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WHEN DO DEVELOPING COUNTRIES NEGOTIATE AWAY THEIR CORPORATE TAX BASE?

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Abstract: Developing countries have concluded thousands of bilateral tax treaties, which restrict their ‘taxing rights’ over international investment. Qualitative case studies of these negotiation outcomes emphasize power politics, knowledge asymmetries and negotiating capability in the eventual distribution of taxing rights between signatories, yet such insights are absent from cross-country quantitative work. This paper bridges the gap by replicating two quantitative studies, introducing new data on countries’ ability to mobilize tax revenue and the outcomes of tax treaty negotiations. It provides statistical support for the insights from qualitative research. The size of a government’s revenue base, and its reliance on corporate tax, might affect the salience of the revenue sacrifice in policy makers’ minds. These variables influence the likelihood of signing a tax treaty and the particular concessions made. Power asymmetries between signatories lead to more unequal distributions of taxing rights away from developing countries, in contrast to the findings of earlier studies. Developing countries also become better negotiators as they gain experience. © 2018 UNU-WIDER. *Journal of International Development* published by John Wiley & Sons, Ltd.

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1 INTRODUCTION

Since the 1960s, developing countries have signed over 2000 bilateral tax treaties (BTTs).¹ Often referred to as ‘double taxation agreements’, these treaties’ main effect is to constrain

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¹Although the term ‘bilateral tax treaty’ (BTT) is used throughout this paper, it is interchangeable with the terms ‘double taxation treaty’, ‘double taxation agreement’ and ‘double taxation convention’.

developing countries' ability to tax inward investors, ostensibly to relieve double taxation and hence to attract inward investment. Quantitative studies of tax treaty negotiation have generally assumed that negotiation decisions by developing countries reflect a rational assessment of the costs and benefits (Barthel & Neumayer, 2012; Chisik & Davies, 2004; Rixen & Schwarz, 2009). In contrast, qualitative case studies, admittedly anecdotal, have repeatedly suggested that negotiating outcomes often reflect asymmetries of power, knowledge and bargaining skill and that developing countries' approach to negotiating tax treaties under these constraints has been 'boundedly' rational at best (Hearson & Kangave, 2016; Irish, 1974; Kangave, 2009). In a bounded rationality framework, negotiators and policy makers with limited capacity to assimilate information will resort to heuristics, for example, by according a greater weight to information that is 'more available' because it is easier to understand or obtain (Poulsen, 2014; Weyland, 2007).

This paper replicates two quantitative studies that analyse tax treaty negotiations, introducing a bounded rationality perspective. Barthel and Neumayer (2012) developed a model that suggested competition for inward investment drove developing countries' decisions to enter into tax treaties. Rixen and Schwarz (2009) studied the negotiated content of tax treaties, suggesting that capital-importing countries negotiated harder when the fiscal sacrifice entailed by a treaty had the potential to cost them more. Asymmetries in power, knowledge and skill were largely absent from the results of these studies. This replication changes that by incorporating two new sources of data: the ICTD Government Revenue Dataset (Prichard, Cobham, & Goodall, 2014), which provides the developing country's tax performance and reliance on corporate tax, and the ActionAid Tax Treaties Dataset (Hearson, 2016), which gives a more comprehensive and detailed assessment of treaty negotiation outcomes, for a much larger sample of treaties. With these data, we can gain an idea of the importance of the revenue sacrifice in a tax treaty to a government's revenue base and hence how salient the sacrifice may be to policy makers. We can also segment the negotiating outcome between different treaty clauses, some of which are more striking and easily understood than others. The analysis also examines how power and investment asymmetries affect negotiating outcomes and how negotiation outcomes change as a country gains experience.

This paper informs a growing international debate about the appropriateness of existing networks of tax treaties for developing countries. South Africa, Rwanda, Argentina, Mongolia, Zambia and Malawi are among the developing countries who have cancelled or renegotiated tax treaties in recent years, while others, such as Uganda, are undertaking reviews (Hearson, 2015). Perhaps in response to the international debate and the threat of further cancellations, the Netherlands and Ireland have also reviewed the impact of their treaty networks on developing countries (IBFD, 2015; Netherlands Ministry of Finance, 2013). The OECD (2014b) has produced guidance to 'make it easier for countries to justify their decisions not to enter into tax treaties with certain low or no-tax jurisdictions'. The International Monetary Fund (IMF, 2014a, p. 24) states that developing countries 'would be well-advised to sign treaties only with considerable caution'. Non-governmental organizations including Tax Justice Network Africa, ActionAid and SOMO have published reports critical of tax treaties from a development perspective (Hearson, 2015; McGauran, 2013; Weyzig & Van Dijk, 2007). This builds on a longstanding tradition of critical legal scholarship questioning the value of tax treaties to developing countries (e.g. Avi-Yonah, 2009; Brooks & Krever, 2015; Christians, 2005; Dagan, 2000; Irish, 1974; Paolini, Pistone, Pulina, & Zagler, 2016; Thuronyi, 2010).

The next section gives some context by setting out the debates in existing literature on the wisdom of signing treaties for developing countries. Section 3 then summarizes the existing studies on the determinants of tax treaty negotiation outcomes. Section 4 sets out the bounded rationality framework through a series of hypotheses to be tested. In sections 5 and 6, the results of the two replications are reported. Section 7 provides a robustness test and concludes the paper.

2 THE QUESTIONABLE CASE FOR TAX TREATIES

The formal function of BTTs, reflected in the commonly used term ‘double taxation agreement’ and in the title of most treaties (‘agreement for the relief of double taxation ...’), is to promote trade and investment by reducing the potential that companies operating in the two countries will be taxed twice on the same income. For example, the commentary to the OECD Model Tax Convention on Income and Capital (‘the OECD model’), which is the starting point for most negotiated BTTs, states that ‘The principal purpose of double taxation conventions is to promote, by eliminating international double taxation, exchanges of goods and services, and the movement of capital and persons’ (OECD, 2014a, p. 59).

