On the relevance of double tax treaties in the presence of treaty shopping

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Abstract

This paper investigates the effects of double tax treaties (DTTs) on foreign direct investment (FDI) after controlling for their *relevance* in the presence of treaty shopping. DTTs cannot be considered a bilateral issue, but must be viewed as a network, since FDI can flow from home to host country through one or more conduit countries. By accounting for treaty shopping, we calculate the shortest (i.e. the cheapest) tax distance between any two countries allowing the corporate income to be channelled through intermediate jurisdictions. We use these data to derive four important results. First, only *relevant* DTTs increase bilateral FDI, whereas others do not. Second, a reduction in the overall tax burden along the direct route due to a DTT increases FDI. Third, a reduction in taxation along the indirect route will lead to a reduction in bilateral FDI on the direct route due to treaty shopping, as investment is channelled through conduit countries. Finally, the need to use conduits along the cheapest route increases direct FDI, which indicates non-negligible non-tax costs of treaty shopping.

JEL Codes: F21, F23, F53, H25, H26, H73, H87, K34

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1 Introduction

Traditionally, double tax treaties (DTTs) served as an important policy tool to promote international economic activity by preventing international double taxation. However, despite the growing number of contributions, the empirical evidence on the effects of double tax treaties on bilateral FDI remains inconclusive (Blonigen & Davies, 2004; Egger, Larch, Pfaffermayr, & Winner, 2006; Neumayer, 2007; Egger & Merlo, 2011). The well intended motivation to eliminate double taxation has created a highly complex network of DTTs that span the globe, with often unforeseen consequences (Easson, 2000). While preventing international double taxation, DTTs shift taxing rights from capital-importing countries to capital-exporting countries, denying investors the benefits of lower source taxation (Braun & Zagler, 2014). Moreover, in order to avoid high host country withholding taxes on outgoing passive income, many multinational companies divert FDI via a third country with a more favourable tax treaty, a practice that has been labeled treaty shopping in the literature (OECD, 2015; Dyreng, Lindsey, Markle, & Shackelford, 2015). The OECD highlights that treaty shopping is one of the most significant sources of concerns regarding the Base Erosion and Profit Shifting (BEPS) project. Against this background, this paper investigates the effects of double tax treaties on foreign direct investment (FDI) controlling for the possibility of treaty shopping that might give multinational companies benefits, such as lower or no withholding taxes.

We follow the novel paper by Barrios et al. (2012) and interpret the international tax system as a network where the tax distance between two countries is defined as the cost of channelling corporate income from one country to another in terms of taxes to be paid. In particular, the tax cost between two countries consists of corporate income taxes to be paid in the host country, a non-resident withholding tax on the income of the subsidiary and corporate income taxes in the home country. We account for treaty shopping and calculate the shortest (i.e. the cheapest) distance between any two countries allowing for corporate income to be channelled through one or more intermediate jurisdictions. Our main hypothesis is that only *relevant* tax treaties - i.e. tax treaties that offer investors a financial advantage over the conditions under domestic law, given the entire existing tax treaties network - lead to more immediate home to host country FDI.

We indeed find that *relevant* DTTs increase FDI, whereas *neutral* and *irrelevant* DTTs have no impact. Second, a reduction in taxation along the direct route increases FDI. Third, a reduction in taxation due to treaty shopping will lead to a reduction in bilateral FDI on the direct route, as investments are channelled through conduit countries. Finally, the need to use conduits along the cheapest route increases direct FDI, which indicates non-negligible non-tax costs of treaty shopping.[1] These results suggest that treaty shopping will only come into place after a certain threshold.

Our paper contributes to various strands of research. First, we advance the understand-

[1] Non-tax cost of treaty shopping may consist of the costs of setting up the intermediate company or the higher risks associated with tax planning.

ing of the effects of DTTs on combined effective tax rates (Marques & Pinho, 2014). In this regard, we calculate the benefit of every DTT on the combined effective tax rate relative to the conditions under domestic law. Second, we advance the literature that adopts a network approach to study the tax treaties network (Van't Riet & Lejour, 2017; Hong, 2017). Here, we improve the methodology and, by allowing for tax treaty shopping potential, we estimate the minimum tax cost between any two countries in our sample. We then evaluate the benefit of every particular DTT relative to the minimum tax distance between the two countries with the respective tax treaty. Third, we build on the work of Mintz and Weichenrieder (2010), Dreßler (2012) and Weyzig (2013), and analyse the effects of DTTs on FDI in the presence of treaty shopping. Overall, we advance the research on the effects of DTTs on FDI through a rich analysis that accounts for their differential impact instead of a simplified binary definition.

The remainder of this paper is structured as follows: Section 2 summarises the existing literature and identifies the research gap. In section 3 we discuss the theoretical background. In section 4 we discuss our sample and research methodology. We present our results in section 5. Section 6 concludes.

2 Literature

The economic effects of DTTs have been analysed in numerous studies. Using OECD data on the stocks and flows of bilateral aggregate FDI for the years 1982-1992, Blonigen and Davies (2005) find that new tax treaties have a strong negative impact on FDI. Blonigen and Davies (2004) confirm these results using US data. The authors attribute their results to DTTs reducing tax evasion, at least in the short run. For a sample of 67 DTTs and aggregate bilateral outward FDI between OECD countries from 1985-2000, Egger et al. (2006) find a negative average treatment effect of DTTs on FDI using different matching estimators and focusing on difference-in-differences. Baker (2014) uses a similar estimation strategy, i.e. propensity score-matched difference-in-difference estimation, and shows that tax treaties do not have any effect on FDI. Against all the results so far mentioned, Neumayer (2007) finds robust empirical evidence that DTTs increase FDI to developing countries. However, when the author splits developing countries into low-income and middle-income countries, he finds that DTTs are effective only in the group of middle-income countries.

Whereas studies using aggregate country- and country-pair-level data tend to find negative or statistically insignificant results, there is a tendency for studies based on microdata to find some positive effects of DTTs. For instance, Egger and Merlo (2011) argue that DTTs have a positive effect on foreign investments of multinational firms using microdata on German multinational-firm activity over 1996-2005. Blonigen et al. (2014) use firm-level data from the United States Bureau of Economic Analysis on their activity in 174 countries between 1987 and 2007. They find a positive effect of DTTs on foreign direct investment,

which is larger for firms that use differentiated inputs. These (multinational) firms benefit from treaty provisions establishing guidelines for resolving disputes between taxation authorities. In contrast, firms that use more homogenous inputs are on average less likely to see any significant effect. This difference can be explained by the additional regulations on the calculation of internal prices and encouraging the exchange of information between authorities.

A closely related stream of the literature considers the effects of DTTs on the location decision of multinational firms. Using microdata from Sweden between 1965-1998, Davies et al. (2009) find a positive effect of DTTs on multinational firm's decision to locate the first affiliate in a treaty country. The authors argue that the positive effect of DTTs comes from the reduced investment uncertainty. Marques and Pinho (2014) analyse the extent to which tax treaties influence the number of new foreign subsidiaries incorporated by European multinationals between 2000 and 2009. The authors use two measures for tax treaties: a binary variable and an effective tax rate, which (similarly to the combined effective tax rate used in this paper) captures the corporate tax rates of both host and home countries, as well as tax-treaty features such as withholding tax rates and double taxation relief methods. However, in contrast to our paper, the authors ignore the possibility of treaty shopping and do not measure the impact of tax treaties relative to domestic law.

Prior literature offers several explanations for these ambiguous and inconclusive results. As argued by Owens (1962), and later pointed out by Davies (2004) and Baker (2014), for given tax rates, double taxation can be relieved just as easily unilaterally as through a bilateral tax treaty. In particular, since most capital exporting countries already offer tax credits or exemptions, treaties have only a very limited role in avoiding double taxation. More generally, Bösenberg, Egger and Erhardt (2016) suggest that the impact of DTTs depends on their content (e.g. which method of double tax relief is specified in a treaty or whether a treaty includes provisions on exchange of information) and the economic environment in which they occur (e.g. the profitability of bilateral multinational activity in absence of a treaty; the domestic corporate and withholding tax rates; and the unilateral method of double taxation relief). Meanwhile, the vast majority of the existing literature treats DTTs as a binary variable, thereby ignoring their complexity and their domestic and international interactions. To our knowledge, only Marques and Pinho (2014) analyse the effect of DTTs on the combined effective tax rates.

