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Bilateral Tax Competition and Regional Spillovers in Tax Treaty Formation

By Kunka Petkova[*], Andrzej Stasio[†] and Martin Zagler[‡§]

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Tax treaties are often seen as a means to mitigate fierce tax competition. We challenge this view by arguing that taxes on passive income reduce effective average tax rates, and induce neighbouring countries to react by reducing bilateral tax rates. As opposed to traditional tax competition, where every foreign investor would benefit from lower tax rates, we show that countries also engage in cutting tax rates for investors from a particular country, leaving taxes for everyone else unaffected. We call this bilateral tax competition, and we test these predictions empirically. We focus on the four treaty withholding tax rates on passive income - portfolio dividends, participation dividends, interest, and royalties - and collect these rates for 3,000 tax treaties and amending protocols signed between 1930 and 2012. We find a positive relationship in the negotiated withholding tax rates of a destination country's tax treaty and destination country competitors' past tax treaties with the same source country. This relationship is strongest for the tax rates on interest and royalties, and varies from an average elasticity between 0.19 and 0.36 with both source and destination country being an OECD member, and an average elasticity up to 0.64 when both countries are tax havens.

JEL: F50, F53, F68, H29, H39

Keywords: tax competition, international taxation, double taxation treaties, tax treaty formation

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1. Introduction

Tax treaties are often seen as a means to mitigate fierce tax competition. Building on existing literature, we challenge this view by demonstrating, in a theoretical framework, how withholding taxes on passive income reduce effective average tax rates between two countries, and how this will induce a reaction of competing countries, who in turn will reduce their withholding tax rates. Next, we test these theoretical predictions empirically. We focus on the four distinct treaty withholding tax rates on passive income - portfolio dividends, participation dividends, interest and royalties - and collect these rates for nearly 3,000 tax treaties and amending protocols signed between 1930 and 2012. We find a positive relationship in the negotiated withholding tax rates of a destination country's tax treaty and destination country's competitor's past tax treaties with the same source country. This relationship is strongest for the withholding tax rates on interest and on royalties. We show that this effect is strongest for developing countries, whereas the impact of existing treaties with tax havens is surprisingly limited.

Traditionally, double tax treaties have been serving as an important policy tool to promote international economic activity by preventing international double taxation. Despite their long history, the economic consequences of DTTs remain inconclusive (Blonigen and Davies, 2004; Egger et al., 2006; Neumayer, 2007). However, over the years, DTTs have come to pursue additional goals such as providing legal certainty, preventing tax discrimination in the state of investment and exchange of information for tax matters. Most recently, DTTs serve to mitigate tax avoidance practices and protect domestic tax base.

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§ The authors jointly declare to (i) have no competing interests; (ii) that all authors have contributed in equal amount to the design of the study; the collection, analysis and interpretation of the data; and the writing of the article; (iii) that all authors approve the submitted version of the article; and (iv) that none of the sources that provided financial support for this research had any involvement in the conduct of the study, and - in particular - in the design of the study; in the collection, analysis and interpretation of the data; in the writing of the article; and in the decision to submit the article for publication.

Against these different goals, Ligthart, Vlachaki and Voget (2011) empirically study the determinants of DTT formation for a large sample of more than 17,000 country pairs covering the 1950 - 2006 period. Using a gravity framework, they conclude that countries sign DTTs primarily to reduce international double taxation and, to a lesser extent, to provide a legal instrument for the exchange of information in tax matters. In support of this finding, Davies (2003*a*,*b*), argues that the main role of DTTs lies in the harmonisation and the lowering of withholding tax rates on international capital income. OECD countries are encouraged to conclude a double tax convention for limiting the exercise of taxing powers by the destination state. Reciprocity in flows of income and capital is expected to level out any potential loss of taxing powers between such states.

