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Arjan Lejour
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The Foreign Investment Effects of Tax Treaties

Arjan Lejour*

Abstract

We examine the impact of bilateral and multilateral tax treaties on bilateral FDI stocks. First, we present panel regressions of the effects of treaties on FDI based on an extensive database of all OECD countries from 1985 onwards. We use geographic instruments to correct for the endogeneity of tax treaties. In contrast to many papers we find that these treaties increase bilateral FDI significantly. The increase is about 16 percent and for new treaties this is even 21 percent. Moreover, the EU parent subsidiary directive doubles bilateral FDI stocks. Second, we analyse the effects of treaty shopping on FDI using the number of tax treaties as proxy for the attractiveness of a country for establishing a holding. This indicator has a significant impact on FDI: twenty extra tax treaties increase bilateral FDI stocks by about 50 percent. Lower withholding tax rates of dividends do also attract FDI.

Key words: bilateral tax treaties, instrumental variables, FDI, treaty shopping

JEL codes: F21, F23, H25

* CPB Netherlands Bureau for Economic Policy Analysis, e-mail: arjan.lejour@cpb.nl

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1. Introduction

The role of bilateral tax treaties attracts a lot of attention nowadays. Although bilateral tax treaties are originally used to avoid double taxation, it seems that multinational firms use the network of these treaties to avoid taxation by establishing shell companies in countries with attractive treaties (treaty shopping), resulting sometimes even in double non taxation. Many people are worried about tax base erosion and profit shifting of multinationals resulting in lower profit tax payments using these treaties (OECD, 2013).

There is less attention now for the investment effects of tax treaties which is the prime aim of negotiating on these treaties. This topic is the main purpose of this paper. Various papers have investigated the impact of bilateral tax treaties on bilateral FDI using macro and micro data, but their findings are not clear cut and often point to insignificant or negative effects (see the review in section 2). These negative or insignificant results in the literature are often explained by a second aim of tax treaties: the administrative cooperation between countries to fight tax evasion. However, the effectiveness of this cooperation is hardly studied (if possible at all), and these theoretical explanations of negative investment effects are therefore not very satisfactory.[1] Keen and Ligthart (2004) is one of the few papers that investigates information sharing. They conclude that information sharing is increasing in recent years, particularly due to automatic exchange. However, there are many impediments to an effective use of this information by tax authorities. In recent years, governments seem to commit themselves towards automatic exchange of information and to use this information, but this change in attitude is happening after 2011 which is the final year of the data period in this study.

As the treat of detecting tax evasion is not very convincing other factors must explain the different inconclusive results. Some factors are the (lack of) treatment of endogeneity of the bilateral tax treaties and the selection of the data sample in terms of country pairs and years. We contribute to the literature, first, by using geographic variables as instruments for bilateral tax treaties and, second, by constructing a very extensive data set covering all bilateral FDI data of reporting OECD countries to all their partner countries between 1985 and 2011. Third, we also include multilateral tax treaties as explanatory variables. Finally, we include indicators for treaty shopping.

We use bilateral FDI stocks from the OECD running from 1985 to 2011. We have 34 OECD countries reporting inward and outward stocks towards 233 partner countries. The UNCTAD provides information of bilateral tax and investment treaties including the year of signature and the type of

[1]

tax treaty. We are mainly interested in the treaties on income and capital dealing with tax treatment of the returns on foreign investment from the host to the home country. These are dividend, interest and royalty flows which have a different fiscal treatment. In our estimations we explain bilateral FDI stocks by GDP variables based on the "knowledge-capital" model of Markusen (2002) and gravity equations. We add bilateral investment treaties and regional-year dummies. Our main interests are the dummies on tax treaties. We include a dummy for a treaty on income and capital and a dummy for the other treaties. Apart from bilateral tax treaties, a multilateral tax agreement is included. This is the parent-subsidiary (PS) directive in the EU, which disallows the double taxation of profits of multinationals in 1991 (EC, 1990). The withholding tax rates on dividend between EU countries are set to zero. We include this as a dummy. It is time-variant for a number of country pairs, because the EU was extended in 1995, 2004 and 2007. From 2005 to 2009 this directive is gradually extended to include finally participation shares of 10 percent (instead of 25 percent).[2]

The panel OLS estimations with fixed effects for the country pairs and regional-time dummies reveal that the instrumented dummy for tax treaties on income and capital is positive and significant. A new tax treaty could increase bilateral FDI stocks by 21 percent. The coefficient for the PS directive is also positive and significant. Country pairs subjected to this directive have twice as large FDI stocks as other country pairs. This does not reflect only the fiscal treatment of returned profits, but also market integration in the EU. The panel OLS estimations identify the investment effects of bilateral tax treaties by comparing the development of the FDI stocks over time between countries pairs. We also want to check the differences between country pairs with and without treaties are still significant if mainly the differences between country pairs are used for identification. Instead of a panel we use matching propensity score methods on new treaties if these are instrumented following Egger et al. (2006). The matching propensity score methods conclude that FDI stocks increase more if a treaty is signed compared to the rise of FDI stocks of country pairs without a treaty. Depending on the time length the difference is 11% to 16% which is somewhat smaller than in case the tax treaties are not instrumented.

Finally, we assess the effect of treaty shopping by including the number of tax treaties that country has signed and the average withholding tax rate on dividends as extra explanatory variables. Bilateral FDI stocks could increase by 50 percent if the home country has signed 20 extra treaties. This effect is statistically and economically significant. For the host country the effects are smaller.

[2]The EU introduced also the interest and royalty (IR) directive (EC, 2003). This directive imposed zero withholding tax rates on interest and royalty flows between EU countries. We do not include it in the estimation model because of the correlation with the PS directive, see Table 2.

Moreover, lower withholding tax rates in the host country have a significant positive effect on the FDI stocks to these countries.

The remainder of the paper is structured as follows. Section 2 presents the literature. The data are discussed in section 3 and section 4 lays out the estimation framework. The empirical results of the OLS panel regressions and the matching propensity score methods are discussed in section 5. Section 6 focuses on the panel regressions with treaty shopping and section 7 concludes.

2. Literature

A number of papers have empirically tried to establish the effects of bilateral tax treaties on international capital movements. Due to the dual objectives of bilateral tax treaties, the qualitative effect is a priori unclear (Davies, 2004). The first objective, the prevention of double taxation, has a stimulating effect on FDI, while the second objective, the sharing of information between governments, can counteract tax evasion and thus discourage FDI. Research has focused on the first objective using macro and micro data, especially for the US.

Blonigen and Davies (2005) find that bilateral tax treaties are often correlated with more FDI in an analysis of FDI flows between OECD countries and other countries in the period 1982 to 1992. They apply OLS estimations. However, the tax treaties signed in the sample period can be distinguished from the treaties concluded before 1982. Then, the authors find no positive effect of the new treaties on FDI, in a fixed-effects estimation the effect is even negative. Another study by the same authors (Blonigen and Davies (2004)) finds insignificant or even negative effects on the in- and outward FDI flows of the US between 1980 and 1999. Millimet and Kumas (2009) apply the data of Blonigen and Davies (2005) to test the hypothesis that the effect of a treaty depends on the size of FDI. If the distribution of the FDI values is split into four parts, irrespective of the country, they find a significant and negative impact of tax treaties if FDI is large while there may be potential benefits with limited FDI flows. These effects hold mainly in the short term.

