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Estimating the revenue costs of tax treaties in developing countries

Petr Janský | **Marek Šedivý**

Faculty of Social Sciences, Charles University, Prague, Czech Republic

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1 | INTRODUCTION

Foreign direct investment (FDI) by multinational enterprises (MNEs) is given substantial weight by an expanding number of developing countries. How much tax revenue developing countries' governments gain from this investment is influenced by their bilateral tax treaties with the MNEs' investor countries. Bilateral tax treaties, or double taxation agreements (DTAs), are signed by two countries to divide up the right to tax cross-border economic activity between them. While these tax treaties can increase investment and thus the tax base, of which Neumayer (2007) finds some evidence for middle-income but not low-income countries, they often reduce the applicable tax rates; we focus on the effects of this latter aspect. Paolini, Pistone, Pulina, and Zagler (2016) use a theoretical model to show under which conditions a developing and a developed country will voluntarily sign a tax treaty where the developing country is more inclined to share the information with the developed country and whether they should share revenues. Among others, Hearson (2016) argues that when one of the signatories is a developing country that is predominantly a recipient of foreign investment, the effect of the tax treaty is to impose constraints on its ability to tax inward investors. We attempt here to find out what the impact of this effect on tax revenues is, for as many developing countries as possible.

The existing literature on the revenue costs of tax treaties is limited, and we are only aware of six specific estimates so far and each centred around one country only. McGauran and Fernandez (2013), estimated dividend and interest-related tax revenue losses of €770 million in 2011 for developing countries because of lower withholding tax rates in the developing countries' tax treaties with the Netherlands. Also for the Netherlands, Weyzig (2013) provided revenue estimates for a few countries and the Dutch special purpose entities in the concluding chapter of his dissertation. The International Monetary Fund (IMF, 2014) estimated tax revenue losses of US$ 1.6 billion in 2010 for non-OECD countries that had tax treaties with the United States. ActionAid (2016) estimated that Bangladesh might have lost up to US$ 85 million in 2013 due to dividend tax breaks in its treaties with 30 other countries. van de Poel (2016) calculated the impact of the reduction in tax rates in Belgian tax treaties on the government revenues for dividends and interest earnings. He estimates the total loss for developing countries in 2012 at around €35 million, with Brazil and the Democratic Republic of Congo losing most (€9.44 million and €7.83 million, respectively).

While van de Poel (2016) notes that only 3% of Belgium's overall FDI stock is located in a developing country with which it signed a tax treaty, he also argues that these are very conservative estimates because he focuses on one developed country only and only two provisions in tax treaties.

Most recently, the World Bank's Balabushko, Beer, Loeprick, and Vallada (2017) provide perhaps the most rigorous quantification of the revenue effects of tax treaties for one country, Ukraine. They exploit administrative data to estimate the tax sensitivity of dividend, interest and royalty payments. While they find what they call direct revenue costs of high magnitude, the estimated elasticities are also high and imply that increases in withholding rates at the individual treaty partner level might not necessarily result in increased revenue. Additionally, they use firm-level data to show that the reported profitability of MNE affiliates is sensitive to changes in the relevant treaty network. Due to data limitations, in this paper, we estimate what they call the mechanical (or static), and not the behavioural (or dynamic), revenue effect of tax treaty withholding rates by multiplying dividend and interest payments to a country by the differential of the applicable general withholding tax rate and the rate negotiated in the country-specific treaty. In this paper, we thus provide estimates of how much revenue would increase if a higher withholding rate applied. However, in contrast with Balabushko et al. (2017) for Ukraine, we do not have access to such detailed data for the developing countries in our sample and we do not provide estimates of how much the investments and the associated tax base would change and what revenue implications this would have if there were a tax treaty change. The investments and the associated tax revenue would likely decrease following the increase in an applicable withholding rate, and we use the potential scale of this adjustment estimated by Balabushko et al. (2017) while discussing our results below. For Ukraine and its five most important partner countries in a given payment, they estimate the losses at US$ 144 million (and 169 without reflecting the behavioural change) in 2014 for dividends and at US$ 52 million (and 184) in 2012 for interest payments.

In this paper, we aim to estimate the impact the tax treaties might have on tax revenue for as many developing countries as possible. We focus on the potential tax revenue losses, or revenue foregone, stemming from the fact that the withholding tax rates for dividends and interest payments granted in tax treaties are lower than those that would apply otherwise. Methodologically, we build on the existing literature, especially the estimates by McGauran and Fernandez (2013) for the Netherlands and by ActionAid (2016) for Bangladesh. We aim to apply a similar empirical approach to as wide range of developing countries as possible, limited only by the availability of the data. We rely on detailed information about developing countries' tax treaties from the ActionAid Tax Treaties Dataset introduced by Hearson (2016), and we use cross-country information on FDI stocks and incomes from the IMF. Like the previous estimates, we make a number of assumptions when approximating the revenue losses, which we set out in Section 3.

Most importantly, our estimates are based on the assumption that investment flows and stocks and thus the related payments as tax bases would not change if the withholding rates changed. We make this assumption because we do not have data available to estimate this sensitivity. However, we do discuss the potential implications of it, with reference to the empirical estimates of the same sensitivity for Ukraine by Balabushko et al. (2017). Due to this and other assumptions, including the need to disaggregate the IMF's unilateral FDI income data into bilateral data, our estimates are only illustrative and imprecise, much like the existing estimates for the Netherlands and Bangladesh. Another limitation is that, similarly to the existing literature, we only estimate the revenue effects of selected FDI incomes, namely dividends and interest payments. We do not estimate the

tax revenue effects of other FDI incomes, such as those related to royalties or capital gains, for which there might be special provisions in the tax treaties. However, we substantially improve the availability of estimates—our estimates are based on data for the most recent years and cover the broadest range of developing countries so far.

In this paper, we make contributions to at least four following areas of literature. First of all, we aim to contribute to the literature related to tax treaties, as reviewed recently by Hearson (2016). Tax treaties seem to be of particular importance for FDI, and Haberly and Wójcik (2015), for example, found that including tax treaty information improved the precision of their FDI regression model. Furthermore, for studying the impact of tax treaties on investment, which has been a relatively frequent focus in the existing research, Hearson (2016) only reports two studies that take into account specific treaty provisions rather than just the bilateral indicator of whether there is a treaty or not. Mintz and Weichenrieder (2010) use detailed German data to find a relationship between DTA's withholding rates and probability that FDI is diverted through a third country, first such empirical finding for a developed country. Lejour (2014) finds that lower dividend withholding tax rates in tax treaties increase the stock of bilateral FDI and he argues that these are treaty shopping effects rather than increases in real investment. Azémar, Desbordes, and Mucchielli (2007) find that the existence of the so-called tax sparing clauses for Japanese FDI into developing countries between 1989 and 2000 had important effects. Still, the specific impact of tax treaties on government revenues in developing countries remains largely unknown so far, although some of the country-specific estimates suggest their magnitude is substantial.

