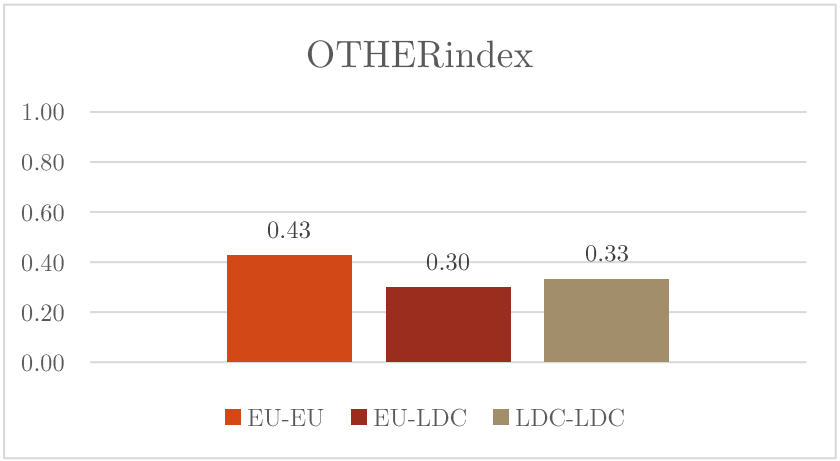

Figure 15: Comparison of the average *OTHERindex* for country pairs with different investment positions

[17] See appendices 11 and 12.

force of attraction principle that allows a source country to tax all business activities of the same kind rendered by a taxpayer in the presence of a PE rather than merely the activities directly attributed to the PE (United Nations, 2011). It thus captures mostly downstream activities following the main project activities and can be regarded as a broad index.

In contrast to the indices presented above, the *OTHERindex* shows the highest rates for treaties concluded between two EU countries, implying that in the presence of equal investment positions, countries tend to agree on higher source taxation for special types of income that are particularly relevant for a country's industries. It is thereby interesting to note that managers' and directors' fees can be taxed in the source state in 92.86% of treaties concluded by two EU countries but in none of the treaties concluded by two LDCs and only in one treaty concluded between an LDC and an EU country. In contrast, the force of attraction principle is included in 70.97% of treaties between two LDCs, 6.6% of treaties with asymmetric bargaining power, and in none of the treaties between two EU countries. This indicates that EU countries and LDCs prioritize different types of taxable activities: While EU countries mostly agree to tax the usually high salaries of managers in the country where the managers provide their services, LDCs focus more on capturing all business activities rendered by an MNE that already became liable to corporate income tax in their territory.

A linear prediction plot in STATA shows an increasing trend in the *OTHERindex* both for the overall results and the DTTs between LDCs and EU countries, implying that also other income like capital gains and directors' salaries is increasingly taxed in source countries. Moreover, LDCs were more successful in recent years to gain taxation rights on special types of taxable income.

Figure 16: STATA visualization of the development of the *OTHERindex* over time - all DTTs in the ICTD dataset

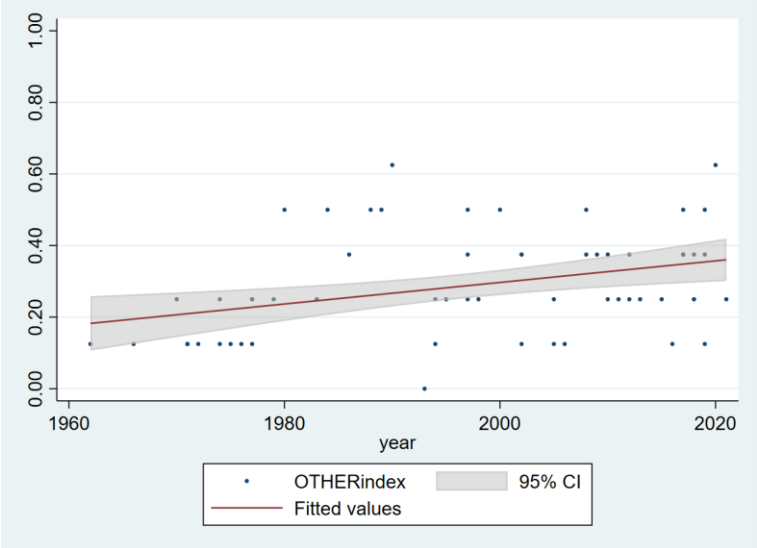

Figure 17: STATA visualization of the development of the *OTHERindex* over time - EU-LDC DTTs

For the *OTHERindex*, negative non-significant effects were obtained via a PPML estimation in STATA[18] which will again not be further interpreted here. However, an explanation for the non-significant results of the *OTHERindex* may be their relevance to MNEs investment location decisions: Provisions like directors' fees are less prominent in DTTs than PE provisions and WHT rates, which may make them less important for the location choice.

