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Network Analysis of Tax Treaty Shopping using dividend-based weights

This note reports on an exercise performed at the request of the OECD in the context of the BEPS-project.

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CPB Notitie

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Summary

This note reports on an exercise performed at the request of the OECD in the context of the BEPS-project.[1]

Multi-national corporations can reduce their tax burden on repatriating foreign profits by using third countries, other than the home and host country of the investment, which have more favourable tax treaties. The practice of *tax treaty shopping* amounts to optimizing tax routes. Its full potential, for repatriating dividends, is in the order of 75 billion USD worldwide, yearly. This estimate follows from an exercise performed by the CPB using a network analysis of international corporate taxation. Hardly any quantitative assessment of treaty shopping is available and the estimate is a background for the OECD work on Base Erosion and Profit Shifting (BEPS). Treaty shopping is only one of the elements of tax planning covered by the BEPS-project.

End 2014 CPB released an earlier version of the network analysis of tax treaty shopping (Van 't Riet and Lejour, 2014). It found an average worldwide double tax rate on repatriating dividends of 12 percent. Treaty shopping was reported to reduce this rate to 6 percent. No attempt was made to quantify the reduction of the tax burden, and hence tax revenue, in money terms. A reason for this was that the underlying bilateral dividend flows were approximated on the basis of GDP. The present exercise replaces these GDP-based weights with weights based on reported

[1] The views expressed in this paper are those of the author(s) and do not necessarily reflect the views of the OECD or its member countries.

bilateral dividend flows and imputations based on reported FDI positions. The data are extracted from the OECD FDI Statistics (4th Edition, BMD4).

With the new weights, a world average repatriation tax rate of 11 percent is found for direct tax routes. And tax treaty shopping can reduce this to less than 5 percent; more than a halving of the tax burden. Combined with an estimated world total of some 1250 billion USD of dividend flows this leads to a potential tax reduction of 75 billion USD yearly. The world average repatriation tax rates are lower for the new weights than for those based on GDP because higher weights are assigned to country pairs with lower repatriation tax rates. This might have been expected as, *ceteris paribus*, lower taxes lead to higher investments.

1 Results of the Network Analysis

This section presents the main results of the network analysis based on the new dividend & FDI based weights. The results are compared with the analysis based on GDP-weights. In general the results do not differ much. The major thrust of analysis remains identical: treaty shopping at least halves the worldwide average double tax rate on repatriating dividends. With the new weights this is from 11 percent to less than 5 percent. In the reference analysis this is from 11.8 to 5.8 percent.[2]

Table 1.1 World average dividend repatriation tax rates

	GDP-based-weights		Div&FDI-based-weights	
	Direct	Indirect	Direct	Indirect
CIT host	29.18	29.18	26.99	26.99
WTH div	7.73	2.15	5.20	1.22
CIT home	4.40		6.12	
Double	11.79	5.75	11.00	4.81
Source	7.73	2.15	5.20	1.22
Conduit		0.32		0.38
Residence	4.06	3.29	5.81	3.21

The world average repatriation tax rates are lower for the new weights than for those based on GDP. This means that based on reported data higher weights are assigned to country pairs with lower repatriation tax rates. This might have been expected as, *ceteris paribus*, lower taxes lead to a higher investments and therefore repatriated flows on investments. In addition the reported data may be inclusive of dividend flows rerouted for tax purposes, which would contribute to lower rates. Another observation is the change in the composition of withholding and residence taxes for the direct routes. Country pairs, where the source country has a low withholding tax rate, apparently have a more prominent presence in the reported data.

The results in terms of centrality in the tax network, a necessary condition for conduit countries, are also comparable, see table 1.2. Relatively few changes are observed in the top 10 ranking.

[2] This differs from the 12.1 and 6.0 percent reported in Ranking the Stars, Van 't Riet and Lejour (2014). A new reference analysis, still based on GDP-weights, was performed accommodating a number of data corrections.

Table 1.2 Top 10 ranking in Betweenness centrality[3]

	GDP_based	Div&FDI_based
1	United Kingdom	United Kingdom
2	Luxembourg	Luxembourg
3	Estonia	Netherlands
4	Netherlands	Hungary
5	Hungary	Cyprus
6	Singapore	Estonia
7	Ireland	Finland
8	Slovak Republic	Belgium
9	Cyprus	Denmark
10	Malta	Ireland

As an example of the more detailed results of the network analysis, the changes in tax revenues following treaty shopping are discussed for a number of selected countries, see table 1.3. The results only concern the analysis with dividend & FDI based weights.