Second, we make an important contribution to the question of how much revenue developing countries might lose due to tax treaties. As discussed above, all the existing studies have focused on one country only and there are only six existing one-country studies so far. To date, only six studies have provided estimates of tax treaty-related revenue losses for developing countries, each of them only for one country: McGauran and Fernandez (2013), Weyzig (2013), IMF (2014), ActionAid (2016), van de Poel (2016) and Balabushko et al. (2017). We apply a methodological approach that enables the estimation for as many countries as there are suitable available data for, which currently results into a sample of 14 developing countries. By providing results for 14 developing countries, we substantially expand the number of countries for which estimates are available and provide the first multi-country comparison of this kind.

The third strand of the relevant literature is one on non-revenue effects of DTAs on developing countries. There are a few analyses of the effects of DTAs on developing countries that do not provide estimates of potential revenue implications for governments of developing countries. In addition to the theoretical model by Paolini et al. (2016) and an empirical argument by Hearson (2016) discussed above, there is, for example, IBFD (2013) that examined tax treaties concluded between the Netherlands and developing countries, but it did not estimate revenue implications. Also, within the IBFD and while looking at wider effects of the Irish tax system on developing countries, Kosters, Kool, Groenewegen, Weyzig, and Bardadin (2015) discuss DTAs, including withholding taxes on dividends, interest and royalties, but they do not provide revenue estimates. Similarly, Bürgi and Meyer (2013) analyse the DTAs of Switzerland with developing countries (it has a DTA with one quarter of the world's 134 developing countries). While they do not provide revenue estimates, they find that the treaties tend to contain provisions that are more favourable to Switzerland. Also, Braun and Fuentes (2016) analyse Austria's DTAs with developing countries and, although they do not quantify the potential revenue loses, they show that the signatory states may suffer from limited withholding taxation rights established in DTTs for the source country, which could lead to reduced tax revenues in developing

countries. Most recently, Braun and Zagler (2018) evaluated alternative indirect revenue channel providing a theoretical model and empirical evidence for the effect of tax treaties on increased foreign aid flows to the developing country in question. In contrast with these studies, our focus here is on providing revenue estimates.

Fourth, we aim to estimate revenue losses due to taxing rights limitations in tax treaties, that is, how much revenue developing countries might be losing due to their tax treaties with other, especially developed, countries. Similar revenue losses have only very recently been estimated for various individual countries—but not in relation to tax treaties—by IMF's Crivelli, de Mooij, and Keen (2016) and Cobham and Janský (2018), UNCTAD (2015) and Janský and Palanský (2017), Clausing (2016), Cobham and Janský (2017), OECD (2015) and Johansson, Skeie, Sorbe, and Menon (2017), IMF (2014) and Tørsløv, Wier, and Zucman (2018). We add our dividend and interest payments tax treaties-related estimates to this growing set of estimates of tax revenue losses. Out of these listed cross-country tax-related estimates, UNCTAD (2015) and Janský and Palanský (2017) in particular focus on FDI, but also cover other potential tax revenue losses than those that we cover in this paper and thus highlight some of the limitations of our approach. Still, by estimating the revenue costs of tax treaties, we manage to address the three main challenges in international tax cooperation that developing countries face according to Hearson (2018). We estimate the potential scale of tax avoidance by foreign investors in an international tax institutions' environment that supports tax competition and places disproportionate restrictions on capital-importing countries' ability to tax foreign investors.

The rest of the paper is structured as follows. In Section 2, we describe the data. In Section 3, we outline the methodology that we use for estimating the revenue effect of tax treaties in developing countries. In Section 4, we present our results. The final section concludes and provides lessons for policy and questions for further research.

2 | DATA

We now proceed to discuss the data sources on tax treaties, FDI and other data that we use to estimate the revenue impact of tax treaties in developing countries. For tax treaties, we rely on detailed information about DTAs between developing and, mostly, developed countries from the ActionAid Tax Treaties Dataset introduced by Hearson (2016), rather than the other often used source, the International Bureau of Fiscal Documentation (IBFD), to which we have no access. The ActionAid data set is freely available and includes the encoded content of 519 tax treaties signed by low-income and lower-middle-income countries in Africa and Asia. As Hearson (2016) acknowledges, his data set might be the most recent one, but the biggest study of tax treaty content compared 1,811 treaties on the basis of 30 standardised variations that affect how constrained a developing country is in its ability to tax inward investors (Wijnen & de Goede, 2014). One of the most important limitations of the data set from the point of view of using it to estimate the tax revenue costs of tax treaties is that it does not include information on national tax systems. For example, the data set only includes information on withholding tax rates as stated in the tax treaties, but what the comparable tax rates are without a treaty is not included and we need to complement these data from other data sources. Therefore, when needed, in addition to the ActionAid tax treaty data set, we rely on data concerning domestic corporate tax rates from PwC (2017), EY (2017) and Deloitte (2017), which we consider credible sources of this information. In addition, we use information about tax rates in Bangladesh from ActionAid (2016).

We use cross-country information on FDI stocks and incomes from the IMF. The important data required are FDI income, which we source from the IMF's balance of payments data. Specifically, for dividends, we use data on investment income, debit; direct investment income; dividends and withdrawals from quasi-corporations, while for interest payments we use data on investment income, debit; direct investment income; interest. Furthermore, we use data on FDI stocks on a bilateral level from the IMF's Coordinated Direct Investment Survey (CDIS), which contains data for around 100 countries between the years 2009 and 2015. We have downloaded the data in November 2017, and we use the data from this original download for all countries with the exception of one, Pakistan. For Pakistan, only the CDIS data have been revised substantially between November 2017 and July 2018 and we thus use the revised data downloaded in July 2018. Specifically, for Pakistan, the volume of total FDI stock increased by an order of magnitude and the share of FDI investment from DTA countries doubled. Therefore, in the case of Pakistan, we have decided to work with the revised data in order to avoid obvious imprecisions in our results. More generally, the case of Pakistan serves as a reminder that our estimates depend on the quality of the underlying data and why our estimates are only illustrative.

Indeed, before proceeding further, it is useful to provide a brief discussion of the inherent limitations of the FDI data. As is described in Mesías (2015), IMF follows the guidelines outlined in the Benchmark Definition of Foreign Direct Investment (2008) during the construction of the FDI data. These are based on the immediate investor approach. Consequently, the data do not enable us to distinguish whether an investor country is only a conduit or represents the real origin of the investment. We possess information only about the immediate investor, whose tax treaties with the developing country are relevant. There are additional reasons for which this may represent a significant issue. Among the principal ones is the existence of SPEs, pass-throughs and the practice of round-tripping. While the first two complicate the identification of the ultimate investing country, the last inflates the FDI statistics as they include investment for which the ultimate investing and ultimate host economy are identical. Ledyaeva, Karhunen, Kosonen, and Whalley (2015) identify three principal reasons for round-tripping. It is motivated by regulatory, fiscal and secrecy arbitrage. Both OECD and IMF are aware of these limitations. OECD (2008) proposes remedies against SPEs in the Benchmark definition of foreign direct investment. It states that each national compiler should provide separate data on them. However, it also acknowledges that it is nearly impossible to provide a concrete definition of SPEs as what constitutes them varies across different countries. Based on these objections, Haberly and Wójcik (2015) dispute the representativity of the FDI data. They state that they can be considered representative within an order of magnitude rather than being a robust indicator. While we are aware of the limitations of the FDI data, we use them as these are to the best of our knowledge the most reliable data currently available. Nevertheless, we want to stress the importance of further research into the above outlined issues. OECD also identifies the above described challenges as key areas for further research in OECD (2008).