Our study addresses this gap in the literature and analyses the effects of double tax treaties in a richer setting that goes beyond their binary treatment. Relying on the work of Mintz and Weichenrieder (2010), Dreßler (2012) and Weyzig (2013), we treat the international tax system as a network and subsequently account for treaty shopping potential when estimating the effects of DTTs on FDI. In order to avoid high host country withholding taxes on outgoing passive income, many multinational companies divert FDI via a third country with a more favourable tax treaty. If a country has several tax treaties, MNEs will take advantage of the "worst" one - i.e. the most favourable one from the firm's perspective - structuring their investment via the cheapest route (Brumby & Keen, 2016).

It is plausible that DTTs have a different effect on investment depending on whether investors consider the direct route as a viable investment channel. Therefore, in contrast to the previous literature, instead of treating tax treaties as a binary variable, we evaluate their relevance given the entire tax treaties network and allow for a differential effect on FDI. We do not concentrate on a single country or a single year, but conduct our analysis using a panel with more than 140 countries and their corresponding tax treaties network between 2005 and 2012 allowing for sufficient variation under domestic law and in the tax treaties network. Finally, in contrast to the previous literature that takes into account only the world average corporate income tax as the rate to be credited in conduit situations, we do not use such approximations. Instead, we consider the actual taxes paid on route. By doing so, we are able to measure the impact of DTTs on combined effective tax rates given the entire tax treaties network and estimate the corresponding effect on FDI.

3 Theoretical background

We build on the work of Mintz and Weichenrieder (2010), Dreßler (2012) and Weyzig (2013) consider the international tax system as a network and account for treaty shopping potential when estimating the impact of DTTs on FDI. Mintz and Weichenrieder (2010) construct the chains of corporate structure for German multinationals across various countries for the year 2001 and relate these structures to the underlying fiscal motives. The level of withholding taxes is found to be important in determining which countries are used as a platform for investments. More specifically, higher bilateral withholding taxes to and from Germany substantially increase the probability that outward and inward FDI is diverted via a third country.

Dreßler (2012) traces the group structures of multinationals across 58 countries in the years 1996 to 2008 and analyses to what extent these structures are tax-efficient. In this case, the level of withholding taxes between two group members is found to be important in determining the probability of an indirect participation. Holding companies are generally established in jurisdictions where they can, at least potentially, lower the applicable withholding taxes. Accordingly, operative subsidiaries are likely to be held via intermediate companies located in jurisdictions with low withholding tax rates towards the country of the ultimate parent. However, in about half of the observations, the intermediate conduit company does not lower the overall tax burden and in about 5% of the cases the tax burden on such repatriated profits is actually higher.

Finally, Weyzig (2013) uses microdata from Dutch Special Purpose Entities to analyse the geographical patterns and the structural determinants of FDI diversion. The results confirm that tax treaties are a key determinant of FDI routed through the Netherlands. In particular, the effect of tax treaties on FDI diversion partly arises from the reduction of dividend withholding tax rates, which provides evidence for tax treaty shopping.

Following Barrios et al. (2012), we capture the features of the international tax system

by measuring the tax distance between two countries, where tax distance is defined as the cost of channelling corporate income from one to another in terms of taxes to be paid. In particular, the tax cost between two countries consists of corporate income taxes to be paid in the host country, non-resident withholding taxes on the income of the subsidiary and corporate income taxes in the home country. The combined effective tax rate $t^e_{SP}(rm_{SP})$ for the multinational company can be determined depending on the relief method applied in the home (parent) country P on income from host (subsidiary) country S:

$$t^e_{SP}(no\ relief) = t_S + w_{SP} - t_S w_{SP} + t_P - t_S t_P \tag{1}$$

$$t^e_{SP}(deduction) = 1 - (1 - t_S)(1 - w_{SP})(1 - t_P) \tag{2}$$

$$t^e_{SP}(direct\ credit) = max\{1 - (1 - t_S)(1 - w_{SP}), 1 - (1 - t_S)(1 - t_P)\} \tag{3}$$

$$t^e_{SP}(indirect\ credit) = max\{1 - (1 - t_S)(1 - w_{SP}), t_P\} \tag{4}$$

$$t^e_{SP}(exemption) = 1 - (1 - t_S)(1 - w_{SP}) \tag{5}$$

where (rm_{SP}) is the applicable relief method, t_S the corporate tax rate in the host country, t_P the corporate tax rate in the home country and w_{SP} the non-resident withholding tax on the income of the subsidiary.

About half of the countries in our sample operate an exemption system under which foreign dividends are not taxed in the home country (5).[2] Other countries subject the received dividends to home country taxation at the corporate tax rate t_P. Most of these countries avoid double taxation by crediting the taxes paid in the host jurisdiction on the amount of distributed dividends (3). Such credit is usually limited to corporate taxes due in the home country. In some cases, also an indirect credit for the underlying corporate taxes is offered (4). Alternatively, a small number of countries does not exempt, nor credit foreign taxes, but instead allows them to be deducted as a business expense (2). Finally, some (especially less developed) countries do not provide for any form of double tax relief (1). The received dividends are then subject to full double taxation.

Next, we consider the possibility of an indirect repatriation of dividends, i.e. through a third (conduit) country C. It is rational for the MNE to choose the indirect route over the direct route, *ceteris paribus*, when its costs in terms of taxes are lower (Mintz & Weichenrieder, 2010; Weyzig, 2013; Van't Riet & Lejour, 2017). Since the corporate income tax of the host country t_S is always paid, irrespective of the relief method, we can define the direct tax distance d^e_{SP} between host country S and home country P based only on the relevant withholding tax rate and the corporate income tax of the home country. Depending on the relief method, the combined effective tax rate t^e_{SP} can be then defined as

[2]This includes states that operate a territorial tax system where all foreign profits are exempt and states that adopt worldwide taxation with a participation exemption for foreign dividends. Some countries exempt only 95% of the received dividends with, typically, a foreign tax credit or no relief for the remaining 5% of the dividends. Other countries exempt 100% of the received dividends, but disallow the deduction of certain costs connected with the participation. To simplify the analysis, we ignore these distinct characteristics.

$1-(1-t_S)(1-d^e_{SP})$, where d^e_{SP} accounts for the tax "distance" between the two countries measured in taxes paid en route:

$$d^e_{SP}(no\ relief) = t_P + w_{SP} \tag{6}$$

$$d^e_{SP}(deduction) = 1-(1-w_{SP})(1-t_P) \tag{7}$$

$$d^e_{SP}(direct\ credit) = max\{w_{SP}, t_P\} \tag{8}$$

$$d^e_{SP}(indirect\ credit) = max\{w_{SP}, \frac{t_P - t_S}{1-t_S}\} \tag{9}$$

$$d^e_{SP}(exemption) = w_{SP} \tag{10}$$

It follows that the condition for treaty shopping is that total taxes over the indirect route are less than over the direct one, i.e. $1-(1-d_{SC})(1-d_{CP}) < d_{SP}$ where the total tax distance with an initial host $k=1$ and final destination $k=n$ equals $1-\sum_{k=2}^{n}(1-d_{k-1,k})$ (Van't Riet & Lejour, 2017).