The rank number in the table refers to the ranking in terms of relative tax loss, given in the last column. Source and residence taxation are percentages of the country's own outward and inward dividend flows, respectively. Conduit and total taxation are given in the table as percentages of worldwide dividend flows.

Table 1.3 Tax revenue results (percentages)* – selected countries

		Direct			Optimal Indirect				Loss
	rank	SRC	RES	TOT	SRC	RES	CON	TOT	%
Egypt	1	0	15.3	0.004	0	0	0	0	100
Jordan	2	0	9.9	0.000	0	0	0	0	100
Spain	35	5.6	3.4	0.251	0.5	0	0.050	0.063	74.8
United States	47	10.8	17.3	5.663	0	13.0	0	2.859	49.5
United Kingdom	86	0	0	0	0	0	0	0	0
Virgin Islands U.K.	87	0	0	0	0	0	0	0	0
Latvia	107	3.8	0.1	0.002	0	0	0.014	0.013	-497.0
Albania	108	7.7	0.5	0.002	0	0	0.021	0.021	-1245.6

*SRC: source, RES: residence, CON: conduit and TOT: total taxation.

[3] Betweenness centrality has been computed with an algorithm developed by Sven Polak at CWI (Polak, 2015).

Egypt and Jordan are among the countries that would lose all their taxes on international corporate dividends if the full potential of treaty shopping would be realized. All incoming dividends would be routed through countries with which they have agreed on preferential treatment in form of dividend participation exemption.

Spain is the country with the highest revenue on conduit taxation, as is also the case with the GDP weights. Overall Spain loses tax revenue following optimal indirect tax routing.

The USA, with only a 50 percent tax loss, does not rank high as a relative loser because of treaty shopping. In absolute terms it loses most. Its total tax revenue with direct repatriation is 5.7 percent of worldwide dividend flows. This is about half of all worldwide taxation, which is 11 percent, see table 1.1.

The UK and the British Virgin Islands are examples of countries that neither gain nor lose tax revenue from treaty shopping because they do not tax international corporate dividends at all.

Albania and Latvia are, in relative terms, the potential winners of full treaty shopping. They lose all source and residence taxation on international dividends but they have large potential conduit tax revenue. For Latvia this is almost 5 times its revenues under direct dividend repatriation, for Albania 12.5 times.

2 Construction of the dividend-based weights

The task to construct a matrix of new bilateral weights for the Network Analysis of tax Treaty Shopping (NATS) has been tackled from two sides. From the inside, the cells of the matrix, 'observations' of bilateral dividend flows have been used. And from the outside total FDI positions of countries, both Inward and Outward, have been taken to construct the row and column totals of the matrix. The full approach to the construction is presented below, as well are some comments on the coverage and quality of the data. A number of observations, however, have to be made beforehand.

The network analysis derives its strength from the fact that it is a worldwide analysis. Most of FDI, and its subsequent repatriated FDI income, will be between OECD members, and next between OECD countries and the rest of the world. Non-OECD jurisdictions, however, from all over the world, may play a crucial role in indirect financing structures and subsequent tax minimizing repatriation routes. Thus, a world perspective needs to be taken. This requires some additional steps which are outlined below.

The emphasis of the current exercise is to construct a set of new weights, dividend-based to replace GDP-based weights. Weights need to sum up to one, thus imposing a consistency requirement. This implies that the totals of Inbound and Outbound data must be equal; this condition is usually not satisfied.
We use reported bilateral dividend flows, paid out as a return to FDI. Ideally, these dividend data would be the flows to the ultimate beneficial (corporate) owners, clean of rerouting for tax reasons. When dividend data are unavailable we would like to use 'clean', or undiverted, FDI data, i.e. FDI stripped of its international diversion. These 'clean' data may not be available at all. Helpful is when data are reported exclusive of flows (or stocks held) through Special Purpose Entities (SPE's).[4] This feature also distinguishes international data sets: the IMF CDIS database is inclusive of data through SPE's whereas UNCTAD requests its member countries to report exclusive. The new OECD BMD4 standard also requires countries to report their data exclusive of resident SPE's.[5] Unfortunately not all countries seem to make the SPE distinction in their data collection or they apply different definitions.[6] This results in some irregularity of international patterns and seemingly inconsistencies, some of which are presented below. Careful scrutiny of the basic data would be required to address this. This is outside the scope of the present exercise. Fortunately, however, the approach taken irons out some of the inconsistencies and the network analysis has proven to be robust to changes in the weights, suggesting that the results are not heavily affected by the quality and limited availability of the data.