We now discuss some basic descriptive statistics. Table A1 in the Appendix shows the total FDI stock from the DTA countries and their share in the total. There is a considerable difference between the countries' total FDI stocks—large in Mozambique and the Philippines, small in Guinea-Bissau and Mali—perhaps reflecting a range of factors such as the size of the economy or the countries' openness to international investment and trade. There is also substantial heterogeneity in terms of the percentage of the FDI stock from countries with DTAs. According to the available data, Benin, Burkina Faso and Togo seem to have no FDI stock from their DTA countries and therefore we would expect no tax treaty-associated tax revenue losses (or revenue foregone). On the other hand, Bangladesh, the Philippines, Pakistan and Sri Lanka

all receive more than three quarters of their FDI stock from DTA countries. Even without looking at the details of the tax treaties, it is clear that these countries are dependent on what is in their DTAs and that the related losses might be substantial. Table A2 in the Appendix provides an overview of the FDI stock in developing countries covered by the ActionAid tax treaties data set, conditioned on having a DTA between the investor country and the developing country. According to the available data for this specific sample of 21 countries, the Netherlands is the biggest investor country, accounting for nearly a fifth of the total investment, followed by the United Kingdom, China and the United Arab Emirates. Other big economies follow, but some of the countries often considered tax havens, such as Mauritius, Singapore and Switzerland are also substantial investors among the top 12, which might, according to Blanco and Rogers (2014), further increase FDI for developing countries. On the recipient side, some countries such as the Philippines, Nigeria and Pakistan have higher FDI stocks than others and their most important investor countries differ, although for all of these three the Netherlands is among the four most important investor countries. The Netherlands was already highlighted as a top FDI conduit country in existing research on tax treaties by McGauran and Fernandez (2013), treaty shopping by Weyzig (2012) and conduit countries by Garcia-Bernardo, Fichtner, Takes, and Heemskerk (2017).

We also make use of GDP data for the purposes of comparing the tax revenue losses we estimate. We use the World Bank's World Development Indicators series on GDP in current US$. What we do not use, although it might seem relevant at first sight, are country-specific FDI income data from individual countries' statistical offices and other sources, instead relying on the IMF cross-country database which is more readily available. McGauran and Fernandez (2013) used data from the Dutch Central Statistics Bureau, which until 2013 reported how much capital income the Netherlands receives from its FDI stock abroad from withholding taxes on incoming interest and dividend payments. It is unclear whether this data set will be made available for 2014 onwards, but if so, further research should use these data to compare the estimates based on that, and on other country-specific data sources, with those we have made using the IMF data.

We provide an overview of the availability of the data in Table 1. We have information about tax treaties for 43 developing countries. For 21 of those, we have information about their FDI stocks from the IMF's CDIS, and for all those 21 developing countries, there is at least some information about FDI incomes (e.g., for some the totals and for others only the dividend income). For 14 out of those 21, there are available data on standard domestic tax rates from either PwC (2017), EY (2017) or Deloitte (2017). Table 1 also highlights the fact that the IMF data include information for both dividend and interest income for most countries, but only dividend income for some other countries.

3 | METHODOLOGY

In general, our methodological approach requires at least three pieces of information. First, we need information on the existence of tax treaties and the tax rates applied according to these treaties. Second, we need a proxy for what tax rate would be applied if it was not set by the treaty. Third, we need information on the scale of underlying economic activity, that is, the tax base in the form of dividends or other income from FDI. This FDI income is what we multiply with the difference between the real tax treaty-based tax rate information and the alternative tax rate, to

TABLE 1 International Monetary Fund data availability showing the latest years for which data are available

	FDI stock	FDI income	Both	Domestic rates	Notes on the FDI sources
Bangladesh	2015	2016	2015	OK	OK
Benin	2015	2015	2015	–	OK
Bhutan	2015	2016	2015	–	Dividend income for 2014
Burkina Faso	2015	2014	2014	–	OK
Cape Verde	2015	2016	2015	OK	OK
Ghana	2014	2015	2014	OK	OK
Guinea-Bissau	2015	2015	2015	–	Dividend income for 2013 and 2015, interest income for 2014
Mali	2015	2015	2015	–	Dividend and interest income for 2014
Mongolia	2015	2016	2015	OK	OK
Mozambique	2015	2015	2015	OK	OK
Nepal	2015	2016	2015	–	Only dividend income
Nigeria	2015	2015	2015	OK	OK
Pakistan	2015	2016	2015	OK	OK
Philippines	2015	2016	2015	OK	OK
Rwanda	2015	2016	2015	OK	Only dividend income
Senegal	2014	2014	2014	OK	OK
Sri Lanka	2015	2016	2015	OK	Only dividend income
Tanzania	2013	2015	2013	OK	OK
Togo	2015	2015	2015	–	OK
Uganda	2015	2015	2015	OK	OK
Zambia	2015	2016	2015	OK	Only dividend income

Notes: For 22 out of 43 developing countries in the ActionAid tax treaty data set, there are no available IMF CDIS data about stocks. These countries, which are not shown in the table, are as follows: Cameroon, Congo (DR), Congo (R), Ethiopia, Gambia, Guinea, Chad, Ivory Coast, Kenya, Kiribati, Laos, Lesotho, Liberia, Madagascar, Malawi, Myanmar, Papua New Guinea, Sudan, Swaziland, Timor, Vietnam and Zimbabwe. Comparable withholding tax rates are available from either PwC (2017), EY (2017) or Deloitte (2017) for only 14 of the remaining 21 countries listed.

Source: Authors on the basis of the data sources.

arrive at our estimate of revenue effects (losses). Our methodological approach can be then be summed up in the following way:

$$Potential\ tax\ revenue\ loss = (Standard\ rate - Tax\ treaty\ rate) \times FDI\ income,$$

as long as the standard tax rate is higher than the agreed rate in the tax treaty. If the standard rate is lower than the tax treaty rate, the standard rate applies.

We aim to estimate the tax revenue losses that occur as a result of lower dividend and interest withholding tax rates being agreed upon within tax treaties than those that would be applied otherwise, that is, the standard domestic rates. In this approach, we build on the estimates by McGauran and Fernandez (2013) for the Netherlands (they explain their methodology in detail in Annex II, and we rely on their description here) and by ActionAid (2016) for Bangladesh. We apply a similar methodological approach to a wider range of countries, limited only by the availability of the data. To arrive at an estimate of potential tax revenue loss due to tax treaties, we need to make certain assumptions that we discuss along the way, because

we believe that being explicit about these assumptions makes it clear that our estimates of potential tax revenue losses are only illustrative.