Egger et al. (2006) also conclude that new treaties have a negative effect on FDI using matching propensity score methods comparing FDI stocks two years before and two years after treaties are concluded using OECD data between 1985 and 2000. They take into account the endogeneity of the treaties. It is much more likely that a treaty is concluded if bilateral investment is substantial, compared to the situation that there is hardly any investment between the two countries. Coupé et al. (2009) use the number of treaties that both countries have concluded as an instrument for the probability that two countries conclude a treaty in a sample of 17 OECD and 9 transition countries

between 1990 and 2001. With this instrument the coefficients of the tax treaties on income and capital and on income are not significant. For the timing of the effects, they distinguish dummies three years before to three years after treaty ratification, but these are often not significant. Di Giovanni (2005) studies the determinants of the explosion of mergers and acquisitions between 1990 and 1999. He concludes that tax treaties have a positive effect on the financial flows of mergers and acquisitions.

Neumayer (2007) examines whether tax treaties between developing countries and the US lead to more FDI to these countries in the period 1970 to 2001. FDI stocks are on average about 20 percent higher if a treaty is concluded in the sample period, but the effect is only significant for middle income countries. Hines (1998) concentrates on FDI flows between Japan and developing countries in 1990. Instead of a dummy for a tax treaty he uses a rule called tax sparing. This is the tax exemption for the parent company in the home country based on the statutory tax rate in the host country. The effective tax rate could be lower than the statutory tax rate to improve the investment climate in the host country. Many Japanese tax treaties contain this rule. Hines (1998) concludes that FDI in developing countries is 1.4 to 2.4 times higher than without tax sparing.

Blonigen et al. (2011) use data of individual companies based in the US and find that tax treaties promote outward FDI between 1987 and 2007, but that the effect is smaller or even negative if the companies use a lot of intermediate supplies from foreign companies. This suggests that the mechanism of transfer pricing is less used in these cases. Both the number of US companies that establishes a subsidiary in other countries and the size of the investment increase. Davies et al. (2009) use firm-level data from Swedish multinationals in the period 1965 to 1998. They conclude that a treaty has a positive effect on the probability for establishment in a country, but that it has no significant effect on the scope of activities abroad.

The shift of FDI through subsidiaries in third countries to exploit favourable bilateral tax treaties (treaty shopping) is often qualitatively analyzed in the literature. The concept of treaty shopping is not exactly defined (Avi-Yonah and Panayi, 2011). We take this for granted and use an economic definition of Davies (2004): *the case of FDI which run through a third country to use the benefits of a tax treaty which are not present between the mother country and the host country*. Weichenrieder and Mintz (2008) show on the basis of data of German multinationals the chains of corporate structures across various countries and the underlying fiscal motives for these structures in 2001. The withholding tax, income consolidation, and the tax system in the home country determine the extent to which foreign investment is financed through third countries. Especially the withholding

tax is quantitatively important and explains that German multinationals use much more the Netherlands as a platform for their investments than Switzerland after the PS directive was adopted in 1991. Weyzig (2012) uses Dutch micro data of shell companies in 2007 for analysing FDI flows passing the Netherlands as conduit country. By relating these flows to the direct flows between the host and home countries (from the balance of payment statistics) he finds that the share of bilateral FDI that passes the Netherlands is 6 percentage points higher with a tax treaty route between the home and host country via the Netherlands. This is a large effect given that the average share of bilateral FDI passing the Netherlands is 11 percentage points. The low withholding tax on dividends has also a significant effect on treaty shopping.

3. Data

We use bilateral FDI stocks from 1985 to 2011 collected by the OECD. We have 34 OECD countries reporting inward stocks, the accumulated amount of FDI invested *in* the reporting country, and outward stocks, the accumulated amount of FDI invested *by* the reporting country, with potentially 233 partner countries. This implies that we consider FDI stocks and tax treaties between OECD countries and between OECD and non-OECD countries. For the bilateral FDI stocks between OECD countries we have in principle two reporting countries and thus two reported stocks in both directions. If two reported stocks are available we choose for the reported inward stocks, because the quality of inward FDI data is on average better than of outward FDI.[3] If only one reported stock is available we choose for this stock and otherwise we report a missing.[4] In principle, the FDI values do not contain FDI stocks held by shell companies which is important for countries like the Netherlands and Luxembourg.[5] However, many other countries report FDI stocks to the OECD including shell companies. We have potentially 14722 observations per year. It is an unbalanced panel; varying from 644 observations in 1985 to 11045 in 2010 (see the Figure in appendix 1 for more details). In total we have 132,564 observations with bilateral FDI stocks.

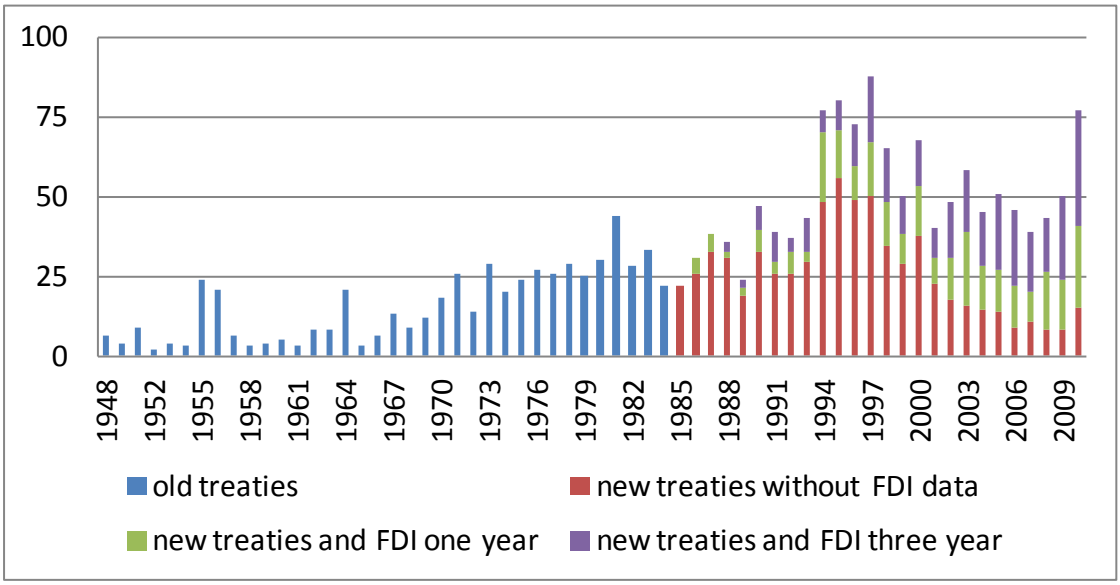
[3] Data experts on FDI argue that governments and firms have a bigger incentive to register the inward flows more accurately than the outward flows for tax and subsidy reasons.

[4] Because the quality of FDI reporting is not very high, it could be the case that we notice substantial changes in the bilateral FDI stock due to a shift in reporting from the outward to the inward stock over time or vice versa. As a robustness analysis we have also constructed a data set with only reported inward stocks between OECD countries, inward stocks from non-OECD to OECD countries and outward stocks from OECD to non-OECD countries. The estimation results are hardly affected by the alternative database. Results are available upon request.