Yet, many researchers argue that double taxation will often be prevented unilaterally (Rixen and Schwarz, 2009). Moreover, with an asymmetric investment position, the lowering of withholding tax rates in treaties using the ordinary credit method leads to a revenue transfer from the net capital importer to the net capital exporter (Rixen and Schwarz, 2009).

Chisik and Davies (2004*a*) discuss how these distributional implications can affect withholding taxes in the framework of tax treaty bargaining. They predict that more asymmetric countries will conclude treaties with higher withholding tax rates. This theory is then tested using data on U.S. and OECD bilateral tax treaties, and the results broadly support their predictions. Rixen and Schwarz (2009) confirm this finding using data on German tax treaties and show that these conclusions also hold for the definition of permanent establishment measured as the minimum number of months necessary to qualify as a "construction permanent establishment". Nevertheless, all of the aforementioned studies view tax treaty negotiations as an exclusively bilateral outcome.

This contrasts with the recent research that postulates the notion that tax treaties are not merely bilateral, but rather part of a global network. van't Riet and Lejour (2018) and Hong (2018) show how the international FDI flows can be partially explained by countries' centrality in the tax treaty network. Petkova, Stasio and Zagler (2019) argue

that the impact of DTTs on FDI depends on their relevance vis-á-vis the domestic law of the signatory states and all other treaties in the network.

A noticeable exception in this context has been presented by Barthel and Neumayer (2012), who analyse spatial diffusion in tax treaty formation. They show that the probability of two countries entering into a DTT increases with specific *source* and *target contagion*. In other words, the likelihood of two countries signing a tax treaty raises with the source country's peers having a tax treaty with a given target (destination) country and, conversely, target (destination) country's peers having a tax treaty with the specific source country. Nonetheless, their analysis is limited to countries' decision to enter into a DTT and does not extend to the negotiated treaty conditions.

This paper complements the previous literature by studying tax treaty bargaining in a global network of tax treaties. We build on the work of Devereux and Griffith (1999, 2003) and show in a theoretical framework (see Appendix) how withholding tax rates on passive income attribute to lower average effective tax rates. Next, we derive countries' best reaction functions and show a positive relationship between the withholding tax rates concluded between a given source and destination state, and between destination country's peers and the same source state.

We then test these predictions empirically. We focus on the four treaty withholding tax rates on passive income - portfolio dividends, participation dividends, interest and royalties - and analyse the predicted patterns of tax competition in a spatial econometric framework. While the spatial lag of the dependent variable would normally suffer from endogeneity, we leverage on the time dimension of treaty formation to mitigate these concerns. In particular, we resort to a space-time regression model, and regress the negotiated withholding tax rate in the year of treaty conclusion on the spatially lagged withholding tax rates from competing tax treaties two years before the observed tax treaty came into force.

We find a positive relationship in the negotiated withholding tax rates of a destination country's tax treaty and destination country's competitor's past tax treaties with the same source country. This relationship is strongest for the withholding tax rates on interest and

on royalties. The estimated elasticities range from a modest 0.05 in the case of portfolio dividends to 0.19 in the case of royalties. Despite being lower than the results reported in some related literature, our results remain comparable when the setting is closer to ours. In particular, our results exclude common trends in the previously negotiated withholding tax rates and are robust to interdependence in tax treaty rates, unobservable treaty characteristics, source-country, destination-country, year, source- and destination-region-year fixed effects, sample selection and model specifications testing for alternative definitions of our key explanatory variable.

In extension of our main analysis, we analyse the heterogeneous effects among three groups of countries, i.e. OECD members, developing countries and tax havens. We note that the effect is strongest for destination countries that are developing countries, regardless of the source country status; when both source and destination country are OECD members; or when both countries are tax havens. The elasticities range between 0.28 and 0.36 for royalties, and 0.64 for interest. In contrast, existing treaties with tax havens matter little.

Further, we validate our results addressing sample selection, potential endogeneity concerns, and a wide range of alternative weight matrixes defining the competitive relationship between destination countries, including re-sampling with placebo geographical locations.