Finally, in a one-period model, where all profits are repatriated, it can be shown theoretically that FDI is decreasing in the relative effective tax rate T where $1-T=(1-t^e)/(1-t)$, with t^e being the effective tax rate on overseas profits and t the effective tax rate on domestic profits (Davies, 2003, 2004). In this model, DTTs increase FDI only to the extent that they reduce the relative effective tax rate. However, accounting for the possibility of an indirect repatriation of dividends, the effective tax rate on overseas profits is the lower one between the one on a direct route and the one on the indirect route. Accordingly, we differentiate between *relevant* tax treaties that offer investors a financial advantage over the conditions under domestic law, given the entire tax treaties network; *neutral* tax treaties that cut the tax cost of the direct route to the minimum one in the network; and *irrelevant* tax treaties that do not provide investors with a financial benefit.[3]

We expect *relevant* tax treaties to have a positive impact on the immediate FDI from the home country to the host country. If there are non-negligible non-tax costs to treaty shopping, *neutral* tax treaties may have a positive impact as well. We expect *irrelevant* tax treaties to have no impact on the immediate home to host country FDI.

[3]This model and the corresponding measure of tax distance focus only on dividend income and thereby ignore the potential for rate shopping where firms distribute profits in the way of interest or royalty payments to benefit from lower withholding tax rates on these types of passive income. Leaving aside the legal arguments, if and to what extent one type of passive income can be transformed into another one, we observe that for tax treaties that became effective in the years 2005-2012, average dividend withholding tax rates are the lowest and less than 10% tax DTTs have a lower withholding tax rate on interest or royalty income. To the extent that firms do "rate shop", we are less likely to find significant results for the impact of DTTs on FDI, when focusing only on dividend income.

4 Data and network analysis

4.1 Data

In order to construct our network analysis, we collect tax data for a sample of 146 countries between the years 2005 and 2012.[4] Our main source of data on domestic and international tax system are the IBFD Global Corporate Tax Handbooks for the years 2009-2012 and IBFD Online Tax Platform. For the countries included in the Global Corporate Tax Handbooks we collect information on the domestic tax system and, in particular, on taxation of foreign income (including the methods of double tax relief), and domestic corporate and withholding tax rates from the respective year books. To the extent that a country is not available in a Global Corporate Tax Handbook, we consult the closest to the missing year source of data for the taxation of foreign income, including the IBFD Online Tax Platform, and, unless indicated otherwise, assume the same method of taxation of foreign income for the missing years.

Moreover, we update all domestic corporate and withholding tax rates with the EY (Ernst and Young) Corporate Tax Guides if the IBFD data are not available for a particular year. For instance, for the years 2005-2008, the EY Corporate Tax Guides are our only source of data on domestic corporate and withholding tax rates. We further hand-collect the relevant withholding tax rates and methods of double tax relief from the respective DTTs and applicable protocols. Also, as the treaties network is subject to four types of changes, we check when new treaties become effective; if treaties have been terminated at a later point in time; if the conditions of the treaties have been changed through protocols in the following years; and if the conditions of the treaties have been altered through amendments in domestic law.[5] Overall, we consult more than 3000 tax treaties that became effective before 2013 and around 300 accompanying protocols.

We obtain data on bilateral inward FDI stocks between 2005 and 2012 from the UNCTAD (United Nations Conference on Trade and Development) database and we invert them to measure the investment from the home to the host country. In presence of FDI diversion via a third country, we would ideally want to observe the indirect investment from the home to the host country via the conduit country. However, the available data reports only the immediate home to host country FDI stocks. Therefore, we can estimate only the impact of DTTs on these immediate home to host country FDI stocks.[6] Finally,

[4] We are limited to this time span, as domestic tax data are not available systematically for the years before 2005, whereas data on FDI are not yet available for the years after 2012.

[5] If under the tax treaty between country A and country B dividends are subject to a withholding tax rate that is equal to the withholding rate under domestic law, any change in the domestic rate affects directly the rate under the tax treaty.

[6] FDI data present one additional challenge: whereas our measure of tax distance consists of the cost of channeling corporate income from one country to another in terms of taxes to be paid, firms may use debt financing instead of dividend. To the extent that FDI stocks include debt financing, the relationship between FDI stocks and tax distance becomes weaker and we are less likely to find significant results. Moreover, as DTTs do not create tax liabilities, they cannot increase the tax cost of debt financing. Therefore, the

the information on bilateral investment treaties (BITs) is from the Investment Policy Hub of UNCTAD.

4.2 Network analysis

Recent contributions by Van 't Riet and Lejour (2017) and Hong (2017) employ a network approach to study the centrality of countries in the tax treaties network and, respectively, the structure of tax-minimising (direct and indirect) investment routes. Both studies analyse the tax treaties network for a single year and ignore any changes in the tax treaties network over time. Moreover, both studies use an adapted Floyd-Warshall shortest path algorithm to estimate these tax-minimising investment routes, thereby overestimating the potential for tax treaty shopping.[7]

We take a different approach and develop a Visual Basic Application (VBA) tool to recalculate the tax distance for every possible combination of host, home and intermediate countries.[8] In this way, we can take into account the actual taxes paid in the jurisdiction before the one receiving the dividends - typically the intermediate jurisdiction - instead of nominal or world-average corporate tax rates. The single limitation of our approach is that we assume and restrict the number of possible intermediate jurisdictions to two in order to avoid long computation time of the analysis. However, this may not be an unrealistic assumption as Mintz and Weichenrieder (2010) show that only 0.2% of German multinational firms use cross-border group structures with three or more pass-through entities. Moreover, when we analyse our network using the Floyd-Warshall algorithm (allowing for an unlimited number of conduits) we do not find any indirect connection with three or more intermediate jurisdictions that would further reduce the tax distance between any two countries in our sample. Thus, we believe that our approach is superior to the Floyd-Warshall algorithm and allows for a more accurate network analysis.

For every year, we update the tax treaties network with all relevant changes. In particular, we account for changes in the provisions of tax treaties through amending protocols; for changes in the provisions of the tax treaties through changes under domestic law (for tax treaties that refer to conditions under domestic law); we add new tax treaties that become effective; and remove tax treaties that have been terminated or replaced by new ones in the course of the year being analysed. We assume a fully owned subsidiary engaged

identification of *relevant* tax treaties is not biased by including tax treaties that leave investor worse off.

[7]The Floyd-Warshall algorithm calculates total taxes over the indirect route taking into account only the nominal taxes in the intermediate jurisdictions. Assume that the home country relieves double taxation through the indirect credit method, whereas the intermediate jurisdiction exempts foreign dividends. Under the Floyd-Warshall algorithm, the home country credits the underlying corporate tax at the full nominal tax rate. However, the actual tax rate on the dividends in the intermediate jurisdiction is 0%. Van 't Riet and Lejour (2017) tackle this problem by substituting the nominal corporate tax rate in any intermediate jurisdiction with a worldwide average corporate tax rate.

[8]VBA is an implementation of Microsoft's programming language Visual Basic 6 and it is built into most Microsoft Office applications, including Microsoft Excel.

in an active course of business and consider only domestic anti-abuse provisions.[9] Specifically, we account for higher withholding taxes upon dividends distributions to tax havens and subject-to-a-minimum-tax clauses.

Several countries in our sample levy a higher withholding tax on dividends when these are distributed to a parent located in a tax haven. Because most of the domestic tax havens lists are not comprehensive, we adopt a common tax haven list for all countries in our sample across the entire time period (Dyreng & Lindsey, 2009).[10] In accordance with the majority of these domestic provisions, we exclude the anti-abuse treatment when a DTT is in place. Similarly, several countries in our sample adapt a subject-to-a-minimum-tax clause as a condition for claiming the benefits of participation exemption and exemption from withholding tax on dividends.[11] Since we observe to what corporate tax rates the subsidiary and the parent company are subject to, we can easily control for this condition.

We describe the entire international network of double tax treaties with eight variables. Our first variable is a dummy that verifies if a DTT between two countries is present, *DTT_dummy*. This is the standard variable used in the previous literature. For every year in our sample, we then measure the direct tax distance between any two countries taking into account a possible tax treaty between these two countries, *DistanceDirect*.