5.5. The Information Exchange Index (*INFOEXindex*)

The *INFOEXindex* consists of merely two treaty clauses: The definition of a mutual agreement procedure including arbitration provisions in article 25 OECD MC and the assurance of mutual assistance in the collection of tax revenue claims in article 27 OECD MC. Thus, the *INFOEXindex* can only assume the values 0, 0.5, and 1, which is a limitation of its explanatory power. Nevertheless, it enables insights into the level of cooperation between two treaty partners which is a central function of DTTs (see chapter 3.3.3.).

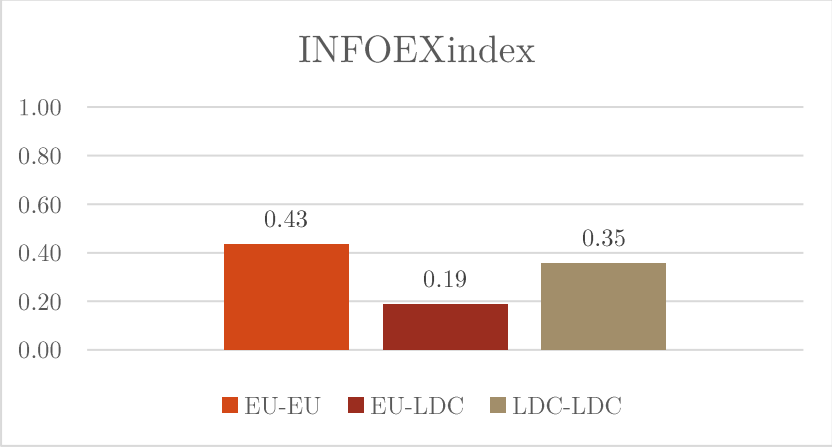

Figure 18: Comparison of the average *INFOEXindex* for country pairs with different investment positions

[18] See appendices 13 and 14.

The empirical results depicted in figure 18 are in line with the assumptions formulated in chapter 3.3.3., showing a slightly lower level of cooperation between two LDCs compared to two EU countries and a substantially lower cooperation level for treaties between an LDC and an EU country.

However, a linear prediction plot showed a positive trend in cooperation both for all countries in the dataset (figure 19) and for DTTs between LDCs and EU countries.

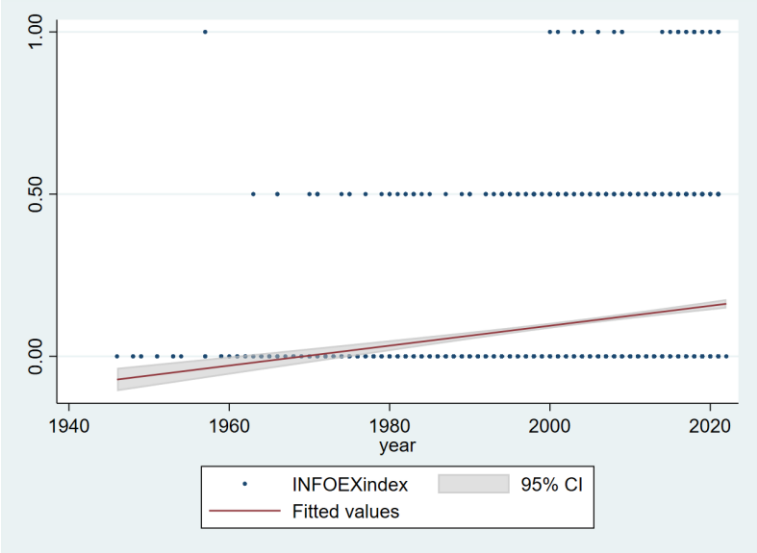

Figure 19: STATA visualization of the development of the *INFOEXindex* over time - all DTTs in the ICTD dataset

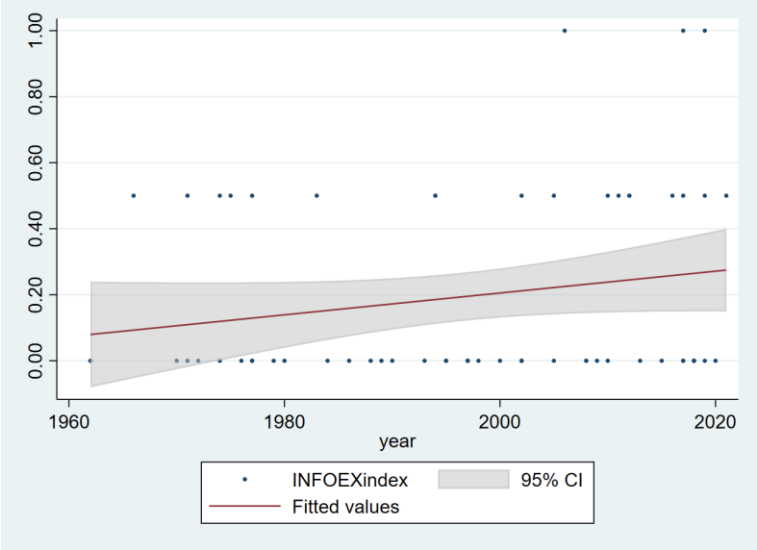

Figure 20: STATA visualization of the development of the *INFOEXindex* over time - EU-LDC DTTs