[5] Since 2009 IMF gathers bilateral FDI data including the FDI held by shell companies or other special financial institutions. Because only data for four years are available we can not employ this data base for the panel analyses.

UNCTAD provides information on bilateral tax and investment treaties, including the country pair, the year of signature and the type of tax treaty. Various country pairs have signed more than one treaty including protocols and treaties on inheritance and gift taxes. We focus on the treaties on income and capital (also sometimes only called income), because these contain the tax treatment of dividend, interest and royalty flows related to foreign direct investment.[6] We use year dummies for the treaties on income and capital (indicating 1 for the years following the year of signature) and use also year dummies for the other types of treaties. Figure 1 presents the development of treaties on capital and income.

Figure 1 Development of bilateral tax treaties on capital and income of OECD countries



Source: UNCTAD.

In the 1950s only a few treaties per year were signed by the OECD countries. This increases to more than twenty treaties per year in the 1970s and develops further to about 40 to 50 treaties in the 1990s and 2000s. Figure 2 presents the number of treaties per year in various colors to indicate the relevance of these treaties in the empirical analysis. Because the FDI data are from 1985 we can not compare the bilateral FDI stock development before and after the treaty if the treaty dates back to 1985 or earlier. We call these old treaties. For newer treaties this comparison is also not guaranteed,

[6] An example from Coupé et al. (2009): income and capital tax treaties cover taxes on both income and capital, while income tax treaties cover taxes on income only. Ukraine has an income and capital treaty with Germany; this treaty covers the following taxes in Germany: income tax, corporation tax, capital tax, and trade tax, and in Ukraine: tax on profit of enterprises, income tax on citizens, tax on property of enterprises, and tax on immovable property of citizens. Whereas with Sweden Ukraine has concluded only an income tax treaty, which covers tax on profit of enterprises and income tax on citizens in Ukraine; and state income tax, special income tax for non-residents, special income tax for non-resident artistes, the communal income tax in Sweden.

because many bilateral FDI data points are missing (from the data sources). We discriminate tax treaties, for which we have FDI data three years and one year prior to the agreement.[7] The declining share of red (no FDI data) in the figure signals the increasing availability of FDI data.

Table 1 presents more details about the development of bilateral tax treaties. Over time more and more countries have signed treaties. From 1970 the number of treaties per country increased, represented by an increasing density. This trend is still going on. Treaties are not randomly signed between countries. Within some groups of countries, such as the industrial countries, more treaties are signed than between developing countries. Treaties are therefore clustered, which is represented by the clustering coefficient in the last column of Table 1.

Table 1 The development of tax treaties, 1950-2011

year	number countries	number treaties	max. number treaties	density (%)	clustering overall
1950	8	7	21	33.3	0.00
1960	46	68	990	6.9	0.00
1970	82	159	3240	4.9	0.03
1980	114	397	6328	6.3	0.13
1990	142	701	9870	7.1	0.26
2000	167	1338	13695	9.8	0.41
2011	184	1898	16653	11.4	0.47

Source: UNCTAD. Note that the values in the column density follow from dividing the number of treaties by the maximum number of treaties.

Data on withholding taxes on dividends by country and by bilateral tax treaty are from Deloitte for the 60 largest countries for the year 2012. Although sometimes tax treaties are renegotiated, the withholding tax rates in treaties are constant over time. For smaller countries we have used the world tax database of Ernst and Young. The data are for the year 2013. Tax treaties often mention various tax rates on dividends depending on the participation share of the parent in the daughter company. We have chosen for the tax rates applicable when the parent company participates for at least 5, 10 or 20 percent in the foreign subsidiary (depending on the treaty). For years in which there is no bilateral tax treaty we assume that the dividend tax rates of the host countries apply.

Data on GDP, GDP per capita and openness (the sum of exports and imports in goods and services as share of GDP) we have from World Bank's World Development Indicators. We have interpolated the

[7] Note that if countries start registering a bilateral FDI stock, they also do this for subsequent years. In nearly all cases we have data until 2010 or 2011.

data on the years of school attainment of Barro and Lee for measuring human capital. However, the World Bank does not provide data for many small (island) countries. This reduces the number of observations used in the regressions.

4. The estimation model

We want to explain the size of the bilateral FDI stocks with different types of tax treaties as a few of the explanatory variables. Nowadays many papers explain bilateral FDI (flows or stocks) using a gravity equation. This application is often derived from the trade literature, but also from theoretical frameworks describing the determinants of FDI. The best example is the "knowledge-capital" model of Markusen based on a formal general equilibrium theory of multinational enterprise (MNE) activity. Carr et al. (2001) and Markusen and Maskus (2002) have found substantial empirical fit of the knowledge-capital model using data on affiliate sales of US firms in other countries and foreign affiliate sales in the US. Blonigen and Davies (2005) and Egger et al. (2006) also use the knowledge-capital model for testing the effects of tax treaties.

According to this theory the sum of real GDP of both countries (measured in logs) reflects the potential for FDI. Larger economies have more resources and capacity for foreign investment. The second explanatory variable, GDPDIFSQ is defined as the squared difference between the two countries' real GDP, also measured in logs. These two variables are also used in the standard gravity equations. The variables of the human capital model are related to differences in relative endowments of skilled labour to unskilled labour and are also interacted with GDP variables. However, we have excluded these variables, because the coefficients did not appear to be statistically significant and did not add to the explanatory power of the models, but did reduce the number of observations (as is the case for openness).

Based on this work we employ the following equation:

$$FDI_{ijt} = f\,(SUMGDP_{ijt}, GDPDIFSQ_{ijt}, BITS_{ijt}, DTT_{jt}, Other_{ijt}, PS91_{ijt}, IR03_{ijt}, D_i, D_j, YEAR_t) \qquad (1)$$

The dependent variable, FDI_{ij} measures the FDI stock in natural logs from a home country (i) to a host country (j). An additional control variable is a dummy for bilateral investment treaties (BITS). These treaties facilitate bilateral FDI and increase the legal certainty of foreign ownership. We expect a positive coefficient.

The dummies on tax treaties are our focus variables. We include a dummy for a treaty on income and capital (or income) and a dummy for the other treaties such as inheritance and gifts and air and sea transport. We call the former the DTT dummy referring to double tax treaties and the latter the other dummy. Because the texts of bilateral tax treaties often follow the protocols of the OECD (between developed countries) or the UNCTAD (between developed and developing countries), the treaty texts are overlapping. However the content of the treaties certainly differs from each other along some dimensions which are very difficult to quantify, such as misuse prohibitions. Therefore, we measure tax treaty activity only as a binary variable taking the value 1 if two countries have a bilateral tax treaty and 0 if they have not.

Apart from bilateral tax treaties, multilateral agreements are included in the regressions. The most important is the PS directive in the EU, which forbade the double taxation of profits of multinationals in 1991. Moreover, the withholding tax rates on dividends between EU countries are set to zero. We include this as a dummy indicating 1 if both countries are EU member in a year from 1992 onwards. Because the EU is extended in 1995, 2004 and 2007 the dummy also switches between 0 and 1 for the country pairs of old and new EU members and between new members in the accession years. In 2003 this directive is extended to participation shares of 10 percent and larger (instead of 25 percent and larger) and the EU introduced the IR directive. This directive imposed zero withholding tax rates on interest and royalty flows between EU countries. In the model a dummy in introduced. We have also introduced a dummy indicating the EU membership of both countries because the internal market in the EU facilitates FDI. However, the IR and EU dummies coincide to a large extent with the dummy of the PS directive. Table 2 reveals that the correlations are 0.97 with the EU dummy and 0.84 with the IR directive.