The innovative element in our analysis is to identify if there exists an indirect route along which the tax distance would be reduced as opposed to the direct route, independent of a country pair having a tax treaty or not[12]. This means that both a country pair with and without a bilateral DTT can have the cheapest connection on a direct or an indirect route. We create a dummy variable that indicates if such an indirect route exhibits a shorter tax distance than the direct route, labeled *NetworkConnection*. The use of a conduit obviously identifies treaty shopping. If the indirect route is the cheapest one,

[9] Assuming a subsidiary engaged in an active course of business allows us to ignore potential anti-abuse provisions targeted against treaty shopping. While this presents a limitation, the significant differences in the subjective and objective scope of these provisions make it fairly impossible to treat them in a systematic way. Moreover, whereas the OECD has put an effort in combating treaty shopping, its actions and recommendations are only recent and later than our sample years (see for instance OECD, 2015). Finally, the effectiveness of anti-treaty shopping rules proves disputable, as shown in the joined cases *Deister Holding* and *Juhler Holding* where the Court of Justice of the European Union declared the German provisions as not compatible with the EU freedom of establishment. To the extent that we overestimate the potential for treaty shopping, we are less likely fo find an effect of tax treaties and our results should be interpreted as the lower bound.

[10] Our sample includes the following tax havens listed in Table 1 in Dyreng and Lindsey (2009): Aruba, Bahamas, Bahrain, Barbados, Bermuda, Botswana, British Virgin Islands, Brunei, Cayman Islands, Cyprus, Gibraltar, Guernsey, Ireland, Isle of Man, Jersey, Latvia, Lebanon, Liechtenstein, Luxembourg, Macau, Maldives, Malta, Mauritius, Monaco, Panama, Seychelles, Singapore, Switzerland, Uruguay, U.S. Virgin Islands.

[11] Note that this differs from a subject to *a* tax condition. Here, we assume that all companies are subject to tax.

[12] This implies looking at 144 different routes with a single conduit for each of our 146 home countries to each of our host countries, and 144 times 143 different routes for two conduits, effectively comparing 440 million cases

we measure the reduction in the tax burden due to treaty shopping, *NetworkBenefit*. In 2012, a South African parent company investing directly in a US subsidiary has to pay 5% tax on distribution of dividends after considering the tax treaty between both countries. However, if the same investment is made through a conduit company in the Netherlands the tax cost can be reduced to 0%. Hence, the network benefit is 5% and we expect the bilateral FDI to decrease with the size of this benefit. We are aware that investors will not always prefer the indirect route over the direct route, in particular when the benefit is small, due to non-negligable costs of treaty shopping. A positive and significant coefficient on *NetworkConnection* could actually be interpreted in this fashion.

Once we estimate the minimum direct and indirect tax cost between any two countries, we identify the relevance of tax treaties. For this purpose, we distinguish between three types of tax treaties. First, we define *relevant* tax treaties as tax treaties that offer investors a financial advantage over the conditions under domestic law, given the entire existing tax treaties network. For example, in the year 2012, ignoring the bilateral tax treaty, the tax distance between Argentina as the home state and Belgium as the host state is 25% under the domestic law of both countries. The lowest possible tax distance when channelling income through the network is 12.5%.[13] Hence, *ceteris paribus*, we expect the MNE to choose the indirect route over the direct one. However, the tax treaty between Argentina and Belgium reduces the direct tax distance to approximately 1.5%, taking away the advantage of the indirect route, and further reducing the minimum tax distance between Argentina and Belgium by 11 percentage points. Therefore, the tax treaty is *relevant*. We expect *relevant* tax treaties to increase the immediate home to host country FDI. In theory, *relevant* tax treaties should stimulate FDI between two countries for two reasons. On the extensive margin, firms should relocate investments from the indirect route to the direct route. Along the intensive margin, firms would also benefit from a lower overall tax burden, and this should increase FDI.

Second, we define *neutral* tax treaties as tax treaties that cut the tax cost of the direct route to the minimum one in the network. Consider Japan as the home state and Canada as the host state. In 2012, the direct tax distance between the two countries is 25% under their domestic law. The shortest tax distance through the network is only 5%. Thus, the indirect route is tax-preferred. Nevertheless, the bilateral DTT between the two states lowers the direct tax distance to 5%, making the MNE tax-indifferent between the two investment channels. Presuming non-negligible non-tax costs to treaty shopping, *neutral* tax treaties may increase FDI between the home and the host state if firms relocate investments from the indirect route to the direct route. This effect occurs only on the extensive margin.

Third, the group of *irrelevant* tax treaties consists of DTTs that do not change the

[13]One of the possible indirect routes is through the United Kingdom and Bolivia: the tax distance between Belgium and the UK is 0% (no withholding tax in Belgium and participation exemption in the UK)and so is the the tax distance between the UK and Bolivia (no withholding tax in the UK, while foreign dividends are not subject to tax in Bolivia). Finally, the tax distance between Bolivia and Argentina is 12.5% resulting in an overall cost of 12.5%.

tax-preference of the indirect route. In the case of Argentina as the home country and Germany as the host state, in 2012, the direct tax distance between the two countries is about 26.4% under their domestic law, while the minimum tax distance through the network is 12.5%. Thus, also in this case, we expect the MNE to tax-prefer the indirect route rather than the direct one. Further, the DTT between the two countries reduces the direct tax distance to 21.25%, which is still higher than the minimum tax distance through the network. As a result, the tax treaty between Argentina and Germany is irrelevant to the MNE's decision to invest via a third country. Taken together, the *relevant*, *neutral* and *irrelevant* DTT dummies add up to *DTT_dummy*.

Given the minimum tax distance under domestic law and through the network, we measure by how much a *relevant* DTT reduces the shortest route between two countries. We label this variable *TreatyBenefit*. Take China as the home country and Austria as the host state. In 2012, the tax distance under domestic law of both countries is 25%. The minimum tax distance through the network is also 25%. The DTT reduces the direct tax distance to 7% giving a tax benefit of 18%. Compared to *NetworkBenefit*, which measures the tax benefit due to treaty shopping, *TreatyBenefit* measures the intended reduction in taxation by the treaty signatories. Consequently, we expect a positive effect of *TreatyBenefit* on the immediate home to host country FDI. Obviously, *NetworkBenefit* is zero for all relevant DTTs, whereas *TreatyBenefit* is zero in the case of irrelevant and neutral DTTs.

Both *TreatyBenefit* and *NetworkBenefit* measure tax benefits in an international setting. MNEs face a complex investment decision and the choice for the appropriate investment channel depends on other non-tax factors as well. In particular, we do not claim that MNEs will always invest along the tax-preferred path. In this regard, *NetworkBenefit* and *TreatyBenefit* capture the opportunity cost of not using the tax-preferred path relative to the other investment route. The higher the *NetworkBenefit* the higher the relative tax cost of investing directly from home to host country and the less immediate home to host country FDI is expected. By analogy, the same holds true for *TreatyBenefit*.

In extensions of our main model, we refine the analysis and disentangle the effects of tax treaties. Mainly, we split the group of *relevant* tax treaties in tax treaties where the second best alternative is an indirect route, *RelevantNetwork*, and tax treaties where the second best alternative is a direct investment under the conditions provided for in the domestic law, *RelevantDomestic*. We also interact both variables with *TreatyBenefit* to measure the impact of tax savings for both groups: *TBxNetwork* and *TBxDomestic*. In this way, we are able to separate the effects on the extensive and intensive margin.

In a similar way, we isolate the group of *irrelevant* tax treaties where, despite the lack of a financial advantage of the DTT, the direct route is still tax-preferred compared to the indirect one. Because of the many non-tax features of tax treaties, such as improved certainty or tax information sharing, tax treaty effects may intensify in case of tax-preferences for the direct investment channel. We label these DTTs: *IrrelevantDomestic*.

4.3 Summary statistics

Our sample consists of 138 countries in 2005 and 2006, 142 countries in 2007 and 2008 and 146 countries for the years 2009 - 2012.[14] This corresponds to 18,906 unique country pairs in the first year of our sample and 21,170 unique country pairs in the last year.[15] Due to missing economic data, the econometric analysis covers only 133 countries.