Bilateral tax treaties set boundaries on when and how each country is entitled to tax income earned in one treaty partner by residents of the other, most usually multinational companies. In a stylised negotiation between a developing country (capital importer, or ‘source’ country) and a developed country (capital exporter, or ‘residence’ country), the developing country accepts constraints on its ability to tax inward investors. These constraints can be considered in three categories:

- **Withholding tax (WHT) rates.** The most visible and easy-to-understand effect of a tax treaty is to fix a maximum rate at which the capital importing country can tax dividends, interest payments, royalties and fees for management, technical and consultancy services (‘service fees’) paid to residents of the treaty partner. These maximum rates are usually lower than the rates in domestic law, and sometimes, they are even zero, giving special tax treatment to the foreign resident. Interest, royalties and fees can usually be deducted from a company’s taxable profits in its operating country, which means that, if they are not taxed in the recipient country, they may not be taxed at all. When WHT are lowered or eliminated by a tax treaty, this creates a stronger incentive for multinational firms to use them to shift profits to a location where they will not be taxed.
- **Permanent establishment (PE).** Another major aspect of tax treaties, PE is a minimum level of activity that a foreign resident must have in the source country before it can be liable for tax there on its profits. Some aspects of the PE definition are binary distinctions. For example, delivery warehouses and the collection of insurance premiums may be ruled in or out of the definition, depending on the outcome of negotiations. In general, the PE definition in treaties states that the taxpayer must operate through a fixed place of business. There are also quantitative criteria that, like the WHT rates, are the subject of negotiations over the precise figures. The minimum number of days before a construction site constitutes a PE is the most common quantitative criterion.
- **Other provisions.** Many of the other variations within the treaty are in clauses that exclude or include particular types of income earned in the source country by residents

of the other signatory from taxation there. This typically includes certain types of capital gains, pensions, social security payments and salaries.

In return for these concessions, the developed country agrees to bear the cost of eliminating any remaining double taxation incurred by its outward investors, by making allowances for the taxes they pay in the developing country. In practice, rather than relieving double taxation, the most significant effect of a BTT between a developed and a developing country is to shift the burden of doing so from the former to the latter (Avi-Yonah, 2009; Brooks & Krever, 2015; Dagan, 2000; Irish, 1974; Paolini et al., 2016; Thuronyi, 2010). This is because most developed countries already take unilateral steps to relieve double taxation on their investors, either by giving them a credit for taxes paid abroad or increasingly by exempting foreign-source income from domestic tax altogether (PWC, 2013). Indeed, a developed country that uses the credit system may raise more tax revenue as a result of the treaty, because the tax liability in the developing country, and hence the credit against home country tax, falls. This has led critical legal scholars to describe the rationale for BTTs as 'a myth' (Dagan, 2000) or 'aid in reverse' (Irish, 1974). Conversely, if developed countries instead exempt their outward investors from tax on the profits they make in developing countries (whether through treaties or their tax laws), this may compromise developing countries' ability to tax those investors. This is because, if investors face no further tax on their earnings beyond that incurred in the host state, they have a greater incentive to encourage tax competition between potential host states or to try to avoid paying tax in them (IMF, 2014a; Matheson, Perry, & Veung, 2013; Mullins, 2006).

These legal arguments notwithstanding, the view that tax treaties will stimulate investment into developing countries is pervasive (Hearson, 2015). Yet the evidence for such an effect is inconclusive. Until 2009, academic studies found a mixed effect of tax treaties on investment flows: positive, neutral or in some instances negative, the latter attributed to tax evading investors likely to be put off by the improved enforcement powers provided by tax treaties (Blonigen & Davies, 2004; Coupé, Orlova, & Skiba, 2009; Davies, 2004; Egger, Larch, Pfaffermayr, et al., 2006; Louie & Rousslang, 2008; Millimet & Kumas, 2009; Neumayer, 2007). Positive effects on investment were more commonly found for treaties between developed countries than those involving a developing country. Since then, the balance has tipped towards studies finding positive effects through the use of more comprehensive bilateral investment data (Barthel, Busse, & Neumayer, 2009; Lejour, 2014) and foreign affiliate microdata (Blonigen, Oldenski, & Sly, 2014; Davies, Norbäck, & Tekin-Koru, 2009; Egger & Merlo, 2011).

There is, however, room to draw different conclusions from the results of these studies. Those that use aggregate investment data employ a dyadic approach, which means that they assess the extent to which a treaty between A and B corresponds to higher investment into A from B. None controls fully for treaty shopping, in which investors from C into A use an intermediate vehicle in B to take advantage of the treaty, a phenomenon for which Lejour (2014) finds support, and which Weyzig (2013) documents using Dutch microdata. Firm-level data avoid this difficulty, but coverage of developing countries is poor, a problem given the differential effects found in earlier studies. Only Davies et al. (2009) have sufficient coverage of sub-Saharan countries, for example, to be able to draw any conclusions about that region. These studies are all to different degrees susceptible to the concern that what they are measuring is tax treaties' responding to, rather than causing, changing patterns of inward investment.

All in all, we cannot say with certainty that tax treaties have generated new investment into their developing country signatories, nor can we say that there is a compelling legal rationale to motivate the conclusion of tax treaties given their costs. The academic literature therefore does not give policy makers in developing countries any clear conclusions about the likely costs and benefits to them of tax treaties. They may, of course, have access to data from their own country that are not available to academic researchers, in particular revenue data with which to calculate the potential costs, and qualitative information with which to evaluate the demand from potential investors. They may also have political and economic objectives beyond the immediate attraction of investment that may be served by a treaty, such as the desire to heighten tax enforcement cooperation with the treaty partner, the need to satisfy the interests of particular domestic constituencies who will benefit from the treaty or the aim of strengthening diplomatic ties with another country (Christians, 2005; Pickering, 2013). Nonetheless, it is likely that tax treaty policy is made in conditions of considerable uncertainty about treaties' potential to promote inward investment. The challenge, in that case, is to explain why so many BTTs have been concluded by developing countries and why many of these BTTs appear to have, as Irish (1974) observed 40 years ago, a bias towards residence taxation.

3 EXISTING STUDIES OF TAX TREATY NEGOTIATION OUTCOMES

One common answer to this puzzle is to note that, if a country's competitors have signed tax treaties with key capital exporting countries, its incentives change and policy makers may seek to conclude tax treaties to maintain their competitive position (Baistrocchi, 2008). To date, the only quantitative study to have explicitly investigated this hypothesis is a survival analysis performed by Barthel and Neumayer (2012). In this result, competition between countries is found to have a significant effect on the likelihood that a particular pair of countries will conclude a tax treaty. This was the case when competition was measured as the number of treaties signed by countries in the same region or by countries exporting a similar basket of goods.

Other authors have investigated the determinants of negotiation outcomes. For one school of thought, negotiation outcomes reflect the rational preferences of the countries negotiating. Chisik and Davies (2004) and Rixen and Schwarz (2009) studied how the WHT rates in tax treaties varied with the balance of foreign direct investment (FDI) stocks between the two signatories, the former using US treaties and those between OECD members, and the latter German treaties. Both studies examined the circumstances in which WHT rates were higher, protecting the source taxation rights of the capital importing country. They found that one determinant of higher WHT rates was a more asymmetrical distribution of FDI stocks between the treaty partners, a situation in which the cost of lowering WHT rates would fall disproportionately more on the capital importer. This seems to confirm Goldberg's (1983) observation that 'treaty partners having unequal income flows will allocate jurisdiction to tax so as to achieve a more even balance between the two extremes'. It is worth noting that these studies did not explicitly examine the case of treaties signed by developing countries, of which there were relatively few within their samples.