Importantly, we assume that FDI inflows and stocks in developing countries would not be any different without the tax treaties. Although the research into the impacts of tax treaties on FDI is not conclusive (Blonigen, Oldenski, & Sly, 2014; Davies, 2004; Egger, Larch, Pfaffermayr, & Winner, 2006; Hallward-Driemeier, 2003; Neumayer, 2007), our estimates are vulnerable to a lack of reliable counterfactual information on FDI incomes (i.e., what they would be in the absence of tax treaties). We make this assumption because we do not have access to any data that would enable us to estimate of this sensitivity, but we understand—from the recent empirical results for Ukraine by Balabushko et al. (2017) in particular—that this assumption has important empirical implications.

The leading IMF data source on FDI income (Balance of Payments Statistics) includes information only at unilateral, rather than bilateral level. The IMF statistics include how much capital income the investor countries receive from all (undistinguished by recipient country) and their FDI stock abroad and distinguishes between interest income and dividend income (direct investment income has one subcategory of income on equity and investment fund shares, which has three subcategories: dividends and withdrawals from income of quasi-corporations; reinvested earnings (direct investor in direct investment enterprises); and interest). Given that this is the only FDI income data available to us, we only estimate the revenue effects of selected FDI incomes, namely dividends and interest payments. We do not estimate the tax revenue effects of other FDI incomes, such as those related to royalties or management fees, for which there might be special provisions in the tax treaties. Corporate income tax and capital gains taxes also fall outside the scope of this study for the same reason, although we are aware that tax treaties may have important implications for tax revenues related to these taxes. Furthermore, we estimate the potential revenue effects of withholding tax rates on interest payments and dividends, but not the effects of other related taxes. However, the lower rates of tax on interest might incentivise MNEs to borrow more, which would reduce corporate profits and thus the corporate income tax base and in turn result in an additional revenue loss. We do not quantify these effects, but Weyzig (2013) calculates that they may be around a third of the avoided withholding tax in the case of the Dutch special purpose entities.

In addition to the assumptions explained by McGauran and Fernandez (2013), it is important for us to highlight the limitation posed by the lack of bilateral data on FDI income. Unfortunately, the FDI income data are only available at country level, and for each investor country, we have only one data point: we do not know which countries that income was received from. In the absence of this information, we assume that the FDI income is distributed across countries in the same way as FDI stock. In reality, this is likely not the case, since FDI income differs according to the origin country (as shown, for example, by Janský & Palanský, 2017). To fill in for this missing detail, it is possible to disaggregate the unilateral FDI income data to obtain bilateral estimates on the basis of the country-pair data on FDI stocks. The additional assumption needed is that an investor country's MNEs' profit in a developing country is proportional to that investor country's FDI stock in the given developing country. In other words, we assume that each dollar of investment leads to the same amount of profit (whatever that amount is). On the basis of this assumption, we can state that a specific percentage of FDI stock equals a specific percentage of the total profit from the total FDI stock (similar to assumption 2 on SPEs by McGauran & Fernandez, 2013). Similarly, unfortunately, the IMF statistics do not classify what income can be attributed to special purpose entities (SPEs), which would provide a further indication of treaty shopping.

The methodology of the calculation can be summarised by the following three steps. First, we extract the data on FDI from the IMF's CDIS. For each country, we consider overall FDI stocks as reported by the country itself, rather than data derived from partner countries' reports or on FDI

stock distinguished between equity and debt, but future research should consider these alternative data, especially if their availability and quality have improved. These data are used to find the share of inward direct investment from the total FDI for each of the countries with a DTA, using the following formula where the numerator stands for the direct investment received from the respective country and the denominator represents the total inward direct investment received, that is, the sum of all inward FDI from all countries:

$$Share_i = \frac{FDI_i}{FDI_{total}}.$$

Second, in order to calculate the volume of dividends and interest payments paid to partner countries, we use data from the IMF Balance of Payments Statistics. However, IMF only reports the total volume of dividends and interests paid from a given country and does not provide bilateral data. Therefore, the below outlined equation is used to estimate the dividends and interest payments from source to resident countries. When data are available for both dividends and interests, we make the estimates for dividends and interest payments separately and then sum them up to arrive at the estimate for both these components of the FDI income. We show the equations below for dividends only:

$$Dividends_i = Share_i \times Dividends_{total}.$$

Third, the data obtained can serve as proxy in the calculation of the loss on dividend and interest withholding taxes. We take the dividend or interest withholding tax rate from the ActionAid data set. We consider all treaties that are labelled in the ActionAid data set as signed, ratified and effective. In addition, we consider treaties that are labelled in the ActionAid data set as signed, ratified, but not effective, if they are listed by either EY (2017) or PwC (2017) as effective. (It is also important to note that in certain cases, there are significant discrepancies between the DTA tax rates provided by the ActionAid data set and the tax rates provided by PwC, 2017; EY 2017 and Deloitte, 2017. Data for Pakistan and Nigeria were the most discrepant, and for these countries, we rely on the ActionAid data set, so that we use one consistent source.) As the comparison rate, the tax rate applied to non-treaty countries as provided by EY (2017), PwC (2017) or Deloitte (2017) was used and the loss of the withholding tax attributable to the DTA was then obtained by:

$$Revenue\ loss_{i,dividends} = (Tax\ rate_{standard} - Tax\ rate_{i,tax\ treaty}) \times Dividends_i,$$

where the standard rate is higher than the tax treaty rate. If the standard rate is lower than the tax treaty rate, the standard rate applies. To illustrate this methodological approach, we present the calculation for Mongolia in Table A3 in the Appendix.

We now provide a brief discussion of how the weaknesses of the FDI data can affect our calculations. We have identified the main weaknesses relevant to our calculations in the previous section on data. Existence of the practice of round-tripping as well as SPEs and pass-throughs can introduce bias in our calculations. The first can introduce bias in the first step. During the calculation of the share of FDI received from a given country, we use the data as they are provided by the IMF. However, these also include round-tripped funds. Consequently, the FDI income received by a DTA country can be overestimated as the round-tripped funds are unlikely to generate the similar return to regular FDI. The latter can have a downward influence on the final stage of the calculation. In the final step, we combine FDI income data with the share estimated on the basis of the FDI stock data. Also, for all countries, the calculations are based on the latest year for which both FDI stock and FDI income data are available. We have decided not to combine data from different years as this approach could cause significant imprecisions in our results due to volatility of the FDI data.

4 | RESULTS

Before moving on to a discussion of our results, we recall the key data restrictions we worked with. Only 21 out of the 43 countries in the ActionAid data set are covered by the IMF's CDIS. Therefore, we were unable to calculate the loss of withholding taxes on dividend and interest payments caused by DTAs for the other 22 countries, more than half of the ActionAid data set, from the very first step. Further data limitations restricted us in the second step of calculation, as data on dividends and interest payments are not reported for all countries in the Balance of Payments Statistics. Thus, in the cases of Rwanda and Zambia, for example, we could only calculate the loss of withholding tax on dividends because there were no data available on interest payments. Finally, in the third step of the calculation, where we used data from EY (2017), PwC (2017) and Deloitte (2017) for domestic tax rates, we found that these rates were only provided for 14 out of our 21 countries. Therefore, our results only present estimates of the losses caused by DTAs for those 14 countries.