Our paper contributes to various strands of research. First, we challenge the established notion that double tax treaties are a means to mitigate tax competition. We present a contrasting view arguing that tax treaties are a tool of bilateral tax competition and present empirical findings in support of our theoretical predictions. We show how international tax competition reaches further than statutory and effective corporate tax rates and materialises through withholding tax rates on passive income.

Second, where the existing literature views tax treaty bargaining merely as a bilateral process, we study the spatial spillovers that affect the negotiated outcome. In particular, treaty signatories will be restricted in their rate-setting capacity by the previously concluded competing tax treaties in their geographical region. By doing so, we demonstrate

that spillover effects in international taxation extend beyond treaty shopping and profit shifting, and exert pressure on domestic treaty policy.

Third, we add to the theoretical work of Chisik and Davies (2004*b*) and the broad literature on the political economy of international institutions. Chisik and Davies (2004*b*) argue that the magnitude of the initial tax reductions under a tax treaty - as compared to the non-treaty case - depends on the extent of irreversibility of FDI. When the initial set of treaty rates is not self-enforcing, more modest tax reductions generate an increase in irreversible bilateral FDI so that further tax reductions become self-enforcing. We complement their work by examining theoretically and empirically the initial choice of the treaty withholding tax rate. Put differently, the competitive scope of treaty bargaining can be seen as limited by the extent of irreversibility and asymmetry of FDI.

To our knowledge, this is also the first work to study tax competition in a truly global sample of countries. This enables us to explore the rich heterogeneity among different groups of countries and various spillover channels.

The remainder of the paper is structured as follows: section 2 summarises the existing literature on international tax competition and motivates our hypothesis; section 3 discusses our sample and empirical methodology; we present our main results in section 4, extensions in section 5 and several robustness tests in section 6. The paper concludes discussing its policy implications in section 7. A formal model for our hypothesis is derived in the Appendix.

2. Bilateral tax competition and tax treaty formation

The small open economy models of tax competition assume a large number of identical countries that are not able to influence the world interest rate (Zodrow and Mieszkowski, 1986; Wilson, 1986). These models can be seen as a game similar to a Bertrand competition, whose result corresponds to the perfect competition case. Assuming a fixed and perfectly mobile world capital stock, the strategic interaction between the individual countries leads to a race-to-the-bottom and the tendency to abandon capital taxes. In contrast, Wildasin

(1988) and Hoyt (1991) discuss models with only on a small number of countries. They find rate setting behaviour leading to higher tax rates, as each country has a higher market power.

Recent literature documents empirical findings in support of international tax competition and strategic interactions between corporate tax rates. Egger, Pfaffermayr and Winner (2007) find a positive reaction function for both corporate and personal income tax rates in a panel of 30 OECD countries between 1985 and 2005.

Devereux, Lockwood and Redoano (2008) develop a model, in which firms choose where to locate their capital in response to effective marginal tax rates, and simultaneously allocate their profit following the differences in statutory tax rate. The authors find evidence of strategic competition over both measures utilising data from 21 OECD countries between 1982 and 1999. Davies and Voget (2008) analyse how a given country weights the taxes of others when choosing its own tax. Using market potential of a country as the weight of choice, the authors find robust evidence for tax competition.

Analysing different competitive behaviours, Redoano (2012) finds evidence of fiscal interdependencies consistent with the literature on tax and yardstick competition. Noteworthy, the regression results suggest that for corporate taxes, European countries follow large countries in order to attract capital. Heinemann, Overesch and Rincke (2010) focus not only on the tax-rate-cutting decisions, but also on how these are affected by the tax rates in neighbouring countries. The authors consider 32 European countries, and find that a country is more likely to decrease its corporate tax rate if its own rate is high, while the one by its neighbours is low.