Figure 20 shows that LDCs and EU countries signed three DTTs after 2000[19] that have an *INFOEXindex* of 1, indicating that more cooperative DTTs may be signed by asymmetric countries in the future. Thus, the theoretical assumption of increasing information sharing over time derived from Keen and Ligthart (2006) can be confirmed.[20]

As expected from the theoretical model described in chapter 3.3.3., the *INFOEXindex* for only DTTs with developing countries was found to be negatively correlated with FDI inflows in the PPML estimation in STATA. Whereas no significant effect was found for all countries (-0.022), the restriction to DTTs involving at least one developing country showed an estimate of -0.587 which was significant at the 5% significance level.[21] Thus, it can be concluded that sharing information with developed countries decreases FDI inflows into a developing country (ceteris paribus). This confirms the trade-off described by Keen and Ligthart (2006).

Finally, although an increasing trend in information sharing in DTTs could be observed, developing countries who focus on the attraction of FDI should rather avoid sharing too much information with the treaty partner as information sharing is negatively correlated with FDI.

[19] The three cooperative DTTs between an EU country and an LDC are: Uganda – Netherlands (2006), Zambia – Netherlands (2019), and Ethiopia – Netherlands (2017).

[20] Since the values for the *INFOEXindex* are discretely distributed and STATA performs a linear regression for the prediction of a trendline across the data, it appears as if negative values were included in the data. However, values of the *INFOEXindex* are strictly positive and the regression line has merely been chosen for a simplified display of the overall trend.

[21] See appendices 15 and 16.

5.6. Results

The following table provides an overview on the empirical findings of this chapter:

Index	Findings for countries with asymmetric FDI balances	Trend (EU-LDC)	Correlation with FDI
SOURCEindex	Higher rates for capital-importers in general	Increasing	**Negative** (significant)
PEindex	Higher rates for capital-importers in general	Increasing	**Negative** (significant)
WHTindex	Higher rates for capital-importers in general	Slightly decreasing	**Negative** (non-significant)
OTHERindex	Higher rates for symmetric countries	Increasing	**Negative** (non-significant)
INFOEXindex	Higher rates for symmetric countries	Increasing	**Negative** (significant)

Table 4: Overview of empirical results for all indices

Rixen and Schwarzes' assumption that asymmetric investment positions lead to a higher percentage of source taxation in DTTs (Rixen & Schwarz, 2009) could not be confirmed by the empirical data. Instead, it could be observed that LDCs generally try to negotiate more source taxation but are less successful in negotiations with developed countries compared to negotiations with other LDCs due to unequal bargaining power.

However, all indices except for the *WHTindex* show increasing trends over time for both developing and developed countries. This indicates that DTT conditions improved for developing countries in recent years and contradicts the theory of the "race to the

bottom" (Rixen, 2011, p. 201). In line with the game-theoretical solution of repeated games, countries seem to agree to profit sharing rules in the long run.

Notably, higher shares of information exchange and other provisions could be found for symmetrical countries, indicating that economically more equal countries tend to collaborate more. Similarly to EU countries, LDCs should insist on getting the taxation rights on certain prioritized provisions in their negotiations, particularly since the negative correlation of the *OTHERindex* and FDI was not statistically significant.

Moreover, governments of developing countries who decide to sign DTTs should keep their PE provisions investor-friendly by establishing comparatively high PE thresholds. At the same time, WHT rates may be set rather high since no statistically significant negative effect could be observed on FDI. This is particularly interesting for developing countries with regards to the increasing importance of digital business activities that usually involve software licenses. Software license payments are considered as royalties in most countries and are subject to WHT according to article 12 of the OECD MC and UN MC (OECD, 2017), (United Nations, 2011).

6. Conclusion and Policy Recommendations

Developing countries face a trade-off between generating income tax revenue and attracting foreign investments that has been widely discussed in the existing literature. By signing a tax treaty, source countries lose taxation rights compared to a non-treaty situation but also expect to become more attractive for investments from MNEs due to legal certainty and lower tax rates. However, a statistically significant negative correlation of FDI and the conclusion of DTTs was found in this research, indicating that a developing country is most attractive for MNEs in the non-treaty situation.

The most striking findings of this thesis are the negative correlation of the *SOURCEindex*, the *PEindex*, and the *INFOEXindex* with FDI inflows: Not only the mere conclusion of DTTs reduces a country's attractiveness to FDI but particularly DTTs with a high proportion of source taxation and extensive cooperation in terms of information exchange significantly reduce FDI inflows into developing countries (as even higher negative estimates could be found for these indices).

Consequently, the findings of this thesis suggest that developing countries with the aim to attract foreign investments should rather focus on specifically designed investment promotion policy programs[22] instead of DTTs. However, DTTs may be a suitable instrument for pursuing further targets of developing countries such as the generation of new jobs through project business, the attraction of technical knowledge, or scientific

[22] These programs often include opening up sectors to full foreign ownership, establishing investor grievance mechanisms and investor ombudsmen, and standardization in accessibility and transparency (The World Bank, 2021).

exchange. A potential correlation of these factors with the conclusion of DTTs could be evaluated in future research.