Despite these significant limitations in data availability and the restrictive assumptions we have had to make, we are still able to present illustrative estimates of dividend and interest withholding tax revenue losses attributable to tax treaties for 14 countries. These estimates are reported in Table 2, together with the size of the estimated loss relative to the GDP of each country. The year for which the calculation was performed (always the most recent year for which data were available) is also indicated in the table. As can be seen, the Philippines endures the greatest loss of withholding tax on outgoing dividend and interest payments in absolute terms (US$ 509 million) and Pakistan comes in second place (US$ 214 million). As far as the relative indicator is concerned, that is, the size of the loss relative to the GDP of the given country, the biggest losses attributable to DTAs are endured by the Philippines and Mongolia (both 0.17%). As Table 2

TABLE 2 Potential revenue loss estimates due to dividends and interest payments (thousand US$)

Country	Year	Dividend loss	Interest loss	Combined loss	Percentage of GDP
Bangladesh	2015	74,736	55	74,791	0.03834
Cape Verde	2015	0	7	7	0.00044
Ghana	2014	8,496	0	8,496	0.02201
Mongolia	2015	7,117	12,848	19,965	0.17004
Mozambique	2015	5,103	81	5,183	0.03503
Nigeria	2015	27,140	131	27,271	0.00567
Pakistan	2015	214,081	474	214,555	0.07934
Philippines	2015	492,796	16,228	509,024	0.17386
Rwanda[a]	2015	495	–	495	0.00599
Senegal	2014	945	227	1,172	0.00766
Sri Lanka[a]	2015	1,314	–	1,314	0.00163
Tanzania	2013	11	0	11	0.00003
Uganda	2015	13,021	218	13,239	0.04753
Zambia[a]	2015	5,090	–	5,090	0.02406

Note: [a]Indicates where we have made the estimates only on the basis of dividends data because interest was not reported, as indicated in Table 1.
Source: Authors.

highlights, the estimated dividend losses are much higher than those related to interest. The majority of the estimated losses are due to dividends, only around 5% are due to interests (Figure 1).

The estimates seem to be comparable in size with those reported in the existing literature on the revenue impacts of tax treaties. McGauran and Fernandez (2013) estimated dividend and interest tax revenue losses of €770 million in 2011 for developing countries as a consequence of lower withholding tax rates in the developing countries' tax treaties with the Netherlands. The IMF (2014, p. 27) estimates tax revenue losses of US$ 1.6 billion in 2010 for non-OECD countries that had tax treaties with the United States. Our estimates are of similar order, to within hundreds of US$. We estimate Bangladesh's potential tax losses related to dividends in 2015 at US$ 75 million, which is lower than the estimate of US$ 85 million by ActionAid (2016) for 2013. The difference is mostly explained by the fact that the total dividends paid from Bangladesh fell by a quarter between 2013 and 2015.

The study of the cross-country determinants of the scale of the losses would require even larger coverage of countries, but it is clear even now that these would include characteristics of both the tax treaties as studied by Hearson (2016) and the countries and their partners. The currently

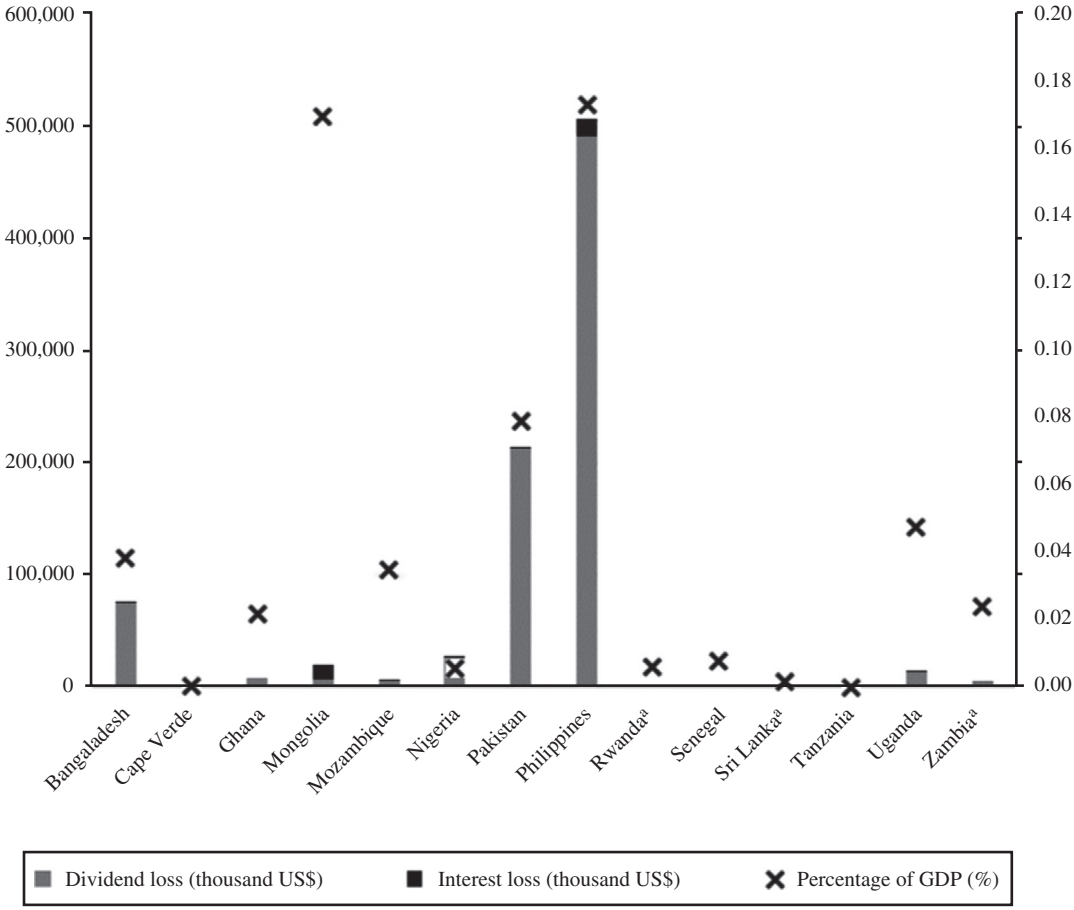

FIGURE 1 Potential revenue loss estimates due to dividends and interest payments

Note: [a]Indicates where we have made the estimates only on the basis of dividends data because interest was not reported, as indicated in Table 1.

Source: Authors.

available FDI data do not enable the distinction by sector, and we are thus not able to shed more light on the sector-specific effects of tax treaties. There is some evidence of this for extractive industries. For example, Otto (2017) argues that treaty provisions that reduce withholding tax rates below the normal statutory rate are of particular importance to foreign-owned mines. He further argues that withholding taxes are often one of the largest fiscal costs incurred by a mine. Also, recent presentations of ongoing contract-level research by IGF-OECD programme to address BEPS in mining have shown that there are many tax incentives given at the contract level in the mining sector. These contract-level tax incentives have effects that are additional to any domestic law and tax treaty provisions. Our estimates focus on two provisions in tax treaties and do not take into account any contract-level tax incentives. It follows that in this respect, the overall costs of tax incentives are likely to be higher than those estimated here for tax treaties.