Table 2 Pair wise correlation between FDI and the tax variables

	ln FDI	Other	BITS	Dividend tax	DTT	PS91	IR03	EU
ln FDI	1.00							
Other	0.12	1.00						
BITS	0.18	0.00	1.00					
Dividend	-0.04	-0.01	-0.04	1.00				
DTT	0.51	-0.08	0.38	-0.07	1.00			
PS91	0.35	-0.01	0.08	-0.13	0.31	1.00		
IR03	0.26	-0.01	0.14	-0.12	0.27	0.84	1.00	
EU	0.36	-0.01	0.08	-0.13	0.31	0.97	0.81	1.00

Note that the dummies are 1 is a treaty exists between two countries. That is also the case for the applicability of the EU directives.

Table 2 also shows positive correlation between investment and bilateral tax treaties (0.38), but no correlation with the other tax treaties. A higher dividend tax rate in the host country is negatively

correlated to FDI and the other dummies. In the EU directives this tax rate is set at 0 and the standard dividend rate is often lowered in tax treaties.

Finally, we include region-year dummies for the parent and host country to identify non-observed time-varying effects for country groups, next to year-dummies in the panel regressions. The use of region-year dummies (based on a geographic classification of the World Bank and North America and Western Europe) is a compromise. Theoretically it would have been more appropriate using country-year dummies, following the framework of Anderson and Van Wincoop (2003). Having in principle about 200 partner and host countries and a 27 year time frame would add 105,000 variables to the regression equation which is computationally not feasible.

Table 3 presents the summary statistics. We have about 130 thousand observations for FDI, but observations on GDP limit the total sample to about 106 thousand observations for most regressions. The main limitation is that the World Bank does not provide GDP data of many (very) small economies. The mean of 0.32 for the bilateral tax treaties implies that nearly one third of the observations (country pair and year specific) have a treaty (DTT). Other tax treaties are uncommon. About one fifth of the country pair-year observations has a bilateral investment treaty (BITS). For the withholding tax on dividends we have fewer observations. The average tax rate is 6 percent but varies between 0 and 35 percent.

Table 3 Summary statistics, 1985-2011

Variable	Observations	Mean	Std. Dev	Minimum	Maximum
ln FDI	106487	1.94	2.94	-5.06	12.81
$SUMGDP_{ijt}$	106487	26.78	1.44	22.55	30.49
$GDPDIFSQ_{ijt}$	106487	-2.88	1.97	-12.58	-0.69
$Other_{ijt}$	106487	0.01	0.11	0.00	1.00
$BITS_{ijt}$	106487	0.22	0.42	0.00	1.00
$DTTi_{jt}$	106487	0.32	0.47	0.00	1.00
$PS91_{ijt}$	106487	0.06	0.24	0.00	1.00
$IR03_{ijt}$	106487	0.04	0.20	0.00	1.00
EU	106487	0.06	0.24	0.00	1.00
No. DTT	106487	36.81	30.95	0.00	117.00
Dividend tax	85273	6.03	5.44	0.00	35.00

5. Tax treaties promote FDI

This section presents the quantitative effects of bilateral tax treaties and the EU directive on bilateral FDI stocks using different econometric techniques. First, we apply panel OLS estimators with fixed effects for the country pairs.[8] Second, we use propensity matching score techniques.

The challenge in the empirical literature on tax treaties and FDI is the possible endogeneity of these treaties.[9] Bilateral tax treaties could possibly stimulate FDI, but these treaties are also needed if bilateral FDI is large. It is costly and time consuming for governments to negotiate and conclude these treaties which makes no sense doing so if the expected FDI flows are limited. Most countries do also not have treaties with countries without a substantial economic relationship, except if these are former colonies (think of the many treaties that France and the UK have concluded with former colonies) or are developing countries (Scandinavian countries have concluded many treaties with African countries).

Panel regressions with fixed effects take care of omitted variables affecting the probability of a tax treaty and the FDI stock, but not of reversed causality which is the main issue. Egger et al. (2006) use a probit model to predict the probability of a treaty and use matching propensity techniques for estimating the effect of the instrumented treaties on FDI. We follow the same method later on in this section. Coupé et al. (2009) use the number of tax treaties of home and host countries as instrument, but these variables also identify treaty shopping, as we will see later.

To be sure that we solve the problem of reserved causality satisfactorily we instrument the probability to form a treaty using probit regressions. The probability to form a treaty depends on the standard explanatory variables and some geographic variables:

$$P(DTT_{ij}) = g\,(SUMGDP_{ij}, GDPDIFSQ_{ij}, DIST_{ij}, CONTIG_{ij}, COL_{ij}, SMCOL_{ij}, COMLAN_{ij}, SMCTRY_{ij}) \qquad (2)$$

The former are the sum of both GDP's and the GDP difference (squared). The geographic variables are distance (between the capitals), contiguity, a colonial relationship, having the same colonizer, a common language and originating from the same country (before a country break up). Of these variables distance (negative), a colonial relationship (positive), having the same colonizer (positive) and the same language (positive) have a significant impact on the probability in forming a treaty (see Table A2 in appendix 2). Based on these regression results we predict the probability that a treaty

[8] We have also run regressions with random effects, but the Hausman test rejected (not surprisingly) this specification in favour of the fixed effect specification.
[9] See Blonigen and Davies (2004, 2005), Chisik and Davies (2004) and Egger et al. (2006), among others.

might be formed.[10] The outcome of the $\chi 2$ test of the six coefficients of the instruments is 336, which convincingly shows that these geographic variables are strong instruments (Staiger and Stock, 1997).

First, we discuss briefly the results for the standard explanatory variables in column (1) of Table 4. The sum of the GDP's in the home and host country is positive and significant. This is also the case for the squared difference between both GDP's. There seems to be more FDI between similar countries which also confirms the standard intuition. Second, we move to the variables of our main interest. Bilateral tax treaties that are not classified as income and capital treaties (dummy other) have no significant effect on bilateral FDI. These are treaties related to protocols, inheritances and gifts, air and sea transport and cooperation and information exchange. These treaties do not cover treatment of profit taxes or withholding taxes related to FDI flows. This effect is reassuring and according to our expectations. Bilateral tax treaties on income and capital (or sometimes called on income, dummy DTT) have a positive and significant effect. The coefficient implies that bilateral FDI stocks between treaty countries are about 28% higher than between non-treaty countries. However, the regression in column (1) uses the data on tax treaties and not the instruments. Bilateral investment treaties (dummy BITS) have also a positive and significant effect on FDI stocks. For EU countries the PS directive has a large impact. Bilateral FDI stocks between EU countries are about twice as large as stocks between non-EU countries, everything else equal. However, it is not possible to sort out the effects from the internal market (EU membership), the IR directive and the PS directive due to the high correlation between these variables (see pair wise correlations in Table 2). Because the PS directive could be interpreted as a special form of bilateral treaties we modified the DTT dummy to 1 for those pairs of EU members without a treaty at the moment the directive became effective. This had nearly no effect on the outcomes. The year and region-year dummies are significant.