Support for this 'rational negotiation' viewpoint can also be found in an International Bureau for Fiscal Documentation survey analysing 30 provisions of 1811 tax treaties signed since 1997. These provisions include the main variations between the two main

international model conventions used in negotiations: the OECD and UN models (Wijnen & de Goede, 2013). The UN model allows developing countries to retain more of their source taxation rights than the OECD model, and so can be regarded as a better outcome for a developing country that wishes to conclude a treaty while retaining its taxing rights over foreign investors. At 37 per cent of total provisions, the UN model was more common in treaties between non-OECD countries than in treaties between OECD countries, where it made up 25 per cent of provisions. Treaties between OECD and non-OECD countries, which may be a proxy for treaties between countries that have a predominantly one-way FDI relationship, were on average composed of 30 per cent UN provisions (Wijnen & de Goede, 2013, p. 66). Notably, UN model provisions comprised a minority of clauses in all three groups.

Hearson (2016) examined these trends in more detail using a new dataset of tax treaties signed by 43 low and lower middle-income countries between 1970 and 2014.² This study found a widening gap in the content of treaties between these countries and OECD member states, compared with those with non-OECD states. The former had become more 'residence' based over time, restricting more of the developing countries' taxing rights over investment from the treaty partner, while the latter had become more 'source' based, giving developing countries greater taxing rights. Disaggregation by type of provision indicated that the overall increase in the 'source' tax orientation of tax treaties was driven by more expansive PE provisions and masked a decline in the maximum WHT rates stipulated by the treaties. Disaggregation by region and income group also indicated differential trends. For example, treaties signed between sub-Saharan countries and OECD member states had become more 'residence' based. African least-developed countries, whose treaties were significantly more residence based in the 1970s, now appear to leave intact the same level of protection for their source taxing rights as those negotiated by other countries in the same region. Asian countries' treaties had become more source-based across the board, except for treaties with OECD countries, where there had been no change over time. In a similar vein, Dauer and Krever (2012) survey tax treaties in 11 African countries. Their survey finds marked differences between some countries and notes that 'as a group, these African countries appear not to have been as successful as Asian countries in retaining taxing rights'. These trends over time and space suggest that more work is needed to understand the determinants of tax treaty negotiation outcomes.

Critical legal scholarship emphasizes differentials in analytical capability, negotiating skill and economic power, suggesting that rational actor models alone are insufficient. In an early essay on the subject, Irish (1974) argues that developing countries are 'unaware' of the disadvantages of tax treaties and 'have or believe they have a relatively weak bargaining position' and that developed countries 'have a propensity to take advantage' of these two deficits. Aukonobera (2012) argues that 'Uganda has a weak tax treaty negotiation team that concludes treaties more intensively reflecting the position of the other contracting state', while Quinones Cruz (2012) reports that in Colombia in the 2000s a policy of 'attracting investment at any price' led to poorly prepared negotiations that resulted in an outcome that was less favourable to Colombia than might otherwise have resulted.

²The sample contains 519 treaties, those signed by low and lower-middle income countries in sub-Saharan Africa and Asia, excluding G20 member states. Of those countries, 43 had signed treaties when the dataset was compiled.

4 HYPOTHESES TO BE TESTED

This paper replicates two of the main studies cited earlier: Barthel and Neumayer (2012) and Rixen and Schwarz (2009).³ The first of these papers finds evidence that competition between countries increases the likelihood of signing a tax treaty, using a model that incorporates a number of control variables, such as diplomatic and trade links between the two countries, but not fiscal data. By incorporating information on taxes raised, we can test a model of policymakers' behaviour under the conflicting imperatives of attracting inward investment and raising tax revenue from it. Developing country governments that are struggling to raise tax may be more reticent to sign tax treaties, because they would be more concerned about the revenue sacrifice. In contrast, countries that already raise a significant amount of tax may be more willing to sign tax treaties because they have a larger tax base, and so, the fiscal costs of tax treaties may seem less significant. A further nuance, however, is that countries for which corporate tax is a larger share of the total tax base may be less willing to sign tax treaties, because in that case, the revenue sacrifice is potentially greater as a share of government revenue.

H_{1A}: *countries with a larger tax base are more likely to sign tax treaties.*

H_{1B}: *countries whose tax base depends more on corporate tax are less likely to sign tax treaties.*

The Rixen and Schwarz (2009) paper finds that WHT rates in tax treaties, but not PE provisions, tend to be more generous to the net capital importing country in a dyad when the FDI relationship is more asymmetrical, in other words when the capital importer has more to lose. This supports the idea that a higher fiscal cost leads to a tougher negotiating stance by a developing country but only for the easiest provisions to understand. This can be contextualized by adding in fiscal data, because the fiscal cost may be more or less salient to policymakers in a developing country government depending on how much it needs the revenue:

H_{2A}: *countries with a larger tax base are less likely to protect it in negotiations.*

H_{2B}: *countries whose tax base depends more on corporate tax are more likely to protect it in negotiations, especially in more salient (easier to understand) areas such as withholding tax rates.*

Two competing (or complementary) explanations can be tested alongside this. A power-based explanation of treaty negotiation outcomes suggests that countries with greater material capabilities are more likely to negotiate treaties reflecting their interests. This is a view that has some support in the area of bilateral investment treaties (Allee & Peinhardt, 2014). When Rixen and Schwarz (2009) tested for this, they found no effect, but it will be tested for again here:

³While each of these papers contains numerous robustness checks using different specifications, the focus here is on the two main preferred models.

H₃: *the greater the power asymmetry in negotiations, the less the treaty protects the tax base of the less powerful signatory.*

A second explanation is that of Rixen and Schwarz (2009) that greater asymmetries in investment will lead to increased source taxing rights in the treaty. This, they argue, is because the capital importing country will face a greater fiscal cost from restrictions on source taxation and seek to mitigate that cost before it is willing to conclude a treaty:

H₄: *the greater the FDI asymmetry, the more the treaty content protects the tax base of the net capital importer.*

Finally, as some studies cited earlier suggested, lack of knowledge and negotiating experience capacity may be one reason that developing countries sign treaties costing them significant amounts of revenue. Hearson (2016) gives examples of developing countries such as Vietnam and Zambia, whose negotiated treaties were less source-based when they first negotiated them but became more source-based over time. In Uganda, Mongolia and China, governments have shifted to more source-based negotiating positions after observing the effects of treaties in force (Hearson & Kangave, 2016; Li, 2012; Michiels, 2012). This leads to a final hypothesis. We might expect to see a learning effect, especially in elements of the treaty whose importance an inexperienced negotiator might not be aware of:

H₅: *the more treaties that a developing country has signed, the better negotiating outcomes it obtains, especially for less salient, more technically obscure treaty provisions.*

5 EFFECT OF TAX PERFORMANCE ON THE DECISION TO SIGN A TREATY

5.1 Data and Methods

This part of the paper replicates the article by Barthel and Neumayer (2012), beginning from the replication dataset made available by Eric Neumayer. They develop a Cox proportional hazard that estimates the likelihood of a dyad of countries signing a tax treaty using ‘spatial lag’ variables capturing the competition effects. This model predicts the likelihood that a given dyad will conclude a treaty at a given time. The likelihood is expressed as follows:

$$h(t|X_{ijt}Y_{ijt}) = h_0(t) \exp(\beta X_{ijt} + \gamma Y_{ijt}).$$

Here, $h_0(t)$ is the baseline hazard function, X_{ijt} represents control variables that are attributes of the dyad and Y_{ijt} represents the ‘spatial lag’ variables capturing the competition effects (Neumayer & Plümper, 2010); i and j are the two dyad members, and t is the year.

‘Spatial lags’ weight the impact of a given treaty conclusion on the country dyad in question by different factors that proxy competition between countries.⁴ The weighting of the first spatial lag compares the makeup of products exported by the two countries that

⁴A third spatial lag, export market similarity, was found to be non-significant.

signed a treaty with that of the two countries in the dyad on whom competitive pressure is being measured. For example, if a country whose exports are dominated by sugar signs a BTT, this will increase the likelihood of signature in all other dyads that include a country for whom sugar exports are important. The second spatial lag takes into account treaty signatures by countries in the same region: a treaty between Ghana and Germany increases the likelihood of signature in all other dyads including both sub-Saharan African and European countries. The authors assumed that in both competition scenarios, it is the capital importer in the dyad on which the competition acts.

The controls include several variables where the attributes of the two dyad members are combined by multiplying them together: population, gross domestic products (GDPs) per capita, *de facto* trade openness and political constraints. Several binary variables measure the attributes of the dyad itself: whether it includes one or two OECD countries, whether its members already have a bilateral investment treaty, whether they are part of a regional trade agreement, whether one of them is an offshore financial centre (OFC), and whether they have diplomatic representation in each other's capitals. Finally, several variables capture other attributes of the dyad: the volume of trade between the countries, the distance between them, the number of years; independence for the dyad member most recently independent, the maximum number of tax treaties signed by one of the dyad members, and the cumulative number of tax treaties that each member has signed. Some of these variables are transformed or lagged as indicated in Annex Table A1. The data sources and further explanation are given in Barthel and Neumayer (2012, p. 649–652).

The replication dataset runs from 1969 to 2005, while some of the other datasets used in this replication cover only recent years. I therefore recreated the replication dataset from the original sources specified in Barthel and Neumayer (2012, p. 652), including the spatial lags, for the period 2004 to 2012, appending this to the existing data obtained from the authors. Descriptive statistics are given in the annex (table A1), and the original and re-estimated models are shown in Table 1, columns 1 and 2. Although some of the model coefficients change in magnitude and significance, the orders of magnitude are broadly the same. These changes seem to represent underlying changes in the role of explanatory variables since 2005, rather than errors in the re-estimated data: the original and new data overlap in 2004, when the values of the spatial lags (explanatory variables) from the original and extended datasets have an 88 per cent correlation.

To test the hypotheses given earlier, the model has been amended to incorporate explanatory variables that relate only to the capital-importing country, designated *i*, in each dyad. This gives the following equation:

$$h(t|X_{ijt}Y_{ijt}Z_{it}) = h_0(t) \exp(\beta X_{ijt} + \gamma Y_{ijt} + \delta Z_{it}).$$

While the variables in the original dataset are largely dyadic, the variables within δZ_{it} apply only to the capital importing country because this is the country that would make most of the revenue sacrifice by signing a treaty. A simple approach was taken to identify the capital importer in each dyad: countries were assigned to their respective World Bank income groups, and the country in the dyad that was the lower income of the two was identified as the capital importer. Where the countries were in the same income group, no fiscal data were added, so these dyads dropped out of the sample along with those for which data were not available. This means that all dyads in the subsample with fiscal data include one low-income or middle-income country. The variable 'OECD-OECD', a dummy for dyads in which both countries are OECD members, therefore becomes redundant. A better approach may have been to use dyadic data to ensure the correct

Table 1. Results for first replication, determinants of likelihood of signing a tax treaty

	(1)	(2)	(3)	(4)	(5)
	Original dataset, 1969–2005	Extended dataset, 1969–2012	Sample of extended dataset for which fiscal and quality data available, 1984–2012		
Revenue/GDP ratio (t-1)				-0.807	
CIT/Revenue ratio (t-1)				0.0961	1.131**
Bureaucratic quality					0.109
Spatial lags:					
Common region (product) (t-1)	1.229***	1.287***	1.544***	1.497***	1.635***
Export product similarity (sum) (t-1)	11.38***	6.018**	-6.661	-6.839	-6.234
Product of populations (ln)	0.0855***	0.0994***	-0.0353	-0.0323	-0.0242
Product of GDPs per capita (ln)	0.0234	0.1500***	0.0424	0.0295	0.0341
Bilateral trade (ln, t-1)	0.137***	0.0813***	0.0546**	0.0550**	0.0535**
Product of openness to trade ¹	6.92e-05***	4.34e-05***	2.60e-05**	2.71e-05**	2.65e-05**
Bilateral Investment Treaty	1.310***	1.365***	1.214***	1.215***	1.224***
Regional Trade Agreement	-0.174	-0.134	0.0550	0.0123	0.00672
Offshore Financial Centre ²	-0.463***	-0.346***	-0.388**	-0.377**	-0.362**
Diplomatic representation ³	1.201***	0.8945***	0.876***	0.867***	0.860***
Distance (ln) ²	-0.255***	-0.302***	-0.169	-0.208*	-0.206*
Product of political constraints	0.640***	0.313**	0.497*	0.369	0.469*
OECD-OECD dyad ²	-0.143	-0.244	-	-	-
OECD-non-OECD dyad ²	-0.504***	-0.628***	-1.021***	-0.947***	-0.980***
Min. years of independence ²	-0.00605***	-0.00469***	0.00185	0.00104	0.000998
Max. number of BTT (t)	-0.0356***	-0.0349***	-0.0354***	-0.0358***	-0.0341***
Cumulative number of BTTs, country i (t-1)	0.0430***	0.0400***	0.0499***	0.0502***	0.0480***
Cumulative number of BTTs, country j (t-1)	0.0417***	0.0394***	0.0455***	0.0460***	0.0442***
Observations	198,820	289,226	18,357	18,357	18,357

Note:

*p<0.1,

**p<0.05, and

***p<0.01. Source: Barthel & Neumayer (2012) and author's own calculations.

identification of capital importers and exporters, but the lack of comprehensive, historical dyadic data would have significantly reduced the number of observations, which were already reduced by 90 per cent in order to include the fiscal data.