Table 1 summarises the characteristics of the international tax network. In 2005, 12 out of 138 countries apply no unilateral method of double tax relief; 7 countries the deduction method; 37 offer direct credit; 13 use indirect credit; and the remaining 69 countries exempt foreign dividend income. Ignoring bilateral DTTs, about 10% of all country pairs are left with no relief; less than 6% deduct foreign taxes from the taxable income; approximately 29% credit the host withholding tax from the domestic tax liability; almost 11% credit also the underlying corporate tax; and slightly more than 44% apply the exemption method. Once we include bilateral tax treaties, the shares of no relief and deduction drop to approximately 9% for the former and 5% for the latter; the percentage of countries using the direct credit method remains stable around 29%; indirect credits' share raises above 11%; while the use of exemption method increases the most to more than 45%.

In terms of the cheapest connection on route, we observe that for more than 55% of all country pairs the direct connection is the cheapest one. Further, 35% achieve the minimum tax distance on an indirect route with one conduit company and 9% on an indirect route with two conduits. Overall, 6,780 out of 18,906 unique country pairs have a zero tax distance, where there are no repatriation taxes on distributed income. Corporate income is taxed thus only once, at the level of the subsidiary, and there is no economic double taxation.[16] Almost 51% of the zero tax distance connections occur on the direct connection, more than 41% on an indirect route with one intermediate country and the remaining 7.4% on an indirect route with two intermediates.

In 2005, 3,439 country pairs have an effective DTT.[17] Out of these, 321 country pairs have a *relevant* tax treaty to the extent that it tax prefers the direct over the indirect route; 439 have a *neutral* tax treaty that cuts the direct tax cost to the level of the minimum tax distance in the network; leaving the remaining 2,679 country pairs with an *irrelevant* tax treaty.

Moving to the last year in our sample, 2012, 13 out of 146 countries have no unilateral method of double tax relief; 7 countries apply the deduction method; 35 offer direct credit for host withholding taxes; 14 credit also the underlying corporate tax, while 77 countries

[14] Due to missing domestic tax data we have to exclude from the network analysis Algeria, Cambodia, Laos and Libya between 2005 and 2008; and Belarus, Madagascar, Montenegro and Serbia in 2005 and 2006.

[15] Note that the tax distance between two countries can be asymmetric, i.e. it is more expensive to distribute dividends from country A to country B than vice versa.

[16] Note that the same outcome is achieved under the EU Parent-Subsidiary Directive.

[17] The effective date of tax treaties can differ between the two signatory countries. This explains the uneven number of effective DTTs.

Table 1: International tax network

		2005	2012
Number of countries:		138	146
Number unique country pairs:		18,906	21,170
Unilateral methods of double tax relief:	no relief	12	13
	deduction	7	7
	direct credit	37	35
	indirect credit	13	14
	exemption	69	77
Bilateral taxation (in absence of DTTs):	no relief	10%	11%
	deduction	6%	5.5%
	direct credit	29%	27%
	indirect credit	11%	10%
	exemption	44%	46.5%
Bilateral taxation (in presence of DTTs):	no relief	9%	10%
	deduction	5%	5%
	direct credit	29%	27.5%
	indirect credit	11.5%	10.5%
	exemption	45.5%	47%
Shortest distance:	direct	55%	52.5%
	one conduit	35%	36.5%
	two conduits	10%	11%
Number of zero tax distance connections:		6,780	9,116
Share of zero tax connections:	direct	51%	47%
	one conduit	42%	43%
	two conduits	7%	10%
Number of country-pairs with an effective tax treaty:		3,439	4,539
Number of effective tax treaties per type:	relevant	321	356
	neutral	439	732
	irrelevant	2,679	3,451

exempt foreign dividends. Leaving again the effect of tax treaties aside, about 11% of all country pairs have no relief for foreign taxes; 5.5% use deduction as the only relief method; 27% apply direct credit; approximately 10% offer indirect credit; and 46.5% apply exemption. Taking into account bilateral DTTs, the share of the no relief method drops below 10% and that of the deduction method below 5%. At the same time, the shares of all other methods increase to 27.5% in the case of direct credit; 10.5% in the case of indirect credit; and 47.3% for the exemption method.

Focusing again on the cheapest connections in the network, we see that now only 52.5% of the cheapest connections occurs on the direct route. This suggests that treaty shopping has gained in importance over the last decade. The use of indirect routes with one conduit company increases to above 36%, whereas indirect routes with two conduits increases to almost 11%. Overall, 9,116 out of 21,170 country pairs have a zero tax distance. Among these, 4,289 country pairs have a direct tax distance of 0%; 3,941 country pairs have a zero tax distance on an indirect route with one intermediate country; while the remaining 886 zero tax distances are achieved on an indirect route with two intermediates. Finally, in 2012, 4,539 country pairs have an effective DTT. 356 of them are *relevant*, 732 are *neutral* and 3,451 are *irrelevant*.

Figure 1 describes the economic consequences of treaty shopping. On the horizontal axis, we plot for every single observation in our panel the direct tax distance in the absence of treaty shopping, *DistanceDirect*. On the vertical axis, we show effective taxes paid if instead an indirect route via one or two conduits is chosen. Points along the diagonal exhibit no gains of treaty shopping. All countries were the direct distance is the cheapest route will be along this line. The greater the vertical distance from the diagonal, the bigger the saving due to treaty shopping. We show ample possibilities for treaty shopping, in some cases reducing the actual tax burden to zero.

Figure 1 reveals two interesting patterns. We find a series of vertical lines, which typically reflect individual country pairs, where neither domestic tax regulation nor the DTT have changed, and hence the tax burden along the direct route remains unchanged. However, subsequent treaties signed with or between third countries have reduced the tax burden along the indirect route, demonstrating how the international DTT network undermines national policy. We also observe that a great deal of our observations occurs along the 5%, 10% and 15% effective tax rates, which reflect the withholding tax rates usually agreed on in DTTs. Under the exemption system applied by the majority of countries in our sample, the actual tax burden is brought back from the level of domestic withholding tax rates to these common treaty withholding tax rates. Moreover, a significant number of observations is concentrated along the 25%, 30% and 35% direct tax distance, which coincides with the corporate tax rates of many counties. These points comprise all instances where the home country unilaterally offers a foreign tax credit - thereby setting the direct tax distance equal to the domestic corporate tax rate - but the MNEs benefit from tax treaties with a more generous method of double tax relief.

Table 2 gives an overview of the summary statistics.