2.1 Approach

i) Reported bilateral data

Data based on the new BMD4 reporting standard released March 2015 has been extracted from the OECD FDI Statistics database. Extractions include the latest reporting year, 2013, and earlier observations where available. The retrieved data involve bilateral dividend flows, total FDI income (of which the dividend flows are part) and FDI positions. All series have been averaged over the last three years whenever the data was available. The reporting countries are OECD members and the data concern both Inward and Outward flows and stocks.

ii) Imputed bilateral data

Where reported data are missing, or confidential, national total FDI income has been used where available. The total FDI income is applied with national average dividend shares, or, where country-level shares are missing, with worldwide average shares (40% and 46% for inward and outward respectively). Average rates of return to FDI

[4] "In general terms, SPEs are entities with no or few employees, little or no physical presence in the host economy, whose assets and liabilities represent investments in or from other countries, and whose core business consists of group financing or holding activities", OECD, 2014, page 19.
[5] In the latest series data excluding SPE's is not available for Belgium, Canada, Finland, Ireland, Slovak Republic and Switzerland. Estonia, Portugal and the United Kingdom report the data but it is currently not publishable. Australia, the Czech Republic, Finland, France, Germany, Greece, Israel, Italy, Japan, New Zealand, Slovenia, Turkey and the United States report that the number of SPE's is not significant.
[6] See Delgado (2014) for a discussion on these data sources.

stocks (13%) have been used where total FDI income was missing but FDI positions available. Negative values have been excluded throughout the procedure.

iii) Inward (reported) data takes precedence

So far the bilateral data has been maintained in two sets: Inward (reported and imputed) and Outward (reported and imputed). Although this may reflect statistical reality, for the construction of one set of weights consistency is required here. As a rule of thumb we let Inward (reported and imputed) data take precedence over Outward data when both are available. With reporting of trade data this is a common practice. Thus a single set of bilateral data is arrived at. It is also brought to the (sub)set of the 108 NATS-countries.

iv) FDI positions for OECD and non-OECD countries

From UNCTAD[7] we obtain FDI positions in 2012 for all countries available, thus taking the world perspective. Again positions are for Inward and Outward FDI stocks. The world totals are, as over the 108 NATS-countries, 22735 and 23886 billion USD, with a ratio of Out over In of about 1.05.

v) From FDI positions to dividend income

In a single stroke the FDI positions are converted to dividend income. The average dividend share (43%, in and out) and a worldwide average rate of return (13%) are used for this, amounting to a downscaling to about 5.6%. Thus also the worldwide total of dividends as FDI income, as in our exercise, is now determined: it is 5.6% of 22735 billion USD, i.e. 1270 billion USD.

vi) Initial bilateral values for the RAS-procedure

A matrix of initial values for the bilateral flows will be confronted with given row and column totals in a final step. The reported imputed bilateral data discussed earlier will be used for this. But for the full matrix on world scale lots of cells are missing, among which all cells of non-OECD to non-OECD. Therefore, first, a matrix is filled equiproportionally to the total dividend incomes derived above. Next, the reported and imputed cells are inserted, overwriting what was just computed.

vii) The RAS-procedure

RAS-procedures are for instance used for updating Input-Output tables (see Parikh, 1979). A RAS-procedure amounts to finding vectors of row and column scaling applied to the initial cell-values to meet the constraints of given row and column totals. A sum of the deviations from value 1 of these scalings factors is minimized. Thus a consistent matrix of bilateral values is found meeting the given total dividends as constructed. Finally, from these values weights have been constructed.[8]

[7] UNCTAD, 2014, Foreign Direct Investment Flows and Stocks.
[8] Both matrices have been made available to the OECD.

Below the resulting OECD versus Rest-of-World shares in dividends as FDI income are shown.

Table 2.1 Shares in worldwide dividend FDI income flows (rows are outbound)

	OECD countries	Rest-of-World	Total
OECD countries	54	13	67
Rest-of-World	27	6	33
Total	81	19	

2.2 Data coverage and quality

The most basic data in this exercise are the reported bilateral dividends as FDI income from the OECD database. In 2013 there are 18 countries reporting positive values for Outbound dividends. For Inbound dividends 2 of the 18 countries do not report positive values. Moreover, another two of the 18 countries do only report values for two partner countries. The total of the reported bilateral data-entries is 330 for Inward, 517 for Outward and 759 entries combined. All in all it seems reasonable to qualify this coverage as modest. The imputations improve matters somewhat. This leads to 1729 entries combined, of which 688 entries of OECD to OECD countries. Given 108 NATS-countries and 34 OECD members the coverage is 15% and 61% respectively.