The first of two fiscal variables measures the size of the tax base through total government revenue as a share of GDP ('Revenue/GDP').⁵ The expected outcome following from H_{1A} is that a higher value of this variable increases the likelihood that a government will be willing to sign tax treaties, because the government has a larger revenue base from which to make the sacrifice entailed. The second fiscal variable, which tests dependence on corporate tax, is corporate tax as a share of total revenue ('CIT/Revenue').⁶ Applying H_{1B} to this measure, a higher value of this variable should reduce the likelihood that a government will be willing to sign treaties, because the government has a smaller tax base outside of corporate tax, and the revenue sacrifice from corporate tax is therefore more important as a share of the government's total tax base.

One further explanatory variable is included. The amount of tax raised by a developing country might reflect the quality and size of its tax policy-making and administrative functions. If so, we might expect this to translate into a greater capacity to negotiate tax treaties, resulting in greater propensity to sign treaties and a more source-based outcome in negotiations. In reality, measures of total tax as a share of GDP tell us little about a country's absolute negotiating capacity, because that depends much more on total absolute government revenue than on any indicator as a share of GDP. Furthermore, corporate tax as a share of total tax is unlikely to be related to bureaucratic quality, because it is a measure of the composition of the resourcing for government capacity, not the size of that capacity.

Therefore, to control for the capacity of the developing country's bureaucracy, the bureaucratic capacity component of the *International Country Risk Guide* is used, a widely used dataset beginning in 1984 (The PRS Group, 2017). This indicator is based on expert assessments, and its authors state that it measures the strength and expertise of a bureaucracy, which is considered to lead to a degree of autonomy from political pressures. This variable should be used with caution, because international tax policy tends to be a small, specialist function within most governments, with treaty negotiations frequently led by one individual. A general indicator of bureaucratic quality across the whole of government may not therefore reflect the knowledge or capabilities of the individual or handful of individuals responsible for negotiations. Indeed, it may serve to measure how constrained these individuals are within a system of bureaucratic checks and balances. A higher score on this measure could mean that tax treaty policy-making is undertaken by specialist civil servants with greater technical knowledge and thus less beholden to the whims of 'boundedly rational' non-specialists, especially politicians. In an ideal world, it would be better to construct a bespoke indicator based on the number, years of experience and specialist training of such specialist staff, but in the meantime, the general indicator has been included in all models.

⁵'Total government revenue, excluding grants and social contributions'.

⁶'Total income and profit taxes on corporations, including taxes on resource firms'. This includes domestic as well as foreign-owned firms. It would have been preferable to include capital gains taxes, the other main corporate tax regulated by tax treaties, within this analysis, but the ICTD Government Revenue Dataset does not provide such a figure for companies separately from that for individuals. The dataset also does not specify whether WHT is included within the measure of taxes on corporations. Indicative examinations of some developing country budget data by the author suggest that WHT is rarely given as a separate line and that WHT where it is the measure often includes all WHTs, whether levied on individuals and companies, domestic or foreign.

Including these new variables in the sample significantly reduces the number of available observations, from 289 226 in column 2 to 18 357 in column 3 of Table 1. Despite this, most of the coefficients in the subsample column 3 stay at a similar magnitude, sign and significance, with the notable exception of export product similarity (one of the spatial legs measuring competition), whose sign changes in the subsample. This would mean that countries are less sensitive to tax treaty-based competition when the competitor exports more similar products to them, which is a counterintuitive result, but this variable also becomes non-significant when its sign changes in the subsample. The sample with all variables included is less than 10 per cent of the size of that without, and some bias may have been introduced. Only treaties signed by developing countries are included, for a start. One other change is that the mean number of treaties concluded in the past and the number of observations in which a new treaty is signed are both higher for the sample with fiscal data. This in part reflects the later time period, the fiscal and quality data running from 1984 rather than 1969 as in the original sample. In sum, in the (more recent) years for which data are available, developing countries for which fiscal and bureaucratic quality data are available (and their treaty partners) have more tax treaties, as well as appearing not to be susceptible to competition on the basis of export product similarity.

5.2 Results

The revenue/GDP ratio does not have a significant effect on the likelihood of signing a treaty (column 4), but the share of corporation tax in total revenue (column 5) has a significant and positive effect. This is the opposite result to that inferred from H_{1A} and H_{1B} . Countries that depend more on corporation tax are more likely to sign tax treaties, but countries with more revenue overall are no more likely to do so. One possible explanation is that the measure of corporate tax as a share of total revenue is positively associated with the effective tax rate incurred by investors. Where this is the case, the dyadic data here may reflect pressure from investors from the capital exporting country who wish it to obtain a treaty with the developing country in order to reduce their effective tax rates. Bureaucratic quality does not have any effect on the likelihood of signing a treaty in these models.

6 EFFECT OF TAX PERFORMANCE ON NEGOTIATED CONTENT OF TREATIES

6.1 Data and Methods

6.1.1 *Dependent variables*

The starting point for this second replication is Rixen and Schwarz's (2009) study of German tax treaties. The study included 45 German treaties for which investment data were available and measured the determinants of several treaty provisions. In the first specification, the dependent variable was the WHT rate, with dummies added for the type of WHT such that each treaty constituted four or five observations (depending on whether the treaty included different WHTs for certain dividends). In the second specification, the minimum number of months for a construction site to count as a PE was used as the dependent variable. The study found a positive relationship between FDI asymmetry and WHT rates, suggesting that the capital importer adopts a tougher negotiating stance when

the fiscal cost is higher. They also tested the effect of FDI asymmetry on the PE definition but found only a weak effect. This could be because they used only one aspect of the PE definition, the number of months' presence required for a construction site to become taxable.

For this replication, the model to be tested is as follows:

$$\tau_{ij} = \beta X_{ij} + \gamma Y_i + \varepsilon.$$

In this model, τ_{ij} is the dependent variable, representing the value of a composite index expressing the balance between source and residence taxation in the treaty between developing country i and its treaty partner j . Four different specifications are used, one for each of the four indices discussed in the following. On the right hand side of the equation, X_{ij} is a set of variables describing properties of the dyad, while the variables represented by Y_i apply only to the developing country in the dyad, as defined in Hearson (2016). The stochastic element of the model is represented by ε .