Finally, it needs to be noted that this research has certain limitations with regards to the number of countries and years analyzed in the gravity model due to limited data availability. Particularly the compilation of dyadic FDI flow data is a challenging task and effects estimated with it need to be interpreted with caution. Consequently, future research with larger datasets is required to confirm or reject the findings of this new approach to assess the influence of certain treaty provisions of DTTs via quantitative indices on FDI.

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8. Appendices

List of Appendices

Appendix 1: Net FDI Exporting Countries Based on FDI Balance in 2019 (UNCTAD, 2021)

Country	Classification	2017	2018	**2019**
Colombia		1.18335	1.55236	**1.01129**
United Kingdom		4.40875	1.4508	**1.11696**
Bahamas		1.2433	0.94433	**1.16809**
Uruguay		2.34923	1.04194	**1.17739**
Zambia	LDC	-0.2783	0.11802	**1.19708**
Oman		3.05755	0.61503	**1.19872**
Montenegro		0.23528	1.97885	**1.23252**
Italy	EU	1.25042	1.56807	**1.2502**
Trinidad and Tobago		-0.0536	0.27376	**1.28476**
Russian Federation		2.15962	2.15714	**1.32441**
France	EU	1.38449	3.79155	**1.429**
Madagascar	LDC	0.80447	0.8512	**1.51545**
Switzerland, Liechtenstein		4.39102	8.53757	**1.56362**
Georgia		1.65877	1.93283	**1.6143**
Hungary	EU	0.84737	3.21305	**1.64967**
Aruba		2.72182	0.94356	**1.69448**
Finland	EU	-0.29	3.95722	**1.70594**
Saudi Arabia		1.05724	2.9377	**1.7159**
Malaysia		1.76779	1.42631	**1.71851**
Spain	EU	3.98835	1.90701	**1.74676**
China, Taiwan Province of		1.95554	2.96942	**1.9365**
Norway		-0.5717	2.9015	**1.96268**

Czechia	EU	3.50141	3.53248	**2.00627**
Luxembourg	EU	54.1658	16.3889	**2.11821**
Korea, Republic of		2.098	2.22148	**2.13519**
Iceland		-0.8502	0.3032	**2.13945**
Thailand		3.72581	3.65203	**2.18598**
Israel		1.7419	1.65051	**2.19856**
Qatar		1.01527	1.84091	**2.34588**
Austria	EU	2.45057	1.28907	**2.37524**
Germany	EU	2.8394	1.9955	**2.58422**
Jamaica		0.31608	0.08063	**2.77829**
Chile		1.98941	0.09327	**2.82193**
Belgium	EU	6.66357	4.88345	**3.7232**
Liberia		2.52517	3.96291	**3.86276**
United Arab Emirates		3.72251	3.64077	**3.8722**
Sweden	EU	4.71865	3.02359	**4.33245**
Canada		4.74783	2.91256	**4.41983**
Japan		3.38858	2.87974	**4.45045**
Denmark	EU	2.88942	-0.3112	**4.61933**
Ireland	EU	-0.6102	0.1901	**4.68434**
Azerbaijan		6.27407	3.75167	**4.94012**
Estonia	EU	3.25558	0.15912	**6.3256**
Singapore		14.5034	8.24145	**9.2016**
Togo		-0.7033	1.35914	**13.0347**
Netherlands	EU	5.62456	-2.0613	**13.7671**

China, Hong Kong SAR		25.3754	22.6648	**16.0751**
Cyprus	EU	60.9589	-8.6226	**57.3555**
Cayman Islands		166.888	75.4699	**126.478**
British Virgin Islands		3879.19	2729.59	**2732.7**

Appendix 2: Categorization of Countries in the Gravity Model Dataset

Country	ISO Code	Developing Country = 1
Argentina	ARG	0
Australia	AUS	0
Austria	AUT	0
Belgium	BEL	0
Bulgaria	BGR	0
Brazil	BRA	1
Brunei Darussalam	BRN	1
Canada	CAN	0
Switzerland	CHE	0
Chile	CHL	0
China	CHN	1
Cyprus	CYP	0
Czech Republic	CZE	0
Germany	DEU	0
Denmark	DNK	0
Spain	ESP	0
Estonia	EST	0
Finland	FIN	0
France	FRA	0
United Kingdom	GBR	0
Greece	GRC	0
Croatia	HRV	0

Hungary	HUN	0
Indonesia	IDN	1
India	IND	1
Ireland	IRL	0
Iceland	ISL	0
Israel	ISR	0
Italy	ITA	0
Japan	JPN	0
Cambodia	KHM	1
Korea, Republic of	KOR	0
Lao People's Democratic Republic	LAO	1
Lithuania	LTU	0
Luxembourg	LUX	0
Latvia	LVA	0
Mexico	MEX	1
Malta	MLT	0
Myanmar	MMR	1
Malaysia	MYS	0
Netherlands	NLD	0
Norway	NOR	0
New Zealand	NZL	0
Philippines	PHL	1
Poland	POL	0
Portugal	PRT	0