Figure 1: Potential gains from treaty shopping

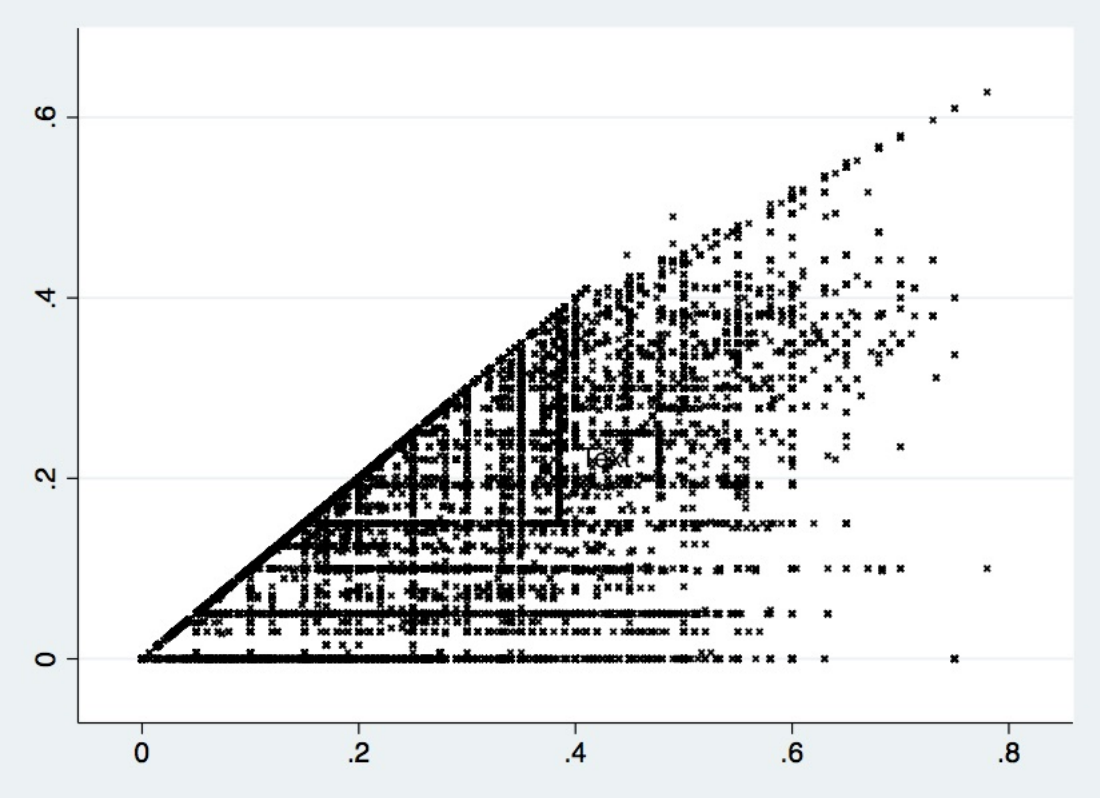

Table 2: Summary Statistics

Variable	n	Mean	S.D.	Min	Max
FDI stocks (in US dollars)	38,400	8928.13	8578.53	0	26540
BIT_dummy	135,252	0.1941	0.3955	0	1
DTT_dummy	135,252	0.2225	0.4160	0	1
DistanceDirect	135,252	0.1830	0.1407	0	.78
NetworkConnection	135,252	0.4705	0.4991	0	1
NetworkBenefit	135,252	0.0705	0.1013	0	0.63
Relevant_dtt	135,252	0.0189	0.1362	0	1
Neutral_dtt	135,252	0.3160	0.1749	0	1
Irrelevant_dtt	135,252	0.1720	0.3774	0	1
TreatyBenefit	125,252	0.0023	0.0196	0	0.35

5 Estimation methodology and main results

The standard procedure to infer DTT effects on bilateral FDI flows employs a gravity model and accounts for the presence of a DTT with a dummy variable equal to 1 when a tax treaty is effective between two countries in year t and 0 otherwise. We include the six variables derived from the network analysis and adopt a Poisson estimator (Pseudo-Maximum Likelihood Estimation - PPML). We resort to the PPML estimator as proposed by Santos-Silva and Tenreyro (2006) to account for zero FDI flows and, more importantly, heteroskedasticity in FDI data. In particular, Santos-Silva and Tenreyro (2006) argue that the standard log-linear OLS approach results in inconsistent coefficient estimates. Mainly because of doubts about the exclusion restriction (Anderson & Yotov, 2016), we decide not to follow the formal model of selection proposed by Helpman, Melitz and Rubinstein (2008). Given the large number of fixed effects, we use the *ppml_panel_sg* STATA command (Larch, Wanner, Yotov, & Zylkin, 2017) and estimate the following equation:

$$FDI_{ps,t} = exp[\beta_1 T_{sp,t} + \beta_2 D_{sp,t} + \beta_3 X_{sp,t} + \eta_{s,t} + \theta_{p,t} + \gamma_{sp}] + \epsilon_{s,t} \tag{11}$$

where $T_{sp,t}$ is a vector of tax rates or tax differentials, composed of *DistanceDirect*, *NetworkBenefit* and *TreatyBenefit*; $D_{sp,t}$ is a vector of dummies that describe the international tax network, consisting of *DTT_dummy*, *NetworkConnection*, *Relevant_dtt*, *Irelevant_dtt*, *Neutral_dtt*; and $X_{sp,t}$ is a vector of control variables, in our case only *BIT_Dummy*. Finally, $\eta_{s,t}$ and $\theta_{p,t}$ denote the time-varying host-country, respectively home-country fixed effects, γ_{sp} captures symmetric country-pair fixed effects and $\epsilon_{s,t}$ is the Poisson error term.

Time varying, host- and home-country fixed effects control for the multilateral resistances as well as the economic mass of both countries. Similarly to Baier and Bergstrand (2007) and Anderson and Yotov (2016), we use country-pair fixed effects, as described by Wooldridge (2002), to address DTT endogeneity and control for the physical distance between the host and the home country. We impose symmetric country-pair fixed effects to exploit the differences in $NetworkBenefit$ and $DTT\_benefit$ within a common country-pair when those are constant across time.

In presence of FDI diversion via a third country, the bilateral FDI flows are not independent of each other. For a given capital stock, the availability of a shorter (cheaper) indirect route leads to lower FDI flows on the direct route and vice versa. Ideally, we want to observe what fraction of bilateral FDI flows is diverted via a conduit country to an ultimate host destination. However, the available FDI data do not allow for that degree of identification. Instead, we cluster our standard errors by total inward FDI of the host country.

We present our main results in Table 3. First, we replicate results of prior literature in column(1), using just a BIT and a DTT dummy, as well as the direct tax distance to measure the tax burden on FDI, alongside our host, home, and country-pair-fixed effects. All variables are statistically insignificant, and given the previous literature, this comes as no surprise.

The results change dramatically once we add the two network variables, *NetworkConnection* and *NetworkBenefit*, and replace the DTT dummy with our measures of relevance in column (2). Whilst the variables of the previous specification (1) remain insignificant, we now observe several interesting effects. First, the results of the three dummies derived from the network analysis reveal a more complex mechanism behind the effects of tax treaties on bilateral FDI. Whereas the simplified DTT dummy did not have a statistically significant effect on bilateral FDI, this effect differs among *relevant*, *neutral* and *irrelevant* tax treaties. In particular, *relevant* DTTs exhibit a statistically significant and positive effect on bilateral FDI, whereas both *irrelevant* and *neutral* tax treaties have no statistically significant effect.

Further, the significant and negative coefficient of *NetworkBenefit* indicates that a reduction of the tax burden along the indirect route will encourage treaty shopping. As a result, the immediate home to host country FDI on the direct route will fall substantially. However, we also observe a positive coefficient on the *NetworkConnection* dummy. The mere existence of a cheaper indirect route does not lead to lower FDI stocks. On the contrary, these country pairs have higher FDI stocks relative to country pairs with a tax-preferred direct route, which suggests non-negligible non-tax costs of treaty shopping. This implies that the net effect of treaty shopping will depend on the size of tax savings. Only if these are sufficiently large, treaty shopping will decrease the immediate home to host country FDI stocks.

We extend the model in column (3) and add the *TreatyBenefit* variable. The significant and positive coefficients indicates that bilateral FDI stocks increase with the size of the tax benefit of a DTT. Simultaneously, the *relevant* tax treaties dummy is no longer significant. This comes as no surprise since the TreatyBenefit variables captures essentially the same effect, but allows for more precision in measuring the effect.

We further disentangle the effect of *relevant* tax treaties and *TreatyBenefit* in column (4). For relevant DTTs where the second best alternative is an indirect route the entire effect on FDI occurs along the extensive margin, with *RelevantNetwork* being positive and significant. The results are just the opposite for DTTs where the second best alternative is a direct investment under the domestic law conditions. Whereas the *RelevantDomestic* dummy is not significant, *TBxDomestic* is positive and significant. This suggests FDI creation on the intensive margin. Moreover, the interaction term is both stronger in magnitude and more significant than the *TreatyBenefit* variable in column (3).

In connection with the significant and positive results for *RelevantNetwork* dummy, it is somehow surprising that we do not observe the same effect for the group of *neutral* tax treaties. In column (5) we isolate one more group of tax treaties, *IrrelevantDomestic*, and continue to label the remaining irrelevant tax treaties as *Irrelevant_dtt*. Just like *Neutral* DTTs, *IrrelevantDomestic* DTTs do not provide for a financial advantage, i.e. they do not lower the minimum tax cost. However, while the direct route is not tax-preferred under the domestic law in case of *Neutral* DTTs, it is tax-preferred under the domestic law in case of *IrrelevantDomestic* DTTs. As such, *IrrelevantDomestic* tax treaties may be

a better reference point for the impact of *Neutral* DTTs. We indeed find a significant and positive effect of *Neutral* tax treaties on home to host country immediate FDI. Similarly to *RelevantNetwork* dummy, we interpret this effect as happening along the extensive margin.