Rather than a direct replication, this is a slightly different model and a very different dataset to that used by Rixen and Schwarz. One reason for this is that the overlap between German tax treaties and countries for which the other data were available in the relevant years was very small. In particular, the dependent variables are drawn from Hearson (2016). This includes 519 tax treaties signed by low and lower middle-income countries in sub-Saharan Africa and Asia. In contrast, most of the 45 treaties in Rixen and Schwarz's dataset were between Germany and developed countries, and only one treaty, between Germany and Pakistan, appears in both datasets.

Another difference is the way in which the relevant content of the treaty is included within the dependent variable. Rixen and Schwarz included each type of WHT rate specified by a treaty as separate observations within their model, with a dummy for the type of WHT. A separate specification tested the minimum length of time for a building site PE. In contrast, the approach in this paper uses the indices developed in Hearson (2016). These include a much wider set of 24 tax treaty provisions with a distributional impact that can vary in individual negotiations. Each of these variations has been coded between zero and one, where one means a provision through which the developing country retains more of its ('source') taxing rights, and zero a provision through which it retains less ('residence' taxation). Aggregate indices are then calculated as follows:

$$\tau_{ij} = \frac{\sum_1^k \pi_{ij}}{k}.$$

In this calculation, τ_{ij} is the index value for the treaty between i and j , calculated as the sum of the coded values for the individual provisions that form the index in the treaty π_{ij} , divided by the number of provisions included in the index k . This gives an average value between 0 and 1 for the clauses included within each index. A higher value in an index means a negotiation in which the developing country has accepted fewer restrictions on its tax base, across the provisions included within that index.

Four different indices are used as dependent variables here. The treaty provisions included within each index are specified in Table 2, and descriptive statistics for the index values within the sample are included in Table A2. The overall 'source index' incorporates all 24 provisions⁷ and gives a general overview of how much the developing country retains its taxing rights in the treaty. Three sub-indices are also used here. The first includes only the WHT rates, including in

⁷Articles 5(3)(b) and 12A are included twice, as binary and continuous variables.

Table 2. Construction of indices of treaty content

Index inclusion	Article number in the UN model tax treaty	Description
PE index & Overall source index	5(3)(a)	PE definition: construction PE length in months
	5(3)(a)	PE definition: supervisory activities associated with construction
	5(3)(b)	PE definition: service PE included
	5(3)(b)	PE definition: service PE length in months
	5(4)(a)	PE definition: delivery exception to PE
	5(4)(b)	PE definition: delivery exception to PE
	5(5)(b)	PE definition: stock agent PE
	5(6) 5(7)	PE definition: insurance PE PE definition: dependent agent extension
WHT rates index & Overall source index	10(2)(a)	WHT rate: qualifying [FDI] dividend WHT in %
	10(2)(b)	WHT rate: other [portfolio] dividend WHT in %
	11(2)	WHT rate: interest WHT in %
	12(2)	WHT rate: royalties WHT in %
	12A(2)	WHT rate: management or technical fees rate
	12A	Management or technical fees included
Overall source index only	12(3)	Royalty definition: films or tapes used for radio or television broadcasting
	12(3)	Royalty definition: industrial, commercial or scientific equipment
'Other' index & Overall source index	7(1)	Limited force of attraction
	7(3)	No deduction for payments to head office
	8(2)	Source shipping right as a %
	13(4)	Source capital gains on 'Land rich' company
	13(5)	Source capital gains on shares other than those covered by 13
	16(2)	Source taxation of earnings by top-level managerial officials
	18(2)	Shared taxation of pensions
	18(2/3) 21(3)	Source taxation of social security pensions Source taxation of other income

Source: Hearson (2016)

each single observation the average of four of the values used by Rixen and Schwarz (2009), plus an additional one, service fees. The PE index aggregates nine entries, only one of which is the length of time for a construction site used by Rixen and Schwarz (2009). Finally, the 'Other' index includes provisions from other articles of the treaty.

6.1.2 Explanatory variables

The same tax variables as in the first replication are used. If developing countries with a larger tax base are more likely to give it away (H_{2A}), the coefficient of revenue/GDP should be positive. If developing countries that depend on corporate tax are less likely to give it away (H_{2B}), the coefficient of revenue/CIT should be negative. These relationships should

differ for the overall source index, the more easily understood WHT index and the indexes measuring parts of the treaty that are more technically obscure, PE and 'Other'. Because of the limited coverage of the fiscal data and the bilateral FDI data, these variables cannot be included in the same model, as would be necessary for a full replication of Rixen and Schwarz's study, while retaining sufficient observations to draw meaningful conclusions.

To measure the effect of power on the negotiated outcome, following Rixen and Schwarz (2009), I use the ratio of countries' capabilities, based on the Correlates of War project's Composite Index of National Capability (version 5.0), which incorporates military expenditure, industrial production and population size variables (Singer, Bremer, & Stuckey, 1972). To obtain the ratio, the capability of the capital exporter is divided by the sum of the two countries' capabilities. A higher value of this ratio means that the capital exporting country has more capabilities relative to the capital importer. If power is a factor in negotiations (H_3), the coefficient of this variable should be negative, meaning that the treaty restricts the developing country's taxing rights more when it is less powerful relative to the treaty partner.

To measure the effect of investment asymmetries on negotiations, bilateral data on FDI stocks are taken from the IMF's Coordinated Direct Investment Survey (IMF, 2014b). As with capabilities, the FDI asymmetry is calculated as the stock of FDI from the treaty partner in the developing country, divided by the sum of bilateral FDI stocks. Where different values are reported by the two countries, the mean of the FDI stocks in each direction is used to calculate the ratio. The Coordinated Direct Investment Survey is the best available source of bilateral FDI data, but it only covers recent years. The figures used here are for 2012, the year with the best coverage, regardless of the year of signature.⁸ Following Rixen and Schwarz (2009), the coefficient of this variable should be positive, meaning that developing countries are more concerned to retain more of their taxing rights over inward investment in treaties where they are overwhelmingly net importers of capital (H_4).

To assess the effect of learning on developing countries' negotiations, the total number of treaties already signed by the developing country, taken from Hearson (2016), was used. If developing countries become tougher negotiators as their experience of negotiation grows, this variable should have a positive coefficient (H_5). Other explanatory variables included are the year of signature, region of the developing country (0 if Asia, 1 if Africa) and whether or not the treaty partner is an OECD member. All of these variables are shown in Hearson (2016) to have affected the negotiated content of tax treaties. In addition, bureaucratic capacity was again included.

6.2 Results

Table 3 gives the results of twelve different specifications. Four different dependent variables were used: the overall source index, and the three sub-indices for WHT rates, PE and other provisions. Each of these were tested in specifications that included the share of bilateral FDI stocks that are received by the developing country ('FDI share') and two fiscal variables: Revenue/GDP ratio and CIT/Revenue ratio.