UNCTAD data on FDI positions are not available for the next five jurisdictions: Guernsey, Jersey, the Isle of Man, Liechtenstein and Puerto Rico. They have been given weights zero. This does not imply that they do not matter for NATS: dividend flows can still be routed through them.

For other tax haven countries the UNCTAD data are available. Here it is found that, in terms of Outward FDI stocks, the British Virgin Islands are of the same size as the Russian Federation or Australia. A similar size is found for Inward FDI. The same observation, though slightly less pronounced, can be made for the Cayman Islands but seemingly not for Barbados or Bermuda. This suggests that the treatment of diverted FDI is not consistent over the different jurisdictions.

The confrontation of the UNCTAD total FDI positions and the cell-level data yields a few new inconsistencies. Outbound dividends are confronted with the Inbound FDI stocks; in some instances the former exceed the latter, implying average rates of return over a 100%. This is found for Barbados and Bermuda.

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Annex: NATS - overview

An overview of the Network Analysis of Treaty Shopping (NATS) can be given in terms of matrices needed as input and the matrices, and vectors, generated as output. The inputs are A *and* W*, where the weights may be based on* F^{cln} *or on GDP. Outputs are* S *and vectors of averages, betweenness centrality and tax revenues.*

1 Tax data

From national tax parameters we construct a matrix A with bilateral dividend repatriation tax rates. Tax rate a_{ij} denotes the combined rate on repatriated dividends from country *i* to country *j*. These are the non-resident dividend withholding tax of country *i* and the corporate tax on foreign income in country *j*. The rate applies on the repatriated profits net of the corporate tax of source country *i*.

2 Dividend data

To be able to assess the magnitude of the tax revenues involved, and to compute weighted averages of the rates, we ideally would have the bilateral dividend flows, paid out as return to FDI. Moreover, these dividend data would ideally be the flows to the ultimate beneficial (corporate) owners, clean of rerouting for tax reasons, returns to FDI stripped of its international diversion.

Such a matrix F^{cln} implies bilateral weights $w_{ij} = f_{ij}^{\text{cln}} / \sum_{k} \sum_{l \neq k} f_{kl}^{\text{cln}}$.

Earlier we had constructed a matrix W of weights from (a vector of) GDP data.

3 Weighted average dividend repatriation tax rates

Given the matrices of the tax rates and weights we compute weighted averages; by country for outbound and inbound dividends, and worldwide.

$$\bar{a}_i^{out} = \sum_{j \neq i} w_{ij} a_{ij} / \sum_{k \neq i} w_{ik} \quad , \qquad \bar{a}_j^{in} = \sum_{i \neq j} w_{ij} a_{ij} / \sum_{k \neq j} w_{kj} \quad , \qquad \bar{a} = \sum_{i} \sum_{j \neq i} w_{ij} a_{ij}$$

4 Treaty shopping: minimal dividend repatriation tax rates

Given matrix A which contains the initial tax 'distances', a minimization algorithm from graph theory is applied to generate matrix S with the 'shortest' tax distances. Tax rate s_{ij} is the minimal rate to be paid when repatriating dividends from country *i* to *j*, by chosing the optimal route over the network.

5 Weighted average minimal dividend repatriation tax rates

Given the matrices of the minimal tax rates and the weights, again weighted averages are computed.

These are: $\overline{s}_i^{out}$, $\overline{s}_j^{in}$ and $\overline{s}$. They are compared with the averages without the possibility of rerouting, thus providing an estimate of the potential tax reduction by treaty shopping.

6 A measure of centrality in the tax network

To determine which countries are most used as a conduit for FDI and dividend flows, a network centrality measure is constructed. It involves examining all (relevant) 'shortest' tax routes.

Let C be a counter, three-dimensional, whose element c_{ijk} denotes the number of times country *k* is on a 'shortest' tax route from *i* to *j*, excluding country *k* as a start and as an end point. Let number N_{ij} be the total number of 'shortest' tax routes between countries *i* and *j*.

The measure of *betweenness centrality* for country *k*, B_k , is then computed from the number of times vertex *k* is on a relevant tax route from *i* to *j*, taken as a share in the total number of relevant routes from *i* to *j*, and then these fractions are weighted over all pairs *i* and *j*.

$$B_k = \sum_{i \neq k} \sum_{j \neq i,k} w_{ij} \frac{c_{ijk}}{N_{ij}}$$

The assumption here is that each of the relevant tax routes between *i* and *j* takes the same share, being $1/N_{ij}$, of the total flow of the pair *ij*, whose weight is w_{ij} .