Regression (2) in Table 4 uses predicted DTT based on the instrumental variables in order to correct for reverse causality. The coefficient for DTT's is smaller, but statistically significant. Bilateral FDI stocks are about 16 percent higher if the country pair has a tax treaty, which is nearly twice as small as the result in column (1). It is therefore important to take account of reversed causality. The coefficients for the other variables remain more or less the same.

Because the sample is highly unbalanced we restrict the sample by eliminating the older years for which we have only a few observations. Column (3) in Table 4 presents the results from 2003 onwards. The results in column (3) show that most coefficients become smaller. The coefficient on

[10] For the treatment in the propensity matching method we had to transform the predicted probabilities between 0 and 1 to the integers 0 and 1. We used the predicted 0.5 as cut off point for rounding the probabilities to 0 and 1.

the squared differences in GDP is not statistically significant. The average panel length is nearly 7 observations out of the maximum 9. The panel is still not completely balanced, but the imbalance is significantly reduced. The coefficient for bilateral tax treaties is still significant, albeit smaller.

Table 4 Effects of bilateral and multilateral tax treaties on FDI stocks for various samples

	(1)	(2)	(3)	(4)	(5)
Country pairs	all	All	all	new & no treaty	old and no treaty
Years	all years	all years	from 2003	all years	all years
IV for treaty	no	yes	Yes	yes	yes
SUMGDP$_{ijt}$	0.303***	0.284***	0.194***	0.0341	0.303***
	(0.0748)	(0.0748)	(0.0634)	(0.0818)	(0.0766)
GDPDIFSQ$_{ijt}$	0.109***	0.0873***	-0.0562	0.0373	0.117***
	(0.0322)	(0.0322)	(0.0341)	(0.0312)	(0.0325)
DTTi$_{jt}$	0.244***	0.147***	0.113***	0.192***	0.173***
	(0.0433)	(0.0369)	(0.0416)	(0.0509)	(0.0404)
BITS$_{ijt}$	0.227***	0.255***	0.138***	0.247***	0.294***
	(0.0407)	(0.0407)	(0.0513)	(0.0460)	(0.0470)
PS91$_{ijt}$	0.760***	0.770***	0.566***	0.920***	0.805***
	(0.0647)	(0.0647)	(0.0641)	(0.116)	(0.0715)
Other$_{ijt}$	0.0284	-0.0365	-0.130	0.0681	-0.00605
	(0.153)	(0.156)	(0.181)	(0.156)	(0.160)
Constant	-7.500***	-7.066***	-4.028**	-0.747	-7.780***
	(1.905)	(1.903)	(1.641)	(2.067)	(1.948)
Observations	106487	106487	69714	74177	95805
R^2	0.363	0.362	0.090	0.277	0.340
No. of country pairs	10606	10606	10406	7912	9985
Log likelihood	-116885	-116970	-55842	-67087	-101142
Max. number of obs	27	27	9	27	27
Average number of obs	10.0	10.0	6.7	9.4	9.6

Robust standard errors are in parentheses. The stars denote: *** p<0.01, ** p<0.05, * p<0.1.
All regressions are panel regressions with fixed effects for the country pairs.
Year dummies and region-year dummies (for eight regions) are included. These regions are Western Europe, Middle and Eastern Europe, Middle East and North Africa, Sub-Saharan Africa, North America, Latin American and the Caribbean, East Asia and Pacific, and South Asia (following mainly World Bank classifications).

The estimation results in columns (4) and (5) of Table 4 provide some useful insights in the role of new and old tax treaties. In column (4) the country pairs that concluded tax treaties before the years for which we have FDI data are excluded. Interestingly, the coefficient on bilateral tax treaties is about 30 percent larger compared to column (2). In column (5) we exclude the newly formed treaties. Newly formed are not only treaties established since 1985 but also treaties for which we have at least 3 years FDI data before the treaty was signed. Most of the coefficients are comparable to the ones in column (2). This is not surprising because the set of observations is more or less similar. From both regressions we conclude that recently formed treaties have a larger impact on bilateral FDI stocks than older treaties. The bilateral FDI stocks could increase by about 21 percent.

Although most of the treaties never expire, it could be the case that the FDI stimulating effects of the treaties become relatively less important after a number of years due to new developments.

The geographic variables seem to be good instruments for the bilateral tax treaties. However, the instruments are time invariant, which makes it hard to exploit the panel dimension of the data, although the GDP variables are time varying. To put it differently, the effects of tax treaties are mainly identified by comparing the FDI stocks of country pairs which are likely to negotiate a treat treaty with those which are not. Following Egger et al. (2006) we could also pursue this identification strategy by using a propensity matching score method to analyse the effects of a new (instrumented) bilateral tax treaty on FDI. Difference-in-difference methods like propensity matching score methods isolate time-invariant unobserved effects. We compare the levels of bilateral FDI stocks two years before and two years after the treaty is signed (d22) and find out whether the change in FDI stocks is significantly different for country pairs with a new tax treaty from country pairs without a treaty. By collapsing the panel observations into two observations before and after the treatment for each country pair, we avoid problems with serial correlation which could have a downward bias on the standard errors of the diff in diff estimators in panel setting (Bertand et al., 2004). We also make the comparison of FDI stock growth four years after the treaty is signed (d42) as an indication of the long term effects instead of two years ahead. As a robustness check we also compare the growth of FDI stocks with and without a treaty six and three years after the treaty is signed compared to the FDI stocks three years before the signature (d63 and d33). Figure 2 shows that bilateral FDI stocks increase on average faster when a treaty is formed than those stocks of country pairs without a treaty. Moreover, the differences seem to increase over time. Also the t tests for comparing the means finds that the differences in FDI stock growth with and without a treaty are highly significant see appendix 3.[11]

We use propensity matching score methods for identifying the role of tax treaties on the growth of FDI stocks. We do so with and without instrumenting the treaties. Propensity matching score methods try to match observations which are treated with those in the control group which are not treated. The treatment is a new tax treaty. The treatment group consists of minimal 314 to maximal 393 observations for d_63 and d_22, respectively. The country pairs in the control group do not have a DTT treaty and do also not sign it in the sample period. The control groups consist of about 5000

[11] The same conclusions hold for comparing the median values instead of mean values. We have also done the same t tests for the sample with instrumented tax treaties. The results are similar.

observations for d_63 and about 10 000 observations for d_22, respectively.[12] The matches are based on the following characteristics: the sum of GDPs, the GDP difference (squared), investment treaty and PS directive. These matches could be made one by one, that is to say one of the observations in the control group has to match as closely as possible one observation in the treaty group, or multiple observations in the control group have to be matched to one observation in the treatment group. We choose as an alternative a 5-1 matching, similarly to Egger et al. (2006).