Paraguay	PRY	1
Romania	ROM	0
Russian Federation	RUS	0
Saudi Arabia	SAU	0
Singapore	SGP	0
Slovakia	SVK	0
Slovenia	SVN	0
Sweden	SWE	0
Thailand	THA	1
Turkey	TUR	0
Uruguay	URY	0
United States	USA	0
Venezuela	VEN	1
Viet Nam	VNM	1
South Africa	ZAF	1

Appendix 3: Descriptive Statistics of the Variables Used in the Gravity Model in Chapter 4

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
year	43920	2006.5	3.452	2001	2012
FDIinflows	43920	298.453	2284.117	0	117617.87
contig	43920	.042	.2	0	1
comlang off	43920	.062	.242	0	1
comlang ethno	43920	.077	.267	0	1
colony	43920	.027	.161	0	1
comcol	43920	.019	.135	0	1
curcol	43920	.001	.033	0	1
col45	43920	.01	.101	0	1
smctry	43920	.015	.121	0	1
dist	43920	7175.595	4995.358	59.617	19629.5
distcap	43920	7144.136	4975.96	59.617	19629.5
distw	43920	7206.036	4927.828	160.928	19563.95
distwces	43920	7164.59	4943.148	134.644	19563.01
GDP T	43920	811718.56	1952080.7	1758.177	16155255
GDP O	43920	811718.56	1952080.7	1758.177	16155255
DC T	43920	.246	.431	0	1
DC O	43920	.246	.431	0	1
EU T	43920	.426	.495	0	1
EU O	43920	.426	.495	0	1
EU EU	43920	.178	.382	0	1
DC DC	43920	.057	.233	0	1
DC EU	43920	.213	.41	0	1
DTTexistence	43920	.231	.421	0	1
SOURCEindex	8704	.485	.152	.089	.81
WHTindex	8704	.456	.133	0	.76
PEindex	8704	.52	.265	.05	.95
OTHERindex	8704	.48	.186	0	1
INFOEXindex	8704	.108	.213	0	1
CorruptControl T	40260	.668	1.094	-1.673	2.47
RegQuality T	40260	.761	.897	-2.344	1.971
RuleOfLaw T	40260	.678	.994	-1.74	2.014
ln dist	43920	8.485	1.045	4.088	9.885
lnGDP O	43920	12.153	1.824	7.472	16.598
lnGDP T	43920	12.153	1.824	7.472	16.598
years	43920	6.5	3.452	1	12

Appendix 4 and 5: STATA Output Tables Related to Chapter 4

Appendix 4: STATA Output for the Linear Regression with Fixed Effects for DTTs that Involve At Least One Developing Country

HDFE Linear Regression

Number of obs	=	17,490
F(11, 17468)	=	469.22
Prob > F	=	0.0000
R-squared	=	0.2610
Adj R-squared	=	0.2601
Within R-sq.	=	0.2558
Root MSE	=	6.0594

		Robust				
lnFDI	Coef.	Std.Err.	t	P>t	[95%Conf.	Interval]
DTTexistence	0.647	0.123	5.250	0.000	0.406	0.889
ln_dist	-2.644	0.105	-25.280	0.000	-2.849	-2.439
lnGDP_O	1.298	0.028	46.290	0.000	1.243	1.353
lnGDP_T	0.829	0.028	29.190	0.000	0.773	0.885
contig	-0.483	0.425	-1.140	0.255	-1.317	0.350
comlang_off	1.087	0.242	4.500	0.000	0.613	1.560
colony	3.242	0.462	7.020	0.000	2.337	4.146
BITdummy	-0.178	0.294	-0.610	0.544	-0.755	0.398
RegQuality_T	2.189	0.125	17.560	0.000	1.945	2.434
RuleOfLaw_T	-3.301	0.217	-15.190	0.000	-3.726	-2.875
CorruptControl_T	0.835	0.170	4.920	0.000	0.503	1.168
_cons	-12.725	1.016	-12.520	0.000	-14.718	-10.733

Absorbed degrees of freedom:

Absorbed FE	Categories	-	Redundant	=	Num.	Coefs
year	11		0		11	

Appendix 5: PPML Estimation with Fixed Effects for DTTs that Involve At Least One Developing Country

PPML Regression (ppmlhdfe)