We extend this literature by considering tax competition in destination countries' taxes on corporate income, in particular withholding tax rates on passive income. In a theoretical framework - presented in the Appendix - we resort to the seminal model of Devereux and Griffith (1999, 2003) to indicate how countries can manage the effective average tax rate ($EATR$) through their withholding taxes. Next, we derive destination countries' tax reaction function in the same fashion as Davies and Voget (2008), and show that

withholding tax rates on passive income are indeed strategic complements. This predicts a positive peer effect in the empirical part of our analysis, as measured by the *peer rate* variable.

Building on these theoretical predictions, our paper makes a novel contribution. Traditional tax competition literature posits the idea that countries underbid each others corporate income tax rates in order to attract mobile capital. This is a rather crude measure, as it also reduces corporate income tax rates for investors that already see higher tax rates at home, thus giving them a windfall profit. In contrast, this paper shows empirically that countries (also) engage in a more subtle form of tax competition. Destination countries employ double tax treaties to bilaterally reduce tax rates for foreign investors from a specific source country, leaving tax rates with respect to all other source countries untouched - a policy which we label bilateral tax competition.

3. Data and empirical methodology

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Having derived the slope of destination country's reaction function theoretically (Appendix), we test these predictions empirically. In particular, we estimate a pooled cross-section across all years in our sample in the following form:

$$WHT_{ij,t,k} = \alpha + \rho\omega_j\Omega_{im,t-n} + \beta X_{i,j,t} + \theta_i + \phi_j + \eta_t + \upsilon_{it} + \omega_{jt} + \epsilon \tag{1}$$

where $WHT_{ij,t,k}$ is the negotiated withholding tax rate of type k between source country i and destination country j in year of treaty conclusion t; $\omega_j\Omega_{im,t-n}$ indicates our key explanatory variable, *peer rate* - to be defined below; and $X_{i,t-n}$ is a vector of control variables capturing the bargaining position of source and destination state, such as GDP, GDP per capita and a proxy for both countries' treaty policy. We employ a rich set of fixed effects with θ_i and ϕ_j standing for source, respectively destination-country fixed effects; η_t representing a vector of year dummies; and υ_{it} and ω_{jt} standing for source-region-year,

respectively destination-region-year fixed effects. ϵ is the error term.

Whereas treaty withholding tax rates are available over a long time period once the double tax treaty has been concluded, they are typically constant over time. Thus, while a panel regression may appear desirable, the lack of within-treaty variation over time prevents us from estimating such a model. Instead, for each tax treaty we take a single observation in the year of treaty conclusion t and pool all available observations across time into a single cross-section.

We construct the *peer rate* variable by interacting the spatial weight matrix of destination country j (ω_j) with the matrix of withholding tax rates between source country i and all other potential destination countries $m \neq j$, i.e. Ω_{im}. We define two countries to be spatially connected if they share the same geographical region at the intermediate level according to the UN M49 standard.[1] The following set of examples will illustrate this construct.

Consider Germany as the single source country and the region of South-eastern Asia as the location of the following destination countries: Indonesia, Malaysia, Philippines, Singapore, Thailand and Vietnam. Per Table 1, we can see that the first double tax treaty between Germany and the region of South-eastern Asia is the tax agreement between Germany and Thailand signed in 1967. This treaty provides for a 15% withholding tax rate on royalties. Notice that up to this point, none of the destination countries observes a peer rate among its geographical peers. This is the mechanical consequence of the lack of treaties between Germany and countries in South-eastern Asia prior to 1967.

With the 1967 tax agreement between Germany and Thailand, there is now a single peer rate to compete against for all destination countries, i.e. 15%, except for Thailand itself. Following the spatial econometric literature, we assume that a country cannot be spatially dependent on itself. Therefore, Thailand's withholding tax rate is excluded from Thailand's *peer rate*.