Overall, we believe that our results shed light on the empirically mixed results in prior literature. Specifically, we are confident that our results highlight the importance of recognising the international tax system as a network and allowing for distinct effects of tax treaties through distinguishing their position in the network.

6 Robustness tests

Tables 4 to 6 report several robustness checks to gain additional insights and confirm our main results. We reproduce each time the reduced model presented in Table 3 column (2) in column (1) and the full model presented in Table 3 column (5) in column (4) for the ease of comparing the results.

As pointed out by Cheng and Wall (2005), "Fixed-effects estimations are sometimes criticised when applied to data pooled over consecutive years on the grounds that dependent and independent variables cannot fully adjust in a single year's time." (p.8). To address this concern, we follow Anderson and Yotov (2016) and estimate our model using only the years 2005, 2007, 2009 and 2011, which is comparable to the 3-years interval in Trefler (1993). We present these results in Table 4, columns (2) and (5). All of our variables, except *TBxDomestic*, remain significant at the same or even higher levels. In particular, *relevant* DTTs increase the immediate home to host country FDI. Additionally, also *neutral* DTTs increase FDI once we isolate the effects of *IrrelevantDomestic* DTTs.

In columns (3) and (6), we allow for a non-linear tax effect and square the *NetworkBenefit*, *TBxNetwork* and *TBxDomestic* variables: *NB_non-linear*, *TBxNetwork_non-linear* and *TBxDomestic_non-linear* respectively. Across both columns we find no non-linear tax effect of *NetworkBenefit* and *TBxDomestic*. However, whilst the *TBxNetwork* variable is not significant in the main model, we do observe a non-linear effect in column (6). The results indicate an increasingly positive effect of *TreatyBenefit* among DTTs where the second best alternative is an indirect investment via a conduit country. This suggests that at small values of *TreatyBenefit* the entire effect on FDI can be attributed to the tax "lead" of the direct route as opposed to the indirect route, which is also reflected by the higher coefficient of *RelevantNetwork*.

We conduct our initial tests clustering the standard errors by total inward FDI of the host country to address the concern that bilateral FDI flows are not independent between the country-pairs. Table 5, columns (2) and (5) show that clustering by total outward FDI of the home country yields almost identical results. Whereas clustering by total outward FDI addresses our concern of dependent FDI flows between the country pairs, this is not true for clustering by country-pair. Nevertheless, we present those results in columns (3) and (6).

In all of our baseline estimations we follow the standard practice in the empirical literature on the effects of DTTs and use FDI stocks as the dependent variable. In case there were a lot of inertia in foreign direct investment, changes in the treaty network might only affect new FDI, suggesting to use FDI flows instead. We do this by including lagged FDI as a dependent variable in Table 6. In particular, we add one-year lagged FDI in columns (2) and (5) and moreover two-year lagged FDI in columns (3) and (6) as further explanatory variables. Focusing on the variables of interest, we note that while the *RelevantNetwork* dummy remains positive, but is not statistically significant anymore, the *Irrelevant_dtt* dummy is now significant at the 10% and 5% level in column (5) and column (6) respectively. We consider these results to be in line with the strong negative impact of DTTs found by Blonigen and Davies (2005), who attribute this result to tax treaties limiting the tax planning opportunities. More specifically, as we do not rule out bilateral FDI in the presence of more beneficial indirect routes, the impact of *irrelevant* tax treaties that to do not offer investors any financial advantage, is likely to be dominated by the "negative" aspects of tax treaties. *NetworkConnection*, *NetworkBenefit* and *TBxDomestic* variables remain largely consistent and confirm our initial findings.

7 Conclusions

This paper has contributed to the literature on the effects of taxes on foreign direct investment. Despite the growing number of contributions, the empirical evidence on the effects of double tax treaties on bilateral FDI so far has been inconclusive. This paper provides ample evidence that this can be due to the neglect of treaty shopping in the literature. In order to avoid high host country withholding taxes on outgoing passive income, many multinational companies divert FDI via a third country with a more favourable tax treaty. Nevertheless, the vast majority of the existing literature treats DTTs as a binary variable, thereby ignoring their complexity and their domestic and international interactions. Our study addresses this gap in the literature and analyses the effects of double tax treaties allowing for treaty shopping and for a differential effect of DTTs. We identify DTTs as relevant if they reduce the overall tax burden below the one under domestic law and below the minimum one in the network. We define as irrelevant a DTT that would not provide investors with a financial benefit. We also include neutral DTTs that cut the tax costs of the direct route to the minimum one in the network.

In line with the previous literature, we find that the direct tax distance has no impact on bilateral FDI, defined as investment that does not run through intermediate countries, but goes directly from the resident to the source state. We contribute to the literature by asserting that this may be due to a strong presence of treaty shopping. Indeed, only relevant DTTs will increase bilateral FDI, whereas we observe no effect of irrelevant or neutral DTTs on FDI. A reduction in the overall tax burden due to treaty shopping has a strong and negative effect on bilateral FDI, as investments are channelled through conduit

countries. Finally, the need to use conduits along the cheapest route increase direct FDI, which gives an indication for non-negligible non-tax costs of treaty shopping.

This paper has shown that treaty shopping is a significant issue globally. We demonstrated that the presence of a cheaper indirect route to channel foreign direct investment indeed exhibits a significant negative impact on direct foreign investment. Tax treaties can only impact foreign investment if they reduce the tax burden with respect to the existing global network of double tax treaties, i.e when they are relevant. Any treaty between third countries can affect the relevance of a national treaty network, which implies that countries loose some of their capabilities to set tax policy.

Table 3: Regression results: effects of double tax treaties

	(1)	(2)	(3)	(4)	(5)
BIT_dummy	0.0537	0.0530	0.0535	0.0532	0.0536
	(0.0411)	(0.0409)	(0.0409)	(0.0408)	(0.0409)
DTT_dummy	-0.0023				
	(0.0315)				
DistanceDirect	-0.0394	0.1241	0.1058	0.1282	0.1003
	(0.1119)	(0.1969)	(0.1976)	(0.1964)	(0.1967)
NetworkConnection		0.1315***	0.1279***	0.1300***	0.1732***
		(0.0272)	(0.0272)	(0.0270)	(0.0331)
NetworkBenefit		-0.3366*	-0.4276**	-0.4232**	-0.5011**
		(0.1963)	(0.2005)	(0.2008)	(0.2025)
Relevant_dtt		0.1248***	0.0745		
		(0.0457)	(0.0565)		
RelevantNetwork				0.1383*	0.1587**
				(0.0763)	(0.0771)
RelevantDomestic				0.0223	0.0399
				(0.0694)	(0.0688)
Neutral_dtt		0.0523	0.0525	0.0545	0.0715*
		(0.0410)	(0.0410)	(0.0407)	(0.0409)
Irrelevant_dtt		-0.0125	-0.0103	-0.0120	-0.0424
		(0.0316)	(0.0316)	(0.0317)	(0.0367)
IrrelevantDomestic					0.0215
					(0.0354)
TreatyBenefit			0.5571*		
			(0.3262)		
TBxNetwork				0.2506	0.2214
				(0.6715)	(0.6745)
TBxDomestic				0.7912**	0.7807**
				(0.3555)	(0.3553)
Observations	32,554	32,554	32,554	32,554	32,554
Home-year FE	Yes	Yes	Yes	Yes	Yes
Host-year FE	Yes	Yes	Yes	Yes	Yes
Country-pair FE	Yes	Yes	Yes	Yes	Yes
R-squared	0.4863	0.4869	0.4869	0.4870	0.4871

Note: Dependent variable: FDI (2005-2012). Robust clustered (by total inward FDI of the host country) standard errors in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent confidence level.