In columns 1 to 4, there is a highly significant positive association between the size of the overall tax base and both the overall source index (column 1) and the PE definition (column 3) in the treaty, as well as a weaker association with the Other index (column

⁸An alternative would be to use data on FDI stocks reported by OECD countries in the year of signature, and these data were used in a robustness test, not reported here, with no difference to the overall result.

Table 3. results for second regression: determinants of treaty content

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Source Index	WHT rates index	PE index	'Other' index	Source Index	WHT rates index	PE index	'Other' index	Source Index	WHT rates index	PE index	'Other' index
Revenue/GDP	0.404**	-0.0439	0.988***	0.708**								
CIT/Revenue					0.118	0.217*	0.0210	0.0229				
FDI asymmetry					-0.146***	-0.0257	-0.333***	-0.177**	-0.0702*	-0.0132	-0.195**	-0.0366
Capability	-0.0982***	-0.0152	-0.256***	-0.0945					0.0527	0.0429	0.0807	0.0545
asymmetry												
Learning	0.00228**	0.00239***	-0.00149	0.00625***	0.00635***	0.00315**	0.00369	0.0147***	0.00329***	0.00216**	0.00339	0.00589***
Bureaucratic	0.0254	0.0193	0.0692	-0.0169	0.0151	-0.00216	0.122	-0.0407	-0.00268	0.0238	-0.00737	-0.0556
quality												
Developing country	0.000101	-0.00622***	0.0135**	-0.00448	-0.0115**	-0.00952***	0.00346	-0.0280***	-0.00326*	-0.000618***	-5.43e-05	-0.00131
Africa region												
Treaty partner	-0.0418**	-0.00611	-0.0972**	-0.0415	-0.0696***	-0.0401**	-0.108*	-0.0479	-0.130***	-0.0314	-0.244***	-0.154***
OECD member												
Year of signature	-0.0536	-0.00364	-0.181**	0.000245	0.00852	0.0110	-0.0881	0.125	-0.00868	0.0191	-0.0315	-0.0529
Constant	0.124	12.67***	-26.60**	9.172	23.40**	19.27***	-6.373	56.25***	6.971*	12.58***	0.834	3.060
Observations	157	157	157	157	92	92	92	92	103	103	103	103
R-squared	0.347	0.243	0.281	0.273	0.431	0.298	0.296	0.381	0.348	0.220	0.317	0.280

Note:

*p<0.1,

**p<0.05, and

***p<0.01. Source: Author's own calculations.

4). In contrast to H_{2A} , countries with a larger tax base are also those most likely to protect its negotiations. Furthermore, these are all measures that might be affected by the government's technical negotiating capacity, because they are predominantly composed of more technically obscure components of tax treaties, which would be less salient to negotiators with less technical expertise. In contrast, there is no effect for WHT rates, despite them being the easiest part of the negotiated settlement to understand at a glance. Based on the coefficient of 0.988, an increase in the revenue/GDP ratio of 0.076 (one standard deviation) corresponds to an increase in the PE index of 0.075. Because the index comprises nine clauses, this corresponds to approximately 0.7 more clauses protecting source taxation. This outcome is unexpected. It could be that a higher revenue/GDP is attributable to a better technical capacity (in a way not captured by the non-significant bureaucratic capacity variable) or that it reflects bargaining strength, both of which may lead to increased negotiating capabilities.

The corporate tax dependence variable in columns 5 to 8 appears to act only on WHT rates (column 6), and the effect is only significant at the 10 per cent level. Countries that depend more on corporate tax as a share of total revenue therefore appear to retain more taxing rights with respect to WHT rates, consistent with H_{2B} . (It is hard to give an interpretation of this coefficient because the WHT index is an amalgamation of several continuous variables). This would seem to support the rationalist negotiating model, as employed by Rixen and Schwarz (2009), that when countries stand to lose more from tax treaties, they retain more source taxing rights. Because a larger dependence on corporate tax also increases the likelihood of signing a treaty overall, however, one interpretation is that countries that depend more on corporate tax revenue are susceptible to certain incomplete ideas about tax treaties: that signing them provides net benefits, provided the country negotiates firmly on the easily understood WHT provisions. Expressed simply, these countries may believe they have negotiated good deals, as they have obtained good results on WHT rates; the overall Source index reveals, however, that they did not obtain a significantly better settlement once the less salient parts of the treaty are taken into account.

Turning to the other explanatory variables, there is a negative relationship between the FDI asymmetry (columns 9 to 12) and the overall source index (column 9) and a more significant one for the PE definition (column 11). A more imbalanced FDI relationship means a greater cost to the developing country of restrictions on its source taxing rights. Yet this result suggests that developing countries give away more taxing rights in precisely those situations where the cost of doing so is greater, the opposite of H_4 . Concretely, a change in the ratio of FDI stocks between the two countries in the dyad from 0.5 (perfectly symmetrical FDI stocks) to 1.0 (perfectly asymmetrical FDI stocks) would lead to a reduction in the PE index of 0.10. This corresponds to approximately one less clause that protects the developing country's taxing rights. This is the opposite to Rixen and Schwarz's (2009) finding that net capital importing countries retained more of their taxing rights in WHT rate clauses, and to a lesser extent in PE clauses, when the FDI relationship was more imbalanced.

There is also a negative and significant effect of the capability asymmetry on the PE and Other indices in several specifications, except where FDI asymmetry is included. This seems to add weight to a power-based hypothesis (H_3): the FDI and capability asymmetries are moderately correlated (0.31), and both could be measuring economic power. Rixen and Schwarz (2009) found no significant effect for the capability asymmetry on WHT rates or PE lengths. The different conclusions between this study and Rixen and Schwarz (2009) for both FDI and capability could result from either the different specification, larger sample size or sample composition. The latter seems quite likely: power may be a more

important factor in negotiations with developing countries, and the power asymmetries are greater in the treaties studied here than those in the earlier study, which included few developing country treaties.

The ‘learning’ variable is consistently positive throughout most specifications (H_5). In particular, it has a significant and positive effect on the ‘other’ provisions index, which suggests that the learning effect is most relevant to these more obscure provisions of the treaty. The coefficient of the learning variable on the ‘other’ dependent variable ranges from 0.006 to 0.015 in the different specifications. This means that after a country has signed 16 more treaties (the standard deviation), the ‘other’ index will be between 0.096 and 0.240 higher. Because the ‘other’ index is made up of nine clauses, this corresponds to between one and two additional clauses that retain the developing country’s taxing rights.