FDIinflows	Coef.	Std.Err.	t-value	p-value	[95% Conf	Interval]	Sig
DTTexistence	-.35	.112	-3.11	.002	-.57	-.129	***
ln_dist	-1.015	.067	-15.14	0	-1.147	-.884	***
lnGDP_O	.809	.031	25.87	0	.748	.87	***
lnGDP_T	.648	.028	22.82	0	.592	.703	***
contig	.113	.142	0.80	.425	-.165	.39	
comlang_off	.738	.139	5.33	0	.467	1.01	***
colony	1.173	.172	6.81	0	.835	1.51	***
BITdummy	-2.573	.297	-8.65	0	-3.156	-1.99	***
RegQuality_T	.849	.151	5.64	0	.554	1.144	***
RuleOfLaw_T	-2.06	.173	-11.92	0	-2.399	-1.722	***
CorruptControl_T	.925	.158	5.84	0	.615	1.235	***
Constant	-5.916	.866	-6.83	0	-7.613	-4.219	***

Mean dependent var	79.042	SD dependent var	553.852
Pseudo r-squared	0.542	Number of obs	17490
Chi-square	2696.872	Prob > chi2	0.000
Akaike crit. (AIC)	4128361.467	Bayesian crit. (BIC)	4128454.699

*** p<.01, ** p<.05, * p<.1

Appendix 6: Coding Strategy - Treaty Provisions Included in the Indices

Art. in UN MC	Description	SOURCE index	PE index	WHT Index[1]	OTHER index	INFOEX index
5.3A	Construction PE length in months	o	o			
5.3A	Inclusion of supervisory activities	x	x			
5.3B	Inclusion of service PE	x	x			
5.3B	Service PE length in months	o	o			
5.4A	Delivery facilities excluded from PE definition	x	x			
5.4B	Delivery stock excluded from PE definition	x	x			
5.5B	Inclusion of stock agent in PE	x	x			
5.6	Insurance PE definition	x	x			
5.7	Dependent agent extension to PE	x	x			
7.1B	Limited force of attraction	x			x	
7.3	No headquarter deductions	x			x	
8.2	Source taxation of shipping	x			x	
10.2A	WHT rate for dividends in %	o		o		

10.2A	Threshold for shareholding to qualify for lower WHT rate					
10.2B	WHT rate for portfolio dividends in %	o		o		
11.2	WHT rate for interest in %	o		o		
12.2	WHT rate for royalties in %	o		o		
12.3	Royalty definition I.	x		x		
12.3	Royalty definition II.	x		x		
12.4	WHT definition for technical services	x		x		
12.4	WHT rate for technical services in %	o		o		
13.4	Capital gains taxation of immovable property	x			x	
13.5	Capital gains taxation of shares	x			x	
16.2	Source taxation of directors' salaries	x			x	
18.2	Source taxation of pensions	x			x	
18.2	Source taxation of social security pensions	x			x	
21.3	Source taxation of other income	x			x	
25.5B	Mandatory binding arbitration					x

27	Assistance in tax collection					x

x = included as binary variable; o = included as continuous

[1] Note: If no maximum WHT rate was defined in the DTT (no limitation), the maximum rate found in the dataset has been applied.

Appendices 7-16: STATA Output Tables Related to Chapter 5

Appendix 7: PPML Estimation of the Effect of the *SOURCEindex* - All Countries in the Dataset

PPML Regression (ppmlhdfe)

FDIinflows	Coef.	Std.Err.	t-value	p-value	[95% Conf	Interval]	Sig
SOURCEindex	-1.299	.306	-4.24	0	-1.9	-.699	***
ln_dist	-.925	.069	-13.35	0	-1.061	-.789	***
lnGDP_O	.682	.049	14.06	0	.587	.778	***
lnGDP_T	.474	.027	17.46	0	.421	.527	***
contig	.09	.187	0.48	.629	-.276	.456	
comlang_off	.84	.109	7.70	0	.626	1.054	***
colony	.733	.183	4.00	0	.374	1.092	***
BITdummy	-.922	.22	-4.19	0	-1.353	-.49	***
Constant	-2.045	.966	-2.12	.034	-3.939	-.151	**

Mean dependent var	224.383	SD dependent var	1244.962
Pseudo r-squared	0.591	Number of obs	8704
Chi-square	2753.074	Prob > chi2	0.000
Akaike crit. (AIC)	4425043.969	Bayesian crit. (BIC)	4425107.613

*** p<.01, ** p<.05, * p<.1

Appendix 8: PPML Estimation of the Effect of the *SOURCEindex* - DTTs that Involve At Least One Developing Country

PPML Regression (ppmlhdfe)

FDIinflows	Coef.	Std.Err.	t-value	p-value	[95% Conf	Interval]	Sig
SOURCEindex	-1.991	.306	-6.52	0	-2.59	-1.392	***
ln_dist	-.891	.09	-9.90	0	-1.068	-.715	***
lnGDP_O	.825	.041	20.06	0	.745	.906	***
lnGDP_T	.5	.026	19.22	0	.449	.551	***
contig	.397	.183	2.16	.031	.037	.756	**
comlang_off	.638	.166	3.85	0	.313	.963	***
colony	.911	.197	4.63	0	.525	1.296	***
omitted	0	.	.	.	.	.	
Constant	-4.478	1.089	-4.11	0	-6.613	-2.343	***