Figure 2 Effects of DTT treaties on bilateral FDI stocks pas

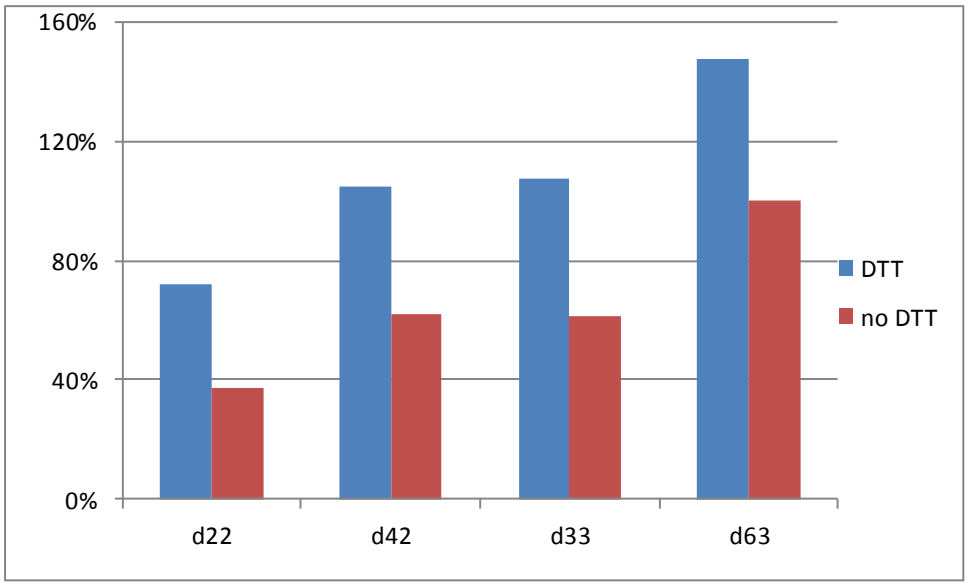


Table 5 Regressions results of matching propensity score methods for country pairs with DTT's

	d_22		d_42		d_33		d_63		matching
	Coeff.	**FDI**	**Coeff.**	**FDI**	**Coeff.**	**FDI**	**Coeff.**	**FDI**	
DTT treaty	0.088	6.4	0.249**	15.2	0.071	4.0	0.280*	11.9	1-1
	(0.105)		(0.119)		(0.117)		(0.155)		
DTT treaty	0.192**	14.6	0.301***	18.9	0.159*	9.3	0.246**	10.2	5-1
	(0.079)		(0.092)		(0.096)		(0.108)		
Obs.	10553		8305		8220		5275		
IV DTT	0.224**	17.8	0.379****	26.0	0.128	7.7	0.279	12.8	1-1
	(0.102)		(0.129)		(0.135)		(0.228)		
IV DTT	0.142*	10.8	0.195*	12.2	0.168	10.4	0.342***	16.2	5-1
	(0.080)		(0.104)		(0.114)		(0.126)		
Obs.	9109		6951		6886		4108		

Robust standard errors are in parentheses. The stars denote: *** p<0.01, ** p<0.05, * p<0.1.
The FDI effects are cumulative changes of bilateral FDI stocks in the d_xy period compared to the average FDI stock increase without a DTT treaty.

[12] If the tax treaties are instrumented the treatment and control group are different because predicted tax treaties do not match perfectly with the signed treaties. Then we have 298 and 164 observations for the treatment group and 3815 and 1946 observations for the control group, respectively.

Overall, the results in Table 5 support the FDI stimulating effects of tax treaties, but the positive coefficients are not always statistically significant, in particular not with 1-1 matching. The standard errors of 5-1 matching are smaller than of 1-1 matching, as expected. The coefficients for d_42 are larger than d_22 and similarly for d_63 compared to d_33. This is due to the longer time period; the effects on the increase of the FDI stock are minor. Based on the signed treaties bilateral FDI stocks are 10 to 20 percent larger if the country pair has signed a treaty compared to the control group.

If the tax treaties are instrumented to deal with endogeneity issues, we find similar results. The coefficients are positive and have more or less the same magnitude, but are not always significant. With 1-1 matching the coefficients are not significant. With 5-1 matching most coefficients are statistically significant at the 90 percent level.

It is hard to compare the coefficients over the various time periods, because also the increases in FDI stocks differ for these periods. Therefore we have calculated the cumulative increase of the FDI stocks for all cases compared to the increases of bilateral FDI stocks without a DTT treaty. Our preferred estimates are the IV's, correcting for reverse causality with 5-1 matching. If the estimated coefficient is significant, the results show that FDI stocks are about 11% to 16% higher if a tax treaty is signed.

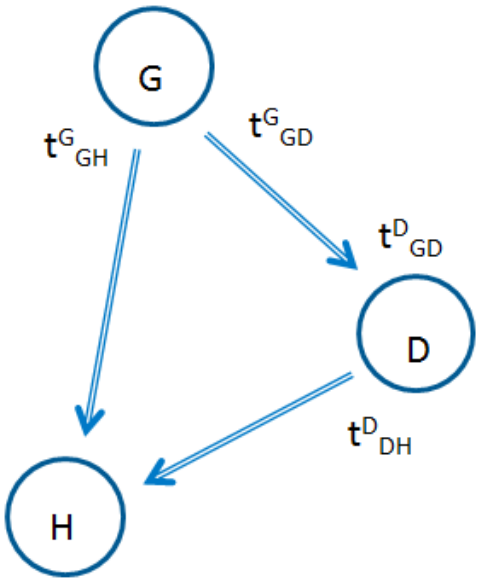
The effects between both methods are similar. The regressions in Table (4) are based on panel of about ten years. On average the bilateral stocks increase by 142% points for country pairs without a treaty in this period. According to the estimations stock for country pairs with a new treaty are in the end 21% higher). Starting from an index of 100 in the beginning of the average panel, the level of the FDI stocks will be about 270. According to the results in Table 5 the increase in FDI stocks with a treaty is about 11% to 16% points higher than the 142% points increase. At the end of the period the bilateral FDI stock will be about 255.

6. Tax treaties and treaty shopping

The role of bilateral tax treaties in tax base erosion and profit shifting of multinationals is heavily debated nowadays. Many large multinationals use the network of these treaties to avoid taxation by establishing shell companies in countries with attractive treaties, resulting sometimes even in double non taxation. The use of shell companies is called treaty shopping in the economic literature. Attractive treaties are agreements with low or zero withholding tax rates on dividends, interest and royalty flows (t^{D}_{DH} in Figure 3), often combined with exemptions of the profits of foreign daughters

from taxation in the conduit country (country D in Figure 3 with t^{D}_{GD} is zero). A headquarter in the home country (H) invest in the host country (G) via a subsidiary in country D if the withholding tax rate on returned profits from country G to D is lower than the one from country G to H.[13]

Figure 3 Taxation of returned profits and treaty shopping



Recent papers of Weichenrieder and Mintz (2008) and Weyzig (2012) point to the empirical impact of treaty shopping and from inspecting global FDI stocks we find that countries like the Netherlands, Luxembourg, Hong Kong and Switzerland receive and send much higher FDI stocks than can be expected based on their share in world GDP. Table 6 illustrates this by presenting the top 10 of inward and outward FDI stocks in 2011.