Extractive industries are important for some of the countries in our sample. A case in point is Mongolia (with 16.5% total natural resources rents as a share of GDP in 2015 according to World Development Indicators). Mongolia is also an illustrative example of how contract-level tax incentives can interact with country-level tax treaties. One possible interaction is when tax treaty provisions are changed or cancelled, but still apply for a specific contract because of a so-called stabilisation provision often included in the contracts. A case in point is Rio Tinto's and the government of Mongolia's cooperation on Oyu Tolgoi, one of the largest copper mines in the world, recently discussed by Redhead and Mihalyi (2018) with regard to the Netherlands–Mongolia tax treaty. Although the treaty was annulled by the government of Mongolia in 2014, the 0% withholding tax rate on dividends and interests still applies due to the fiscal stabilisation clause included in this contract. This is important in itself, but also has implications for our revenue estimates, which are in this respect conservative because they consider provisions only in the tax treaties valid at the time and not the contracts or their fiscal stabilisation clauses.

The estimated losses reported in Table 2 include the approximate answers to the key question of what the potential government revenue loss from tax treaties in specific developing countries is. Nevertheless, certain aspects of that answer need to be taken into consideration during its interpretation. We do not estimate the tax revenue effects of other FDI incomes, such as those related to royalties or capital gains, for which there might be special provisions in the tax treaties. A case in point is taxation of assets that are immovable or generating location-specific rents such as mobile phone operators are important from the point of view of tax treaty policy, but are outside the scope of this paper. A specific example is the indirect sale by Zain of various assets in Africa including a mobile phone operator in Uganda discussed in a draft toolkit of the platform for collaboration on tax (World Bank, 2017) by the IMF, OECD, World Bank and UN. The authors of the toolkit argue that the amount at stake is very large, in the order of 5% of total government revenue (and nearly a half of public spending on health). It implies that we are possibly omitting a substantial revenue losses due to tax treaties from our analysis. The toolkit of the platform for collaboration on tax (World Bank, 2017) also provides a policy recommendation. Specifically, provisions of both the OECD and the UN model treaties imply that capital gains taxation of offshore indirect transfers of immovable assets be primarily allocated to the location country. But they note that the relevant Article 13(4) is found only in around 35% of all DTAs and is less likely to be found when one party is a low-income resource-rich country. They also note that the 2017 Multilateral Convention has had a positive impact on this percentage by increasing the number of tax treaties that effectively include the article.

Most importantly, as discussed above, the presented results only estimate the mechanical, not the behavioural, revenue effect of tax treaty withholding rates, as we obtain them by multiplying dividend and interest payments to a country by the differential of the applicable general withholding tax rate and the rate negotiated in the country-specific treaty. We do not take into account how

much the investments and the associated tax base changed, nor what revenue implications these follow-up changes had, when the tax treaties were brought into force, or changed. Investments and the tax revenue associated with them would likely decrease following an increase in the applicable withholding rate.

For the case of Ukraine, Balabushko et al. (2017) do estimate the sensitivity of tax bases to changes in tax treaty rates, and their results can help us shed at least some light on the potential scale of this sensitivity for the developing countries we have studied here. In line with their expectations, they find that increasing the tax rate applied for foreign investors in a specific country (in their case Ukraine) does reduce income flows to that country. They estimate the implied own-price semi-elasticity for dividend and interest payments: A one percentage point increase in the withholding rate reduces income flows to the affected country by around 2.3% and 7%, respectively (while the estimates are 12% for royalty payments, for which we do not have data). For the five most important investor countries for Ukraine, Balabushko et al. (2017) find that adjusting the revenue effects by behavioural change (lower dividend and interest payments as a result of increasing the relevant withholding tax rate) leads to a decrease of 15% for dividends in 2012 and 70% for interest payments in 2014 (and around 92% for royalties in 2014). While acknowledging that Balabushko et al. (2017) made rather imprecise and not very statistically significant estimates for just one country, for illustrative purposes we can combine their estimates with information from our data in order to derive very approximate lower bounds for our estimates. In our data, the average difference between the tax treaty rate and otherwise applied tax rate is 11 percentage points for both 207 dividend and 176 interest observations with non-zero differences, coincidentally of almost the same scale for both. This combination estimated elasticities for Ukraine and our data for 14 developing countries results in the following estimates for the case of average values. If the tax treaty was cancelled and the standard rate applied then, hypothetically, dividends would be reduced by 25.3% and interest payments would be reduced by 77%. These illustrative observations imply that our estimates might overestimate withholding tax revenue losses substantially for interest payments, while for dividends, which account for a vast majority of the revenue losses estimated here, we may have a relatively modest overestimate at around one quarter of the estimated revenue losses.

Furthermore, there are other limitations to our estimates. One is caused by the absence of some values in the FDI data—we came across some which were not specified or were marked as confidential. These were set to zero for the purpose of the calculations. It is important to note that the share of FDI represented by the considered country does not suffer from bias as these flows are reported under the heading titled "Not specified (including confidential)." However, these missing values are likely to introduce a downward bias into the estimates. A second crucial limitation is that we chose to apply domestic tax rates in our calculations, to represent the rates that would apply if there were no DTA; however, we can have no certainty that dividends and interest payments would in fact be subject to these rates if there was no DTA. Furthermore, the potential increase in FDI flows caused by the existence of each DTA should be considered too, if we want to achieve a realistic estimate. Even though this effect is still subject to academic scrutiny, its potential implications should be contemplated when interpreting the estimates we outline below. As can be seen, it is hard to be sure of the direction of the potential bias in our estimates as the last two forces impose an opposite bias to the first.

In Table 3, we show which investor countries are responsible for most of the potential revenue losses shown in Table 2. Naturally, some of the biggest investors (shown in Table A2) are present in this table as well. Not surprisingly, some of the biggest investors in the Philippines, including Japan, play a more important role here than in Table A2. Investor countries Japan, the Netherlands, Switzerland and the United States are together responsible for more than half of all the estimated potential losses.

TABLE 3 Ten investor countries associated with the highest potential revenue loss estimates due to dividends and interest payments, by (thousand US$)

	Dividend lost	Interest loss	Combined loss
Japan	170,242	4,175	174,417
Netherlands	136,765	2,948	139,713
Switzerland	102,611	2,091	104,702
United States	70,576	2,503	73,079
United Kingdom	66,527	3,681	70,208
Singapore	52,931	5,600	58,531
Korea, Republic of	46,047	1,659	47,706
China, PR: Mainland	39,350	3,192	42,542
United Arab Emirates	41,596	219	41,815
Malaysia	11,921	248	12,169

Source: Authors.

5 | CONCLUSIONS

We established that revenue costs of tax treaties can be substantial for some developing countries. In a first multi-country comparison of this kind, we provided estimates of costs of tax treaties for 14 developing countries in sub-Saharan Africa and Asia. We estimated that the annual dividend and interest withholding tax revenue losses associated with tax treaties could reach hundreds of million of dollars for two countries in our sample, the Philippines (US$ 509 million) and Pakistan (US$ 214 million). We estimated the biggest losses relative to the GDP for the Philippines and Mongolia (both 0.17%).