Mean dependent var	132.523	SD dependent var	701.180
Pseudo r-squared	0.433	Number of obs	8028
Chi-square	945.232	Prob > chi2	0.000
Akaike crit. (AIC)	3238914.092	Bayesian crit. (BIC)	3238970.018

*** p<.01, ** p<.05, * p<.1

Appendix 9: PPML Estimation of the Effect of the *PEindex* - All Countries in the Dataset

PPML Regression (ppmlhdfe)

FDIinflows	Coef.	Std.Err.	t-value	p-value	[95% Conf	Interval]	Sig
PEindex	-1.539	.239	-6.44	0	-2.008	-1.07	***
ln_dist	-.96	.065	-14.88	0	-1.087	-.834	***
lnGDP_O	.688	.047	14.50	0	.595	.781	***
lnGDP_T	.481	.027	17.98	0	.429	.534	***
contig	.006	.18	0.03	.974	-.347	.359	
comlang_off	1.004	.109	9.18	0	.79	1.219	***
colony	.67	.18	3.73	0	.318	1.023	***
BITdummy	-.822	.223	-3.68	0	-1.259	-.384	***
Constant	-1.861	.955	-1.95	.051	-3.734	.012	*

Mean dependent var	224.383	SD dependent var	1244.962
Pseudo r-squared	0.600	Number of obs	8704
Chi-square	2610.416	Prob > chi2	0.000
Akaike crit. (AIC)	4324804.623	Bayesian crit. (BIC)	4324868.267

*** p<.01, ** p<.05, * p<.1

Appendix 10: PPML Estimation of the Effect of the *PEindex* - DTTs that Involve At Least One Developing Country

PPML Regression (ppmlhdfe)

FDIinflows	Coef.	Std.Err.	t-value	p-value	[95% Conf	Interval]	Sig
PEindex	-1.608	.26	-6.18	0	-2.119	-1.098	***
ln_dist	-.925	.089	-10.39	0	-1.1	-.751	***
lnGDP_O	.829	.041	20.37	0	.749	.908	***
lnGDP_T	.491	.027	18.16	0	.438	.544	***
contig	.305	.165	1.85	.065	-.019	.628	*
comlang_off	.72	.167	4.32	0	.393	1.047	***
colony	.907	.201	4.52	0	.513	1.3	***
omitted	0	.	.	.	.	.	
Constant	-4.308	1.093	-3.94	0	-6.45	-2.166	***

Mean dependent var	132.523	SD dependent var	701.180
Pseudo r-squared	0.445	Number of obs	8028
Chi-square	962.893	Prob > chi2	0.000
Akaike crit. (AIC)	3173612.648	Bayesian crit. (BIC)	3173668.573

*** p<.01, ** p<.05, * p<.1

Appendix 11: PPML Estimation of the Effect of the *WHTindex* - All Countries in the Dataset

PPML Regression (ppmlhdfe)

FDIinflows	Coef.	Std.Err.	t-value	p-value	[95% Conf	Interval]	Sig
WHTindex	.256	.375	0.68	.494	-.478	.99	
ln_dist	-1.021	.07	-14.65	0	-1.157	-.884	***
lnGDP_O	.689	.045	15.17	0	.6	.778	***
lnGDP_T	.478	.027	17.65	0	.425	.531	***
contig	.057	.184	0.31	.757	-.304	.418	
comlang_off	.928	.104	8.88	0	.723	1.133	***
colony	.664	.188	3.53	0	.295	1.032	***
BITdummy	-.954	.226	-4.22	0	-1.398	-.511	***
Constant	-2.088	.92	-2.27	.023	-3.891	-.285	**

Mean dependent var	224.383	SD dependent var	1244.962
Pseudo r-squared	0.588	Number of obs	8704
Chi-square	2822.884	Prob > chi2	0.000
Akaike crit. (AIC)	4463818.874	Bayesian crit. (BIC)	4463882.518

*** p<.01, ** p<.05, * p<.1

Appendix 12: PPML Estimation of the Effect of the *WHTindex* - DTTs that Involve At Least One Developing Country

PPML Regression (ppmlhdfe)

FDIinflows	Coef.	Std.Err.	t-value	p-value	[95% Conf	Interval]	Sig
WHTindex	-.348	.538	-0.65	.518	-1.403	.707	
ln_dist	-.906	.091	-9.97	0	-1.085	-.728	***
lnGDP_O	.826	.04	20.78	0	.748	.903	***
lnGDP_T	.494	.026	19.01	0	.443	.544	***
contig	.368	.187	1.97	.049	.001	.734	**
comlang_off	.498	.17	2.92	.003	.164	.832	***
colony	1.021	.202	5.07	0	.626	1.416	***
omitted	0	.	.	.	.	.	
Constant	-5.001	1.168	-4.28	0	-7.291	-2.711	***

Mean dependent var	132.523	SD dependent var	701.180
Pseudo r-squared	0.423	Number of obs	8028
Chi-square	1073.209	Prob > chi2	0.000
Akaike crit. (AIC)	3297420.096	Bayesian crit. (BIC)	3297476.021