7 CONCLUSIONS

This paper has replicated two studies of tax treaty negotiation outcomes, integrating fiscal and tax treaty content data. The findings add further nuance to our understanding of developing countries’ decision-making over tax treaty negotiations and, in some cases, challenge the results of these previous studies. First, Barthel and Neumayer’s (2012) study of the determinants of tax treaty formation was replicated, adding in fiscal data from Prichard et al. (2014) for the less wealthy country in each potential treaty-signing dyad. Second, Rixen and Schwarz’s (2009) study of the determinants of tax treaty content was replicated, using the more comprehensive view of treaty content from Hearson (2016), combined again with the fiscal data. As a replication study, the aim was not to make significant changes to the models or design new ones but rather to improve on published studies by introducing these new data.

Combining the results, we can tell the following story. Developing countries that depend more on corporate income tax are more likely to sign tax treaties with wealthier countries and more likely to negotiate higher WHT rates in those treaties, but no more likely to obtain better results overall. Because WHT rates are the most prominent parts of tax treaties to non-specialists, this supports a ‘salience’ argument derived from the bounded rationality literature: policy makers in countries that depend more on corporate tax are willing to support a policy of signing tax treaties, so long as higher WHT rates are negotiated, while ignoring other, less easily understood parts of the treaty.

In contrast, developing countries that raise more tax revenue overall are more likely to negotiate better PE clauses, an area that is less easily understood by non-specialists, as well as a better overall balance across all provisions of the treaty. Greater tax revenue overall is thus associated with better negotiation, but it does not make a country more or less likely to sign tax treaties. Furthermore, the more obscure clauses are less likely to be favourable to developing countries when the FDI relationship between the two countries is more one-sided, with the developing country more of a net importer of capital from the treaty partner. This is the opposite of Rixen and Schwarz’s (2009) finding, which was that the negotiated content of tax treaties reflects a rational compromise between the two signatories, which protects the revenue base of the capital importer more when it has more to lose. This could be because the higher tax/GDP and smaller FDI asymmetry translates into greater bargaining strength in negotiations. A measure of bureaucratic quality was introduced as a (necessarily imperfect) proxy for technical negotiating capacity but did not have a

significant effect on the results. The contradiction with Rixen and Schwarz's (2009) findings could also indicate that power asymmetries play a role in negotiations between developed and developing countries, as in the sample used here, but not in negotiations between more developed countries, as in the sample used in the 2009 study.

Finally, there is a significant and consistent learning effect across most of the specifications in the second replication: the more treaties a country has signed, the better negotiated outcomes it obtains, across all types of provision except the PE clauses. This applies both to the more salient, easier to understand WHT rates, and to the more technically obscure provisions in the 'Other' index. Negotiators may have gained more technical knowledge leading to a greater appreciation of the less salient parts of the treaty, or experience and skills that improved their ability to obtain positive results in negotiations. Other actors may also have gained a greater interest in the outcome of negotiations having seen the application of existing treaties in practice. Taken together with the other results, this suggests that the decision to negotiate and the eventual negotiated content are a function of power and knowledge-based variables, such as how salient the losses from the treaty are to policy makers in a country, the knowledge and experience of negotiators, as well as relative bargaining power. This makes a strong case for developing countries to revisit their existing treaty networks as their understanding of their fiscal costs grows.

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ANNEX

Table A1. Descriptive statistics for first replication

	Full sample					Sample with fiscal and quality data available				
	Observations	Mean	Std. Dev	Min	Max	Observations	Mean	Std. Dev	Min	Max
BTT signed	289 226	0.006	0.08	0	1	18 357	0.019	0.137	0	1
Revenue/GDP ratio (t-1)						18 357	0.230	0.068	0.112	0.498
CIT/Revenue ratio (t-1)						18 357	0.139	0.104	0.023	0.879
Bureaucratic quality						18 357	1.768	0.880	0	4
Common region (product) (t-1)	289 226	0.064	0.108	0	1	18 357	0.119	0.166	0	1
Export product similarity (sum) (t-1)	289 226	0.12	0.055	0.012	0.253	18 357	0.156	0.037	0.030	0.249
Product of populations (ln)	289 226	31.52	2.421	21.9	41.53	18 357	31.969	2.443	25.707	39,664
Product of GDPs per capita (ln)	289 226	15.13	2.155	9.37	22.34	18 357	16.250	1.842	10.341	20,910
Bilateral trade (ln, t-1)	289 226	10.29	7.48	0	25.24	18 357	12.661	6.878	0.000	25,046
Product of openness to trade	289 226	6245	5457	65.34	108 338	18 357	8361	6245	247	69 796
Bilateral Investment Treaty	289 226	0.056	0.231	0	1	18 357	0.131	0.337	0	1
Regional Trade Agreement	289 226	0.093	0.291	0	1	18 357	0.128	0.334	0	1
Offshore Financial Centre	289 226	0.228	0.419	0	1	18 357	0.271	0.444	0	1
Diplomatic representation	289 226	0.274	0.446	0	1	18 357	0.313	0.464	0	1
Distance (ln)	289 226	8.792	0.696	4.54	9.90	18 357	8.858	0.692	4.910	9.884
Product of political constraints	289 226	0.125	0.186	0	0.786	18 357	0.214	0.219	0.000	0.694
OECD-OECD dyad ⁹	289 226	0.007	0.081	0	1	18 357	0.000	0.000	0	0
OECD-non-OECD dyad	289 226	0.248	0.432	0	1	18 357	0.243	0.429	0	1
Min. years of independence	289 226	39.71	17.59	2	87	18 357	49.442	19.868	5	87
Max. number of BTT (t)	289 226	29.91	27.14	0	126	18 357	43.529	24.562	0	126
Cumulative BTTs, country i (t-1)	289 226	17.62	24.04	0	126	18 357	28.569	25.886	0	126
Cumulative BTTs, country j (t-1)	289 226	17.8	23.58	0	126	18 357	27.925	24.318	0	126

Source: Author's own calculations.

⁹There are no OECD-OECD dyad in the fiscal data dataset, which includes only dyads where one country is a developing country.

Table A2. Descriptive statistics for second replication

Variable	Observations	Mean	Std. Dev.	Min	Max
Source index	537	0.420	0.136	0.090	0.760
WHT rates index	537	0.322	0.117	0	0.8
PE index	537	0.533	0.269	0.030	0.970
'Other' index	537	0.377	0.231	0	1
Revenue/GDP	176	0.194	0.076	0.046	0.545
CIT/Revenue	103	0.168	0.093	0.025	0.391
FDI asymmetry	138	0.776	0.290	0.000	1.000
Capability asymmetry	524	0.607	0.326	0.000	1.000
Learning	520	15.840	15.559	0	63
Bureaucratic quality	395	1.746	0.677	0	3
Year of signature	537	1996.410	11.530	1970	2014
Treaty partner OECD member	537	0.453	0.498	0	1
Developing country Africa region	537	0.389	0.488	0	1

Source: Author's own calculations.

SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.