These are illustrative estimates of the potential costs of tax treaties in developing countries. We estimated, if all else remained unchanged, what additional tax revenues the developing countries could have if the standard tax rate applied rather than the tax treaty rate for withholding taxes on dividends and interest payments. Due to data restrictions, we assumed that investments are not influenced by the tax treaties and in this important respect we might overestimate. In reality, as we discussed, there are exiting studies showing a positive effect of tax treaties on investments and the estimated revenue losses that we focus on in this paper might be made up by increased FDI inflows. We make this assumption because we do not have access to any data that would enable us to estimate this sensitivity, although we use the empirical estimates of the equivalent sensitivity for Ukraine by Balabushko et al. (2017) to approximate the scale of this assumption, which seems to be more important for interest rather than dividend withholding tax revenue losses. The available data limit us in two other ways. First, we are only able to estimate the revenue effects of selected FDI incomes, namely dividends and interest payments, because there are no data available for other FDI incomes, nor for corporate income taxes or capital gains taxes. It follows naturally that if these other taxes had been included in the analysis, the estimated potential tax revenue losses would have been higher. Second, our data and other necessary information are available for just 14 developing countries and their investor countries. This is far more than the existing one-country studies have presented, but somewhat less than what we had hoped for when using our aggregate IMF data-based approach.

Against this background, we draw four conclusions with implications for suitable future steps in both policy and research. First, the available data restrict what we can currently learn about the

impact of tax treaties on revenues in developing countries. There are data gaps both in the IMF sources and in the easily accessible and comparable sources of domestic tax rates. The data only enable the calculation of losses related to dividend and interest payments resulting from lower withholding tax rates in tax treaties. However, treaties are also known to lead to considerable losses through avoiding capital gains tax and profit shifting using royalties, management fees or other artificial costs in combination with treaty shopping and tax haven subsidiaries. In this respect, our estimate is conservative: It includes only some of the aspects of tax treaties that potentially lead to revenue losses, whereas including more such aspects would result in higher estimates of tax revenue losses. Policymakers and researchers should work towards closing these gaps and carrying out more rigorous research with a better country coverage.

Second, our results and the limited previously existing evidence suggest that the potential revenue impact of DTAs varies a lot across countries and that it is substantial, at least for some countries, both in dollar terms and relative to their GDP. A case in point is the Philippines, with estimated revenue losses of US$ 509 million or 0.17% of its GDP. Third, we hope that our detailed results can be used to highlight specific tax treaties in need of attention—and maybe revision—by the respective governments. This is relevant especially in those cases where the estimated losses are relatively high. In this respect, it is encouraging that in recent years, some developing countries have moved to renegotiate or terminate their tax treaties. A case in point is Mongolia, which around 2011 decided to cancel tax treaties with the Netherlands, Luxembourg, Kuwait and the United Arab Emirates arguably because of their high costs for government revenues (Jargalsaikhan, 2016).

Fourth, we briefly discuss implications for the design of tax treaties. Currently, most treaties follow either the OECD or the UN model treaty. The UN model tax treaty allows developing countries to maintain significantly more taxing rights than the OECD model (ActionAid, 2016). Of course, we encourage the developing countries' governments to negotiate the tax treaty provisions in their best interests and the suggested rates in the UN model treaty could be considered minimum standards. Indeed, for non-conduit FDI that does not flow in through conduit countries, the main recommendation, directly related to our results, is to renegotiate the tax treaty provisions, especially the withholding tax rates related to interest and dividend payments associated with high revenue costs with not corresponding benefits. To guard against the adverse effects of conduit FDI, countries should aim to effectively implement effective anti-abuse measures (e.g., the 2015 Action 6 of the OECD's BEPS on preventing the granting of treaty benefits in inappropriate circumstances might be a case in point). A further option for lower income countries, that so far have not joined it, would be to join the OECD's Multilateral Instrument. This convention to implement tax treaty-related measures to prevent base erosion and profit shifting was signed by the first 70 countries in June 2017. Lower income countries should carefully consider if it is in their interest to sign it at this stage and, if they are inclined to do so, then lower income countries should consider making some available adjustments (such as not opting in on mandatory arbitration) before signing.

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ORCID

Petr Janský https://orcid.org/0000-0001-6499-9923

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APPENDIX

TABLE A1 FDI stock from double taxation agreement (DTA) countries and in total (in million US$)

	FDI from DTA countries	Total FDI	Percentage
Bangladesh	9,577	12,352	78
Benin	0	146	0
Bhutan	47	203	23
Burkina Faso	0	1,630	0
Cape Verde	287	1,617	18
Ghana	2,728	7,683	36
Guinea-Bissau	44	284	15
Mali	65	2,679	2
Mongolia	4,568	16,746	27
Mozambique	17,495	28,927	60
Nepal	229	906	25
Nigeria	42,300	83,218	51
Pakistan	28,566	34,339	83
Philippines	29,247	33,479	87
Rwanda	579	1,404	41
Senegal	241	2,426	10
Sri Lanka	8,542	9,971	86
Tanzania	5,893	14,876	40
Togo	0	1,803	0
Uganda	5,703	8,877	64
Zambia	11,493	15,659	73

Source: Authors.

TABLE A2 FDI in developing countries covered by the ActionAid tax treaty data set, conditioned on having a double taxation agreement between the investor country and the developing country (million US$)

	Total of these 14 countries	Bangladesh	Cape Verde	Ghana	Mongolia	Mozam-bique	Nigeria	Pakistan	Philippines	Rwanda[a]	Senegal	Sri Lanka[a]	Tanzania	Uganda	Zambia[a]
Netherlands	32,057	689		0			18,162	2,081	5,158			1,768		3,916	283
United Kingdom	27,685	1,294		0	1,198		10,594	9,893	447			490		623	3,146
China	12,118	192			1,048		6,641	1,015	229			789			2,204
United Arab Emirates	12,009	138				7,384		3,798	118			571			
South Africa	10,983			1,559		3,301	1,970	7		165			3,659	322	
Japan	9,425	325						1,340	7,699						61
Switzerland	9,284	9		191	36			5,699	2,592			757			
United States	7,952	3,019							4,616			317			
Canada	7,299	162			403		43	0	518		0	181	1,805		4,187
France	6,871	43		1,546	16		4,840	148	256			22			
Singapore	5,974	433			1,386			336	3,260	5		554			
Mauritius	4,408	97				2,324		0		381	59	321		519	707
South Korea	3,022	715			145			213	1,949			0			
Malaysia	2,925	684			9			707	397			1,128			
India	2,701	327			1	690			69			1,193	79	286	56
Italy	2,526	41		19		2,321		22	1		0	106	7	0	9
Portugal	1,722		287			1,469		5			11				
Germany	980	103		35	42			336	352			71			41
Australia	779								682			97			
Ireland	759							23							736

Note: [a]Indicates where we have made the estimates only on the basis of dividends data because interest was not reported.
Source: Authors.