The peer rate remains constant for all destination countries until 1972 when the tax

[1] Intermediate geographical regions are one level above geographical contiguity. Our findings hold also for spatial weight matrixes based on contiguity or sub-global level - one level above intermediate geographical regions.

agreement between Germany and Singapore comes into place. This treaty provides for a 0% withholding tax rate on royalties. Notice how the peer rate changes for each of the destination countries. For Indonesia, Malaysia, Philippines and Vietnam, there are now two withholding tax rates to compete against in their geographical region, the 15% withholding tax rate levied by Thailand; and the 0% withholding tax rate levied by Singapore. Thus, the peer rate takes the simple average of these two values, i.e. 7.5%. This picture differs for Singapore that continues to observe a single peer rate to compete against, i.e,. the 15% withholding tax rate from the Germany - Thailand agreement. Finally, with the Germany - Singapore treaty coming into force, also Thailand observes a single peer rate to compete against, i.e. 0%.

Table 1 documents the development of the peer rates between Germany as the source state and the countries in South-eastern Asia as the destination states until 1994. We also plot the observed peer rates for two selected destination countries, i.e. Vietnam and Singapore, in Figure 1. Here, the withholding tax rates negotiated in each individual tax agreement are represented by the solid dots, with the withholding tax rates negotiated by the selected destination countries depicted with a hollow circle. The solid line plots the peer rate curve. The dashed continuous lines indicate the selected destination countries' tax agreements (withholding tax rates) throughout their time in force. Notice how the peer rate averages with each new tax treaty being added to the region. Yet, the peer rate does not respond to the conclusion of a tax agreement between Germany and Vietnam (upper graph) and Singapore (lower graph). This reflects the fact that the *peer rate* excludes observed destination country's own withholding tax rates.

We complement our example with Figure 2 which reproduces Vietnam's and Singapore's peer rate curves vis-à-vis Germany, and extends the illustration with Thailand's peer rate curve (XY plane). The in-depth continuous lines (ZY plane) represent each individual agreement between Germany and a destination country located in South-eastern Asia, starting with the 1967 tax agreement with Thailand. Notice that none of the plotted agreements between Germany and subsequent destination countries show variation in the

treaty rate over time. This is not different for Indonesia that concludes a new agreement in 1990, which supersedes the previous agreement from 1977. This lack of within-treaty variation over time prevents us from adopting a panel regression as explained above. Instead, each negotiated withholding tax rate comprises a single observation in the year of the tax treaty's conclusion. Thus, in this example, we would have two separate observations for Indonesia - one in 1977 and one 1990 - each with their individual peer rate.

While the *peer rate* variable would normally suffer from endogeneity with respect to the dependent variable (i.e. with respect to itself), we leverage on the time dimension of treaty formation to mitigate these concerns. In particular, we resort to a space-time regression model, and regress the observed withholding tax rate in the year of treaty conclusion t on the value of *peer rate* n years before. In this way, the peer rate can only contain withholding tax rates from tax treaties that have been concluded before the observed withholding tax rate comes into existence. Throughout all of the main results, we estimate our model defining the time lag of the *peer rate* variable with $n = 2$. In our robustness tests, we replicate our analysis also with different values of the time lag.

Resort once again to Table 1. The year 1977 sees two new tax agreements coming into force: Germany - Indonesia and Germany - Malaysia, both providing for a withholding tax rate of 10%. Since both agreements come into force at the same point in time, taking the contemporary value of the peer rate would indeed suggest an effect of both tax treaties on each other. Hence, the independence of individual observations would be violated and OLS estimates would be biased.

In accordance with Anselin (2019), in the absence of temporal correlation, the spatial lag of the dependent variable from a different point in time than the observed dependent variable will be exogenous with respect to that dependent variable. To this end, our empirical approach regresses both observations on each destination countries' individual peer rates, 2 years before the year of treaty conclusion. Here, the peer rate takes the value of 7.5% in 1975 for both Indonesia and Malaysia. In this way, the OLS estimates will not be biased, and there is no need to resort maximum likelihood in estimating the model.