7 Total dividend flows

Betweenness centrality thus measures the share of total direct flows that run through a country, excluding all the dividend flows that start or end at the given country *k*.

When these are added two *flows* measures, F_k^{out} and F_k^{in} , are defined.

$$F_k^{out} = \sum_{i \neq k} w_{ik} + B_k \qquad F_k^{in} = B_k + \sum_{j \neq k} w_{kj}$$

The sum of this measure over all countries gives an aggregate statistic on the indirect routing.

$$Total\ \ flows = \sum_k F_k^{out} = \sum_k F_k^{in} = 1 + \sum_k B_k$$

Total flows indicates the degree double counting of dividend flows caused by treaty shopping, as there also is double counting in the FDI caused by indirect financing structures.

This degree overestimates the double counting for two reasons. One, it is an upperbound on the double counting as optimal use of indirect routes is considered. Thus, where a direct route is used notwithstanding that it is not optimal, this reduces the double counting. Two, the flows used to construct the degree are the initial dividends to be repatriated to the beneficial (corporate) owner, hence inclusive of what is taxed along the way. These taxes are considered below.

The betweenness and flows measures defined above are based on weights that sum up to one.

The flows measures can be multiplied with the total of the clean dividend flows, $\sum_k \sum_{l \neq k} f_{kl}^{\text{cln}}$, to arrive at money measures.

8 Tax revenue split: Source, Conduit and Residence taxation

Consider the worldwide weighted average dividend repatriation tax rates $\bar{A}$ and $\bar{S}$.

$$\bar{A} = \sum_i \sum_{j \neq i} w_{ij} A_{ij} \quad ; \quad \bar{S} = \sum_i \sum_{j \neq i} w_{ij} S_{ij}$$

Consider, for the direct routes, a split in the source and residence taxation.

$$A_{ij} = Src_{ij}^A + Res_{ij}^A$$

By construction the source taxation is the non-resident dividend withholding tax from *i* to *j*, and the residence taxation is the residual. We are interested in the tax revenue for individual countries.

$$TaxRev_i^A = \sum_{j \neq i} w_{ij} Src_{ij}^A + \sum_{j \neq i} w_{ji} Res_{ji}^A$$

Using the split of A_{ij} given above we can easily establish the following identity.

$$\sum_i TaxRev_i^A = \sum_i \sum_{j \neq i} w_{ij} A_{ij} = \bar{A}$$

A similar split of tax revenues when indirect routes are allowed involves conduit taxation.

Let Con_{ij}^{k} be the tax revenue that accrues to country *k* on the 'shortest' tax routes from *i* to *j*.

$$S_{ij} = Src_{ij}^{S} + Res_{ij}^{S} + Con_{ij} \qquad \text{with} \qquad Con_{ij} = \sum_{k \neq i,j} Con_{ij}^{k}$$

And the tax revenue on repatriated dividends by country also has three elements.

$$TaxRev_{i}^{S} = \sum_{j \neq i} w_{ij} Src_{ij}^{S} + \sum_{j \neq i} w_{ji} Res_{ji}^{S} + \sum_{k \neq i} \sum_{j \neq i,k} w_{kj} Con_{kj}^{i}$$

Again we want to establish the following identity.

$$\sum_{i} TaxRev_{i}^{S} = \sum_{i} \sum_{j \neq i} w_{ij} S_{ij} = \bar{S}$$

For this we need to examine Con :

$$\sum_{i} \sum_{k \neq i} \sum_{j \neq i,k} w_{kj} Con_{kj}^{i} = \sum_{k \neq i} \sum_{j \neq i,k} w_{kj} \sum_{i} Con_{kj}^{i} = \sum_{k} \sum_{j \neq k} w_{kj} \sum_{i \neq k,j} Con_{kj}^{i} = \sum_{k} \sum_{j \neq k} w_{kj} Con_{kj}$$

And, possibly with some renaming of indexes, the desired split of S is demonstrated.

Remark 1

The three-dimensional counter needed for the betweenness measure and the tax revenue split including conduit taxation are the hard part of the network analysis; it involves examining all relevant shortest tax routes. As our standard run has almost a million of these routes, they are not stored or written to file. During the execution of program the relevant aggregates are kept and used in the measures.

Remark 2

The overview above has refrained from discussing a complexity involving dealing with the credit method as double tax relief; in conduit situations it may not be clear which taxes may be credited.

How we deal with this is described in 'Ranking the Stars'; it amounts to the use of a second matrix Q of tax distances.

http://www.cpb.nl/en/publication/ranking-the-stars-network-analysis-of-bilateral-tax-treaties

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