TABLE A3 An illustrative case of calculations: Mongolia in 2015

Investor country	Treaty	FDI	FDI_B	FDI_P	BOP_ Dividends	BOP_ Interests	BOP_ Dividends_P	BOP_ Interests_P	Tax_ D_T	Tax_ I_T	Rate_ D_D	Rate_ D_I	Tax_ Div_rec	Tax_ Int_rec	Tax_ Div_pot	Tax_Int_pot	Lost_Div	Lost_Int
Austria	1	3	3	0	176,441,311	463,690,313	31,609	83,069	0	0	0	0	1,580	8,307	6,322	16,614	4,741	8,307
Belarus	1	0	0	0	176,441,311	463,690,313	0	0	0	0	0	0	0	0	0	0	0	0
Belgium	1	97	97	0	176,441,311	463,690,313	1,022,024	2,685,893	0	0	0	0	51,101	268,589	204,405	537,179	153,304	268,589
Bulgaria	1	0	0	0	176,441,311	463,690,313	0	0	0	0	0	0	0	0	0	0	0	0
Canada	1	403	403	0	176,441,311	463,690,313	4,246,139	11,158,915	0	0	0	0	212,307	1,115,892	849,228	2,231,783	636,921	1,115,892
China, PR: Mainland	1	1,048	1,048	0	176,441,311	463,690,313	11,042,069	29,018,718	0	0	0	0	552,103	2,901,872	2,208,414	5,803,744	1,656,310	2,901,872
Czech Republic	1	12	12	0	176,441,311	463,690,313	126,436	332,275	0	0	0	0	12,644	33,228	25,287	66,455	12,644	33,228
France	1	16	16	0	176,441,311	463,690,313	168,581	443,034	0	0	0	0	8,429	44,303	33,716	88,607	25,287	44,303
Germany	1	42	42	0	176,441,311	463,690,313	442,526	1,162,964	0	0	0	0	22,126	116,296	88,505	232,593	66,379	116,296
Hungary	1	1	1	0	176,441,311	463,690,313	10,536	27,690	0	0	0	0	527	2,769	2,107	5,538	1,580	2,769
India	1	1	1	0	176,441,311	463,690,313	10,536	27,690	0	0	0	0	1,580	4,153	2,107	5,538	527	1,384
Indonesia	1	1	1	0	176,441,311	463,690,313	10,536	27,690	0	0	0	0	1,054	2,769	2,107	5,538	1,054	2,769
Kazakhstan	1	6	6	0	176,441,311	463,690,313	63,218	166,138	0	0	0	0	6,322	16,614	12,644	33,228	6,322	16,614
Korea, Republic of	1	145	145	0	176,441,311	463,690,313	1,527,767	4,014,994	0	0	0	0	76,388	200,750	305,553	802,999	229,165	602,249
Kyrgyz Republic	1	1	1	0	176,441,311	463,690,313	10,536	27,690	0	0	0	0	1,054	2,769	2,107	5,538	1,054	2,769
Malaysia	1	9	9	0	176,441,311	463,690,313	94,827	249,207	0	0	0	0	9,483	24,921	18,965	49,841	9,483	24,921
Poland	1	5	5	0	176,441,311	463,690,313	52,682	138,448	0	0	0	0	5,268	13,845	10,536	27,690	5,268	13,845
Russian Federation	1	143	143	0	176,441,311	463,690,313	1,506,695	3,959,615	0	0	0	0	150,669	395,962	301,339	791,923	150,669	395,962
Singapore	1	1,386	1,386	0	176,441,311	463,690,313	14,603,348	38,377,808	0	0	0	0	730,167	3,837,781	2,920,670	7,675,562	2,190,502	3,837,781
Switzerland	1	36	36	0	176,441,311	463,690,313	379,308	996,826	0	0	0	0	18,965	99,683	75,862	199,365	56,896	99,683
Turkey	1	6	6	0	176,441,311	463,690,313	63,218	166,138	0	0	0	0	6,322	16,614	12,644	33,228	6,322	16,614
Ukraine	1	0	0	0	176,441,311	463,690,313	0	0	0	0	0	0	0	0	0	0	0	0
United Kingdom	1	1,198	1,198	0	176,441,311	463,690,313	12,622,518	33,172,160	0	0	0	0	631,126	3,317,216	2,524,504	6,634,432	1,893,378	3,317,216
Vietnam	1	9	9	0	176,441,311	463,690,313	94,827	249,207	0	0	0	0	9,483	24,921	18,965	49,841	9,483	24,921

Source: Authors.

TABLE A4 Detailed description of the calculations—by column

1. Country
   Country for which the loss based on the double taxation agreement (DTA) is calculated. In this case Mongolia.
2. Year
   The year for which the calculation was made. This is the most recent year available.
3. Country_P
   List of all potential partner countries.
4. Treaty
   A dummy variable indicating the existence of a DTA between the source and resident countries. Note that in this example, the data are already filtered conditional on the existence of a DTA. A full table with all the potential partner countries would include more than 200 entries in the Country_P column.
5. FDI
   The total amount of FDI received by the source country from the resident country. As was outlined in the text, these data were extracted from the Coordinated Direct Investment Survey of the International Monetary Fund (IMF).
6. FDI_B
   Bottom coded FDI data from the previous column. All negative and confidential values were set to zero.
7. FDI_P
   The percentage of FDI received from the partner country relative to total FDI received. Obtained as:

$$share_i = \frac{FDI_i}{Total\,FDI}$$

8. BOP_Dividends
   The total amount of dividends paid by the considered state, extracted from the IMF Balance of Payments Statistics.
9. BOP_Interests
   The total amount of interest paid to other countries, extracted from the IMF Balance of Payments Statistics.
10. BOP_Dividends_P
    The volume of dividends attributable to the partner country, that is, dividends received by the partner country. These are obtained by the formula:

$$BOP\_Dividends\_P = share_i \times BOP_{dividends\,total}.$$

11. BOP_Interests_P
    The volume of dividends attributable to the partner country, that is, dividends received by the partner country. These are obtained by the formula:

$$BOP\_Interests\_P = share_i \times BOP_{Interests}.$$

12. Tax_D_T
    Withholding tax rate on dividends set by the DTA. Extracted from the ActionAid data set.
13. Tax_I_T
    Withholding tax rate on interest set by the DTA. Extracted from the ActionAid data set.
14. Rate_D_D
    Tax rate on dividends for non-treaty states extracted from EY (2017), PwC (2017) and Deloitte (2017).
15. Rate_D_I
    Tax rate on interests for non-treaty states extracted from EY (2017), PwC (2017) and Deloitte (2017).
16. Tax_Dic_rec
    Money actually received from withholding tax on dividends to the partner country.

(Continues)

TABLE A4 (Continued)

17. Tax_Int_rec
    Money actually received from withholding tax on interest to the partner country.
18. Tax_Div_pot
    Money that would potentially be received from withholding tax on dividends to the partner country if these were not subject to the tax rate set by the DTA.
19. Tax_Int_pot
    Money that would potentially be received from withholding tax on interest to the partner country if this was not subject to the tax rate set by the DTA.
20. Lost_Div
    Loss on withholding tax on dividends caused by the DTA. Obtained as:

$$Lost\_Div = Tax\_Div\_pot - Tax\_Div\_rec.$$

21. Lost_Int
    Loss on withholding tax on interest caused by the DTA. Obtained as:

$$Lost\_Int = Tax\_Int\_pot - Tax\_Int\_rec.$$

Source: Authors.