Table 6 Top 10 of inward and outward FDI stocks in 2011

Country	Inward	FDI	country	Outward	FDI
	bln US$	%		Bln. US$	%
World	23816	100.0	**World**	24287	100.0
Netherlands	3327	14.0	**United States**	4156	17.1
Luxembourg	2653	11.1	**Netherlands**	4118	17.0
United States	2548	10.7	**Luxembourg**	2731	11.2
China	1907	8.0	**United Kingdom**	1725	7.1
United Kingdom	1064	4.5	**France**	1597	6.6
Hong Kong	1030	4.3	**Germany**	1356	5.6
France	973	4.1	**Switzerland**	1028	4.2
Germany	928	3.9	**Hong Kong**	972	4.0
Brazil	706	3.0	**Japan**	963	4.0
Switzerland	643	2.7	**Canada**	670	2.8

[13] We assume that the tax rate in country H is the same for returned profits from countries G and D.

Source: IMF Coordinated Direct Investment Survey data, 2011, reporting countries. The totals of inward and outward stocks are not equal due to incomplete reporting and differences in registering stocks by source and host countries.

We miss countries known as tax havens in Table 6. The reason is that these countries do not report FDI data to IMF. However, we can draw some conclusions based on the partner countries of the reporting countries. The top 10 of the outward stocks will hardly change, except for the British Virgin Islands with an FDI stock of about 700 billion US$. Moreover, Bermuda and Cayman Islands are in the top 20 with 400 and 300 billion dollar. The pattern for inward stocks is the same.

These numbers and the empirical papers suggest that treaty shopping could be important. We want to capture the effects of treaty shopping on FDI stocks by adding treaty shopping variables to our basic specification which are those in column (2) of Table 4 if the treaties are instrumented. We add indicators for the home and host country and the average withholding tax levied on dividends leaving the host country. This is the average of all withholding taxes by the host countries agreed upon in treaties with their partner countries. A low withholding tax rate reflects the idea that the source country is attractive for passing dividends.[14] We choose for the tax rate on dividends because these are most important in the financial return flows compared to interest and royalties. Besides, we introduce a simple measure counting the number of bilateral tax treaties. We have also experimented with indicators derived from network analysis which measure the relative importance of countries and treaties in a network instead of simply counting the number of treaties.[15] The regressions with these indicators provide similar results as for the simple measure and the log likelihood using this measure performs somewhat better than using the network indicators.

Table 7 presents the results of the econometric analysis. We focus on the tax variables. Column (1) repeats column (1) in Table 4 with fewer observations for the comparability with the other columns in Table 7. Column (3) presents the outcomes if only the withholding tax rate in the host country is added to the specification. We find that a higher tax rate has a negative effect on bilateral FDI, but it is only significant if the variables for the number of tax treaties are added to the regression (see column (2)). A country which succeeds in lowering the withholding tax rates for dividends with its tax treaty partners by 5%-points increases the bilateral FDI stocks by 6 percent. Column (2) finds also that the coefficients for treaty shopping are positive and significant. Adding 20 extra treaties

[14] We correct for the tax system in the mother country. With a world-wide system there should be no effect because of a compensating tax credit and we assume that the withholding tax rate is zero. According to the OECD, Chile, Greece, Ireland, Israel and Korea, Mexico and the United States have a world-wide system in 2011. Iceland (2003), Norway and Czech and Slovak Republic (2004), Estonia (2005), Poland (2007), and Japan, New Zealand and United Kingdom (2009), have moved from a world-wide system to a territorial system.
[15] Jackson (2011) gives an overview of network analysis in economics and De Benedictis and Tajoli (2011) apply network analysis to international trade.

increases the FDI stock by about 50 percent in the home country and increases the stock by about 20 percent in the host country. The effects on the home country are about twice as low. Note that the average OECD country has about 70 DTT treaties, and that 90 treaties would place them in a top 5 position. Including an indicator for treaty shopping does hardly affect the coefficient of the tax treaty.

Table 7 The effects of treaty shopping on FDI

	(1)	(2)	(3)	(4)
Indicator treaty shopping	**number of treaties**	**number of treaties**	**degree centrality**	**closeness centrality**
$SUMGDP_{ijt}$	0.307***	0.233***	0.311***	0.227***
	(0.0841)	(0.0831)	(0.0841)	(0.0832)
$GDPDIFSQ_{ijt}$	0.075*	0.096**	0.075*	0.095**
	(0.0385)	(0.0385)	(0.0385)	(0.0385)
$Other_{ijt}$	-0.116	-0.030	-0.119	-0.025
	(0.152)	(0.152)	(0.152)	(0.152)
$DTTi_{jt}$ (IV)	0.122***	0.118***	0.121***	0.120***
	(0.0392)	(0.0393)	(0.0392)	(0.0393)
$BITS_{ijt}$	0.221***	0.190***	0.219***	0.194***
	(0.0435)	(0.0425)	(0.0435)	(0.0425)
$PS91_{ijt}$	0.711***	0.616***	0.708***	0.621***
	(0.0653)	(0.0664)	(0.0654)	(0.0663)
Treaty $shopping_{it}$		0.025***		0.025***
		(0.0024)		(0.0024)
Treaty $shopping_{jt}$		0.011***		0.011***
		(0.0023)		(0.0023)
Withholding tax_{jt}		-0.012**	-0.008	
		(0.0052)	(0.0051)	
Constant	-7.631***	-5.894***	-7.707***	-5.778***
	(2.159)	(2.121)	(2.149)	(2.124)
Observations	85273	85273	85273	85273
R^2	0.395	0.404	0.395	0.404
No. of country pairs	8099	8099	8099	8099
Log likelihood	-97560	-96923	-97554	-96939
Max. number of obs	27	27	27	27
Ave. number of obs	10.53	10.53	10.53	10.53

See notes Table 4.

7. Conclusions

This paper examines the impact of bilateral tax treaties and other tax variables on bilateral FDI. First, it presents an econometric analysis of the effects of treaties on FDI based on a very rich database of all OECD countries from 1985 onwards. We conclude that new tax treaties increase bilateral FDI by

21 percent if the tax treaties are instrumented with geographic variables. After ten years, the effects temper out. The analysis is based on bilateral treaties which specifically deal with taxes on profits and returned earnings such as dividends, interest income and royalties. Moreover, the EU directive on parent and subsidiary companies has a significant impact on FDI, nearly doubling stocks. So far we know, we are the first combining multilateral and bilateral tax treaties in a unified framework. Moreover, we find a clear positive effect of new bilateral tax treaties on FDI stocks which is not a common finding in the literature. This is partly due to the rich database we employ in terms of country pairs and years and the use of geographic instruments. Moreover, we have used matching propensity score methods in which the tax treaty is instrumented with exogenous geographic variables and demonstrate that country pairs which sign a tax treaty experience on average a higher increase in the FDI stock than country pairs without a treaty.

Second, we analyse the effects of treaty shopping on FDI using the number of bilateral tax treaties in the home and host country and the withholding tax rate on dividends as treaty shopping variables. Twenty extra tax treaties in the home country increase bilateral FDI stocks by about 50 percent in and about 25 percent in host countries. This result is robust for various specifications. Moreover, low withholding tax rates on dividends in tax treaties have also a positive impact on bilateral FDI stocks.

We do not discuss the implications of treaty shopping, but only conclude that it exists. There are possibly large welfare and redistributive effects of treaty shopping, but these should be considered in wider framework of tax competition including the other relevant instruments.