Moving to the dimension of our data, we do not make any prior assumptions about the direction of the source-destination relationship of the two signatory countries. While rare, treaty signatories can negotiate asymmetric withholding tax rates, each responding to their own peers' rates with the intended treaty partner. This is the reason every treaty appears twice in our sample, both between source country A and destination country B, as well as between source country B and destination country A. As we are interested in withholding tax rates applied to the repatriation of profits from the source to the destination country, we will only consider competing destination countries' withholding tax rates. Thus, we collect and analyse withholding tax rates for every pair ij and ji.[2]

We estimate our model for the four distinct treaty withholding tax rates on passive income - portfolio dividends, participation dividends, interest and royalties. We collect these rates for nearly 3,000 tax treaties and amending protocols signed between 1930 and 2012. We assume a 100%-owned subsidiary for the rate on participations dividends, and collect interest rates commonly applied on inter-company loans and rates applicable to patent royalties. This set of assumptions ensures that we analyse withholding tax rates that are indeed in a competitive relationship vis-à-vis each other. We collect data on treaties signed, terminated and renegotiated during our time span. In this way, our key explanatory variable will include the withholding tax rates negotiated between the source country and other destination countries that are in force at the time of the signature of the observed tax treaty.

All of our control variables, including GDP and GDP per capita, as well as the indicator of contiguity between countries come from CEPII (Head, Mayer and Ries, 2010). We construct the indicators of common intermediate and sub-geographical regions in accordance with the most recent UN M49 standard.[3] Data on tax treaties and treaty withholding tax

[2] Barthel and Neumayer (2012) discuss the distinction between directed and undirected dyads. Even though we do not model our dyads as directed, we effectively treat them as such, with the *peer rate* variable in this paper corresponding to the *specific target contagion* variable in Barthel and Neumayer (2012).

[3] We construct the source-region-year and destination-region year fixed effects at the same regional level as the *peer rate* variable, i.e. intermediate regions. While we acknowledge that source- and destination-year fixed effects would be more desirable, many countries do not conclude more than a single tax treaty in a given year. Thus, country-year fixed effects would take away most of the variation in our dataset.

rates come from the IBFD Tax Research Platform (*see* Petkova, Stasio and Zagler, 2019).

Our initial choice of the spatial weight matrix is motivated by conclusions drawn from past literature. Redoano (2012) observes that fiscal interactions occur mostly with geographically close countries. Altshuler and Goodspeed (2015) resort to a weighting scheme averaging between geographical neighbours. Ruiz and Gerard (2008) also resort to weights indicating the possible influence of neighbouring countries. In the robustness section, we address a wide range of alternative weighting matrix to assess the extent to which our results are unique to the geographical dimension.

As a proxy for each of the source and destination country tax treaty policy, we use an average withholding tax rate of type k across all previously existing tax treaties of the source and destination country. In this way, our *peer rate* variable measures destination country's response to withholding tax rates negotiated by its peers, conditional on its preferred withholding tax rate. In other words, our key explanatory variable will measure the effect driven by the spatial dimension.[4]

4. Main results

We estimate our model using only control variables in Table 2. This will serve as a benchmark for the estimations including our key variable of interest. We find that the unweighted average rates across all former treaties signed by source and destination countries is a good predictor for the negotiated withholding tax rates on interest and royalties. The negative coefficients on the source and destination country GDP per capita in the case of withholding tax rates on participation dividends (Column 2) and royalties (Column 4) suggest that wealthier countries tend to negotiate lower rates. However, the magnitude of these effects is not large.

We present the full model in Table 3. Our key variable of interest, *peer rate*, is statistically

[4]Ideally, we would like to proxy for source and destination country preferred withholding tax rate through the withholding tax rates levied under both countries' domestic law. Unfortunately, we can obtain these data in a structured format only as of 2005, thereby severely limiting the time span and number of observations in our analysis. In light of these considerations, we decided to proxy for source and destination countries' treaty policy through their past average rates and trace bilateral tax competition over a long period of time.

significant and positive for each type of the withholding tax rate, indicating the presence of tax competition in negotiated withholding tax rates on passive income. The magnitude of the effects shows substantial variation between the four types of withholding tax rates, with elasticities ranging from 0.05 to 0.19.