*** p<.01, ** p<.05, * p<.1

Appendix 13: PPML Estimation of the Effect of the *OTHERindex* - All Countries in the Dataset

PPML Regression (ppmlhdfe)

FDIinflows	Coef.	Std.Err.	t-value	p-value	[95% Conf	Interval]	Sig
OTHERindex	-.111	.238	-0.47	.64	-.578	.355	
ln_dist	-.991	.066	-14.96	0	-1.121	-.861	***
lnGDP_O	.686	.048	14.21	0	.591	.78	***
lnGDP_T	.476	.026	18.08	0	.424	.527	***
contig	.075	.185	0.41	.685	-.288	.439	
comlang_off	.902	.118	7.66	0	.671	1.132	***
colony	.678	.183	3.71	0	.32	1.037	***
BITdummy	-.958	.226	-4.24	0	-1.401	-.515	***
Constant	-2.098	.94	-2.23	.026	-3.941	-.255	**

Mean dependent var	224.383	SD dependent var	1244.962
Pseudo r-squared	0.588	Number of obs	8704
Chi-square	2761.257	Prob > chi2	0.000
Akaike crit. (AIC)	4464758.870	Bayesian crit. (BIC)	4464822.514

*** p<.01, ** p<.05, * p<.1

Appendix 14: PPML Estimation of the Effect of the *OTHERindex* - DTTs that Involve At Least One Developing Country

PPML Regression (ppmlhdfe)

FDIinflows	Coef.	Std.Err.	t-value	p-value	[95% Conf	Interval]	Sig
OTHERindex	-.228	.256	-0.89	.374	-.729	.274	
ln_dist	-.897	.091	-9.84	0	-1.076	-.719	***
lnGDP_O	.831	.041	20.11	0	.75	.912	***
lnGDP_T	.498	.025	19.60	0	.448	.548	***
contig	.38	.185	2.05	.04	.017	.743	**
comlang_off	.501	.168	2.98	.003	.171	.83	***
colony	.996	.217	4.59	0	.57	1.421	***
omitted	0	.	.	.	.	.	
Constant	-5.278	1.084	-4.87	0	-7.402	-3.154	***

Mean dependent var	132.523	SD dependent var	701.180
Pseudo r-squared	0.423	Number of obs	8028
Chi-square	1003.158	Prob > chi2	0.000
Akaike crit. (AIC)	3297774.613	Bayesian crit. (BIC)	3297830.539

*** p<.01, ** p<.05, * p<.1

Appendix 15: PPML Estimation of the Effect of the *INFOEXindex* - All Countries in the Dataset

PPML Regression (ppmlhdfe)

FDIinflows	Coef.	Std.Err.	t-value	p-value	[95% Conf	Interval]	Sig
INFOEXindex	-.022	.181	-0.12	.902	-.376	.332	
ln_dist	-.998	.062	-16.05	0	-1.12	-.876	***
lnGDP_O	.685	.049	14.11	0	.59	.78	***
lnGDP_T	.475	.026	17.99	0	.423	.526	***
contig	.077	.188	0.41	.681	-.291	.445	
comlang_off	.921	.125	7.35	0	.675	1.166	***
colony	.677	.203	3.34	.001	.28	1.075	***
BITdummy	-.969	.222	-4.36	0	-1.405	-.533	***
Constant	-2.064	.853	-2.42	.015	-3.735	-.393	**

Mean dependent var	224.383	SD dependent var	1244.962
Pseudo r-squared	0.587	Number of obs	8704
Chi-square	2677.939	Prob > chi2	0.000
Akaike crit. (AIC)	4465398.269	Bayesian crit. (BIC)	4465461.912

*** p<.01, ** p<.05, * p<.1

Appendix 16: PPML Estimation of the Effect of the *INFOEXindex* - DTTs that Involve At Least One Developing Country

PPML Regression (ppmlhdfe)

FDIinflows	Coef.	Std.Err.	t-value	p-value	[95% Conf	Interval]	Sig
INFOEXindex	-.587	.23	-2.55	.011	-1.038	-.135	**
ln_dist	-.883	.091	-9.69	0	-1.061	-.704	***
lnGDP_O	.83	.041	20.32	0	.75	.91	***
lnGDP_T	.497	.026	19.23	0	.447	.548	***
contig	.335	.188	1.78	.075	-.034	.703	*
comlang_off	.506	.164	3.08	.002	.184	.828	***
colony	1.18	.194	6.08	0	.799	1.56	***
omitted	0	.	.	.	.	.	
Constant	-5.439	1.088	-5.00	0	-7.57	-3.307	***

Mean dependent var	132.523	SD dependent var	701.180
Pseudo r-squared	0.425	Number of obs	8028
Chi-square	983.708	Prob > chi2	0.000
Akaike crit. (AIC)	3288638.301	Bayesian crit. (BIC)	3288694.227

*** p<.01, ** p<.05, * p<.1