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Appendix 1: data sources

The 34 OECD countries are Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States. In the past Belgium-Luxembourg FDI positions were often combined. Because we have more observations for Belgium than for the combinations, we decided to use the data for the separate countries. If possible we used the combined data to fill missing observations for Belgium or Luxembourg.

Figure A1The number of observations of the bilateral FDI stock, 1985 to 2011

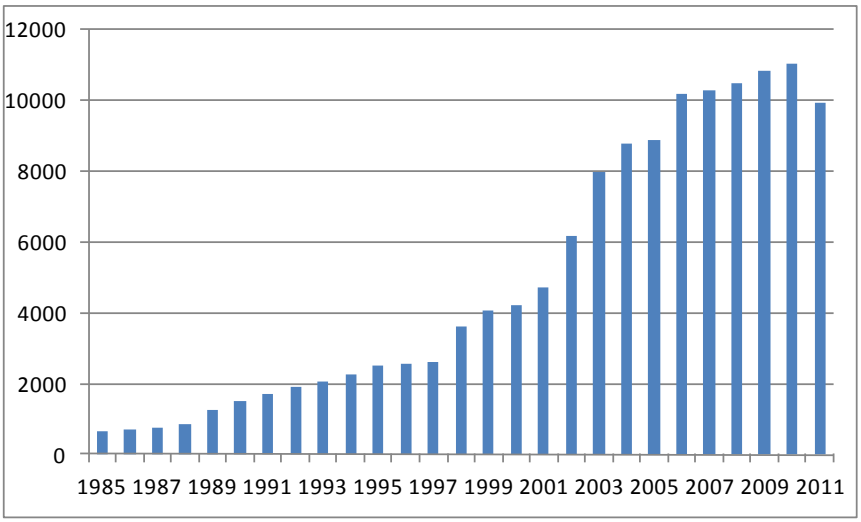

Table A1 Data sources

Data	Sources
FDI data	http://stats.oecd.org/index.aspx, choose Globalisation, Foreign Direct Investment Statistics
Bilateral tax treaties	http://unctad.org/en/Pages/DIAE/International%20Investment%20Agreements%20(IIA)/Country-specific-Lists-of-DTTs.aspx?Do=101,50
Bilateral investment treaties	http://unctad.org/en/Pages/DIAE/International%20Investment%20Agreements%20(IIA)/Country-specific-Lists-of-BITs.aspx?Do=101,50
Dividend tax rates	https://www.dits.deloitte.com/DomesticRates/domesticRatesMatrix.aspx
Divided tax rates in treaties	https://www.dits.deloitte.com/TaxTreatyRates/CompareTaxTreatyRates.aspx
Tax havens	http://www.qwealthreport.com/blog/the-complete-oecd-tax-haven-blacklist/
GDP data	http:/worldbank.org/ World Development indicators
Human capital data	http://www.barrolee.com/
Geographic data	http://www.cepii.org/CEPII/en/welcome.asp

Appendix 2

Table A2: The probability of forming a tax treaty

	(1)	(2)	(3)	(4)
$SUMGDP_{ijt}$	0.643***	0.630***	0.620***	0.612***
	(0.0244)	(0.0229)	(0.0226)	(0.0199)
$GDPDIFSQ_{ijt}$	0.419***	0.414***	0.426***	0.393***
	(0.0171)	(0.0167)	(0.0149)	(0.0130)
$SKDIFF_{ijt}$,	-0.00961	-0.00965		
	(0.0123)	(0.0120)		
$SKDIFF_{ijt}$* $GDPDIFF_{ijt}$	-0.00145	-0.00180		
	(0.00382)	(0.00373)		
$(SKDIFF_{ijt})^2$*$OPEN_{jt}$	-0.0103***	-0.00983***		
	(0.00142)	(0.00136)		
$OPEN_{it}$,	0.0193		0.0123	
	(0.0393)		(0.0372)	
$OPEN_{jt}$	0.0725*		-0.00651	
	(0.0382)		(0.0354)	
Distance	-0.000103***	-0.000102***	-0.000103***	-9.41e-05***
	(6.95e-06)	(6.86e-06)	(6.55e-06)	(6.23e-06)
Contiguity	-0.161	-0.207	0.0145	-0.0123
	(0.205)	(0.201)	(0.187)	(0.180)
Colony (former)	0.841***	0.838***	0.965***	0.936***
	(0.143)	(0.141)	(0.128)	(0.118)
Common colonizer	0.0398	0.0782	0.242	0.290*
	(0.187)	(0.185)	(0.175)	(0.171)
Common language	0.377***	0.392***	0.292***	0.282***
	(0.0857)	(0.0842)	(0.0800)	(0.0758)
Same country	0.465	0.508	0.220	0.310
	(0.334)	(0.331)	(0.252)	(0.250)
Constant	-15.80***	-15.38***	-15.26***	-15.22***
	(0.656)	(0.592)	(0.611)	(0.517)
Observations	6346	6557	7471	8343
R^2	0.453	0.454	0.444	0.445
χ2	3806	3910	4255	4601
χ2(6) (coefficients of IV are 0)				336

See notes Table 4.

Appendix 3

Table A3: The t tests comparing the growth of FDI stocks

Two-sample test with unequal variances for d_22

Group	Obs.	Mean	Std. Err.	Std. Dev.	95% Conf.	Interval
0	10158	0,371657	0,014244	1,43563	0,343736	0,399579
1	393	0,71758	0,070618	1,399952	0,578742	0,856417
combined	10551	0,384542	0,013978	1,435748	0,357143	0,411941
diff		-0,34592	0,072041		-0,48752	-0,20432

	diff =	mean(0)-	mean(1)	t=-4.8018
Ho:	diff= 0			DOF = 431.8

Two-sample test with unequal variances for d_42

Group	Obs.	Mean	Std. Err.	Std. Dev.	95% Conf.	Interval
0	7952	0,621234	0,017683	1,576875	0,58657	0,655897
1	353	1,050305	0,081869	1,538185	0,88929	1,211319
combined	8305	0,639471	0,017311	1,577536	0,605538	0,673404
diff		-0,42907	0,083757		-0,59375	-0,26439

	diff =	mean(0)-	mean(1)	t = -5.1228
Ho:	diff= 0			DOF=385.6

Two-sample test with unequal variances for d_33

Group	Obs.	Mean	Std. Err.	Std. Dev.	95% Conf.	Interval
0	7854	0,616338	0,017778	1,575536	0,581488	0,651187
1	366	1,070616	0,080224	1,534771	0,912858	1,228375
combined	8220	0,636565	0,017388	1,576439	0,602481	0,670649
diff		-0,45428	0,08217		-0,61582	-0,29274

	diff =	mean(0)-	mean(1)	t = -5.523
Ho:	diff= 0			DOF = 401.7

Two-sample test with unequal variances for d_63

Group	Obs.	Mean	Std. Err.	Std. Dev.	95% Conf.	Interval
0	4961	1,00192	0,024624	1,734339	0,953647	1,050192
1	314	1,47305	0,087296	1,546883	1,301289	1,64481
combined	5275	1,029964	0,023781	1,72722	0,983343	1,076585
diff		-0,47113	0,090702		-0,6495	-0,29277

	diff =	mean(0)-	mean(1)	t = -5.194
Ho:	diff= 0			DOF= 364.6

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