The *peer rate* effect is a modest 0.5% point decrease in the negotiated withholding tax rate for a 10% points decrease in the peer countries average withholding tax rate in the case of portfolio dividends. This effect is statistically significant only at the 10% level. However, the *peer rate* effect is considerably higher in the case of withholding tax rates on interest and royalties. The estimates indicate a 1.7% point, respectively a 1.9% point decrease in a 10% points decrease in the peer countries average withholding tax rate, almost four times the effect in the case of portfolio dividends. Moreover, both in the case of withholding tax rates on interest and on royalties, the *peer rate* is statistically significance at the 1% level.

Among the control variables, the source-country's average tax rate is no longer significant for any of the four types of withholding tax rates. In contrast, the destination country's average tax rate remains statistically significant and positive for all rates excluding portfolio dividends. Thus, destination countries' tax treaty policy - as proxied by the average withholding tax rate across all of their previously concluded tax treaties - is a relevant determinant of future negotiations on withholding tax rates. Destination countries that achieved higher withholding tax rates in the past, will continue to negotiate higher withholding tax rates. Furthermore, we continue to observe that the negotiated withholding tax rates increase with destination country's GDP, but decrease with its GDP per capita in the case of royalties.

The estimated elasticities are noticeable lower than some of the results presented in related literature on corporate tax rate competition. Devereux, Lockwood and Redoano (2008) find an elasticity of 0.58 once accounted for common trends. Chen, Huang and Regis (2012) find an elasticity of around 0.66, while Crabbé (2013) estimates the tax competition effect to vary between 0.57 and 0.79. However, neither of the last two papers controls for the common trend and both use only a limited set of country fixed effects. In contrast,

our empirical approach controls for the past trend of withholding tax rates and employs a much richer set of fixed effects. Moreover, withholding tax rates are usually less salient than the headline corporate tax rates and in this way may represent a more subtle form of tax competition.

Our estimates are comparable to the ones shown by Cassette and Paty (2008) and Ruiz and Gerard (2008). When accounted for common trends, Cassette and Paty (2008) find a corporate tax rates elasticity of around 0.17 in the case of FDI weights, which are most appropriate in our context. Similarly, Ruiz and Gerard (2008) find an elasticity in corporate tax rates of around 0.2.

Overall, we interpret our results as supporting our theoretical predictions. The estimates strongly support the presence of tax competition in negotiated withholding tax rates on passive income. Destination countries react to other countries' past tax treaties with the same treaty partner by negotiating lower withholding tax rates with the aim of attracting source-country's mobile capital. This effect goes beyond destination-country's treaty policy and is driven by a geographical dimension. A different - though not exclusive - interpretation of these results is that past tax treaties impose a downward pressure on future tax treaties' withholding tax rates. This spillover effect clearly limits the scope for destination countries' individual treaty policy. These results are statistically robust in the presence of a rich set of fixed effects, including source- and destination-country fixed effects; year fixed effects; and source-region-year and destination-region-year fixed effects.

We continue the analysis addressing the possible interdependence between tax treaties' withholding tax rates. It cannot be excluded that when countries negotiate a double taxation agreement, they agree on a set of withholding rates, rather than on each of them individually. To explore this possibility, we replace the four distinct types of withholding tax rates with their average in Table 4, Column (1); and with the minimum of the four rates in Table 4, Column (2).[5] We find results that are in line with the main results presented in Table 3. In both cases, the *peer rate* is highly significant at the 1% level. Yet,

[5]Note that average *peer rate* across the four separate withholding tax rates is different from the source- and destination-country average rates across all of their treaties, but for each type of withholding tax rate separately.

the magnitude of the *peer rate* is on the lower bound and closer to that of portfolio and participation dividends if we use average withholding tax rates (Column (1)). Meanwhile the *peer rate* approaches the average between the lower bound estimates and higher bound estimates (interest and royalties) when using the minimum withholding tax rate (Column 2).