Table 4: Intervals: (2) and (5); and squared tax benefit: (3) and (6)

	(1)	(2)	(3)	(4)	(5)	(6)
BIT_dummy	0.0530	-0.0380	0.0530	0.0536	-0.0378	0.0542
	(0.0409)	(0.0602)	(0.0409)	(0.0409)	(0.0602)	(0.0408)
DistanceDirect	0.1241	0.1277	0.0202	0.1003	0.1820	0.1336
	(0.1969)	(0.2599)	(0.1929)	(0.1967)	(0.2789)	(0.1986)
NetworkConnection	0.1315***	0.1637***	0.1133***	0.1732***	0.2012***	0.1565***
	(0.0272)	(0.0374)	(0.0351)	(0.0331)	(0.0475)	(0.0389)
NetworkBenefit	-0.3366*	-0.5482**	-0.0187	-0.5011**	-0.6633**	-0.2372
	(0.1963)	(0.2617)	(0.4166)	(0.2025)	(0.2695)	(0.4122)
Relevant_dtt	0.1248***	0.2118***	0.1274***			
	(0.0457)	(0.0648)	(0.0458)			
RelevantNetwork				0.1587**	0.2889***	0.3130***
				(0.0771)	(0.1004)	(0.0996)
RelevantDomestic				0.0399	0.1079	0.0256
				(0.0688)	(0.0967)	(0.0917)
Neutral_dtt	0.0523	0.0949	0.0547	0.0715*	0.1118*	0.0734*
	(0.0410)	(0.0585)	(0.0410)	(0.0409)	(0.0583)	(0.0409)
Irrelevant_dtt	-0.0125	0.0209	-0.0101	-0.0424	-0.0060	-0.0385
	(0.0316)	(0.0453)	(0.0317)	(0.0367)	(0.0538)	(0.0367)
IrrelevantDomestic				0.0215	0.0473	0.0228
				(0.0354)	(0.0487)	(0.0355)
TBxNetwork				0.2214	-0.1164	-3.3543*
				(0.6745)	(0.9125)	(1.8269)
TBxDomestic				0.7807**	0.7486	1.0931
				(0.3553)	(0.4836)	(1.2992)
NB_non-linear			-0.9457			-0.8201
			(1.1134)			(1.1037)
TBxNetwork_non-linear						12.6928**
						(6.3053)
TBxDomestic_non-linear						-1.1058
						(4.6386)
Observations	32,554	16,299	32,554	32,554	16,299	32,554
Home-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Host-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.4869	0.5167	0.4869	0.4871	0.5169	0.4871

Note: Dependent variable: FDI (2005-2012). Robust clustered (by total inward FDI of the host country) standard errors in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent confidence level.

Table 5: Standard errors clustered by total host inward FDI: (1) and (4); total home outward FDI: (2) and (5); and country-pair: (3) and (6)

	(1)	(2)	(3)	(4)	(5)	(6)
BIT_dummy	0.0530	0.0533	0.0533	0.0536	0.0536	0.0536
	(0.0409)	(0.0452)	(0.0542)	(0.0409)	(0.0453)	(0.0541)
DistanceDirect	0.1241	0.0067	0.0067	0.1003	0.1003	0.1003
	(0.1969)	(0.2026)	(0.2484)	(0.1967)	(0.2252)	(0.2725)
NetworkConnection	0.1315***	0.1315***	0.1315***	0.1732***	0.1732***	0.1732***
	(0.0272)	(0.0257)	(0.0338)	(0.0331)	(0.0337)	(0.0433)
NetworkBenefit	-0.3366*	-0.3366	-0.3366	-0.5011**	-0.5011**	-0.5011*
	(0.1963)	(0.2244)	(0.2672)	(0.2025)	(0.2434)	(0.2846)
Relevant_dtt	0.1248***	0.1248***	0.1248**			
	(0.0457)	(0.0449)	(0.0566)			
RelevantNetwork				0.1587**	0.1588**	0.1586
				(0.0771)	(0.0811)	(0.0982)
RelevantDomestic				0.0399	0.0399	0.0399
				(0.0688)	(0.0680)	(0.0793)
Neutral_dtt	0.0523	0.0523	0.0523	0.0715*	0.0715*	0.0715
	(0.0410)	(0.0419)	(0.0506)	(0.0409)	(0.0430)	(0.0518)
Irrelevant_dtt	-0.0125	-0.0125	-0.0125	-0.0424	-0.0424	-0.0424
	(0.0316)	(0.0348)	(0.0392)	(0.0367)	(0.0377)	(0.0439)
IrrelevantDomestic				0.0215	0.0215	0.0215
				(0.0354)	(0.0381)	(0.0441)
TBxNetwork				0.2214	0.2214	0.2214
				(0.6745)	(0.7039)	(0.8721)
TBxDomestic				0.7807**	0.7807*	0.7807
				(0.3553)	(0.4290)	(0.4898)
Observations	32,554	32,554	32,554	32,554	32,554	32,554
Home-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Host-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.4869	0.4869	0.4869	0.4871	0.4871	0.4871

Note: Dependent variable: FDI (2005-2012). Robust clustered (by total inward FDI of the host country) standard errors in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent confidence level.

Table 6: One-year - (2) and (5) - and two-year - (3) and (6) - lagged FDI

	(1)	(2)	(3)	(4)	(5)	(6)
BIT_dummy	0.0530	0.0914**	0.0397	0.0536	0.0918**	0.0420
	(0.0409)	(0.0456)	(0.0630)	(0.0409)	(0.0456)	(0.0629)
DistanceDirect	0.1241	-0.0053	0.1452	0.1003	0.0832	0.2377
	(0.1969)	(0.1952)	(0.2085)	(0.1967)	(0.2022)	(0.2316)
NetworkConnection	0.1315***	0.0993***	0.1231***	0.1732***	0.1369***	0.1925***
	(0.0272)	(0.0269)	(0.0321)	(0.0331)	(0.0329)	(0.0397)
NetworkBenefit	-0.3366*	-0.2392	-0.4949**	-0.5011**	-0.3981*	-0.7297***
	(0.1963)	(0.1987)	(0.2153)	(0.2025)	(0.2077)	(0.2291)
Relevant_dtt	0.1248***	0.0620	0.0874			
	(0.0457)	(0.0491)	(0.0642)			
RelevantNetwork				0.1587**	0.0677	0.0850
				(0.0771)	(0.0797)	(0.1020)
RelevantDomestic				0.0399	0.0089	0.0370
				(0.0688)	(0.0738)	(0.0911)
Neutral_dtt	0.0523	-0.0061	-0.0121	0.0715*	0.0121	0.0224
	(0.0410)	(0.0438)	(0.0543)	(0.0409)	(0.0439)	(0.0547)
Irrelevant_dtt	-0.0125	-0.0452	-0.0577	-0.0424	-0.0711*	-0.1017**
	(0.0316)	(0.0341)	(0.0438)	(0.0367)	(0.0379)	(0.0478)
IrrelevantDomestic				0.0215	-0.0115	0.0035
				(0.0354)	(0.0383)	(0.0494)
TBxNetwork				0.2214	0.2767	0.6302
				(0.6745)	(0.6650)	(0.7555)
TBxDomestic				0.7807**	0.6221*	0.7088
				(0.3553)	(0.3627)	(0.4110)
lagFDI		0.00003***	0.00002***		0.0003***	0.00002
		(1.05e-06)	(1.22e-06)		(1.05e-06)	(1.22e-06)
twolagFDI			-4.34e-07			-4.66e-07
			(9.80e-07)			(9.80e-07)
Observations	32,554	28,869	20,782	32,554	28,869	20,782
Home-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Host-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.4869	0.5386	0.5660	0.4871	0.5387	0.5664

Note: Dependent variable: FDI (2005-2012). Robust clustered (by total inward FDI of the host country) standard errors in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent confidence level.

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