Throughout the main analysis, we assume taxation of participation dividends at the treaty-rate of portfolio dividends, if the former is not negotiated. In Table 4, Column (3) we limit the analysis only to tax treaties that include a negotiated (reduced) withholding tax rate on participation dividends. The results are statistically significant, albeit only at the 10% significance level. However, we note that the sample size drops more than half.

Finally, it is not only possible that countries negotiate a set of withholding tax rates, but negotiate their tax rates conditional on other provisions included in the tax treaty. For instance, destination countries may negotiate more aggressively if the tax treaty includes strong provisions on exchange of information for tax purposes and mutual assistance in tax matters. While further lowering the withholding tax rates, such a treaty could potentially increase destination-countries tax base to profits that would otherwise escape taxation. Since accurate data on other treaty characteristics is not available at this scale, we choose a different approach.

We pool the four separate withholding tax rates on passive income into a single sample. In doing so, our sample now includes four observations for each tax treaty. This allows us to extend our model with a tax-treaty fixed effect. This fixed effect will control for any unobserved heterogeneity in tax treaty characteristics, including the presence, scope and strength of individual provisions; as well as any country-year characteristics. We further adapt our model by including dummies for observations of participation dividends, interest and royalties, and interaction terms between each of them and the *peer rate* variable. Thus, we are able to see the differential effect compared to portfolio dividends.

We note several interesting results (Table 4, Column (4)). First, the dummies for participation dividends, interest and royalties are all negative and statistically significant at

the 1% level indicating that these rates tend to be lower than the withholding tax rates on portfolio dividends. This effect is strongest for participation dividends and interest rates. Second, the *peer rate* variable is still highly significant and positive pointing to statistically robust tax competition in negotiated withholding tax rates on passive income. Interestingly, the interaction terms suggest that there is no additional effect on participation dividends. In contrast, we observe a strong differential effect in the case of interest and royalties, with the sign of the interaction terms suggesting fiercer tax competition on those rates. These results are in line with the higher magnitude of the *peer rate* variable in the case of interest and royalties withholding tax rates in Table 3. Finally, we note that both the source and destination-country average rate across all of their former treaties are now highly significant and much larger in magnitude than before. We interpret these findings as indicating that individual countries' treaty policy extends to all treaty aspects, and countries negotiate their rates conditional on achieving other treaty policy goals.

Next, we re-assess the main effect allowing for a differential effect among tax treaties that supersede an already existing tax treaty between the source and destination country. If destination countries react to tax treaties concluded by their peers by re-negotiating an already existing tax treaty with a given source country, we may expect a stronger tax competition reaction. We present these results in Table 5, Columns (1) - (4). First, we notice that the average effect is marginally higher in the case of portfolio dividends; not statistically significant in the case of participation dividends; and considerably lower in the case of interest and royalties. However, the dummy variable indicating a renegotiated tax treaty suggests that, on average, destination countries renegotiate with lower withholding tax rates than in their original agreements. Note that this effect already excludes any common (downward) trend among previously negotiated treaties over time. Moreover, the interaction term between the dummy variable indicating renegotiated tax treaties and the *peer rate* variable, shows a strong and statistically significant increase in the tax competition elasticity in the case of withholding tax rates on interest and royalties. The estimated effect is now a 3% points decrease in the negotiated royalties withholding tax rate for

a 10% points decrease in the average withholding tax rates in the destination countries' geographical region.

In Table 5, Columns (5) - (8) we focus on the subset of tax treaties that do not follow the OECD Model Tax Convention in the negotiated withholding tax rates. A substantial number of agreements follows the OECD Model that provides for withholding tax rates of 15% in the case of portfolio dividends, 5% in the case of participation dividends, 10% in the case of interest, and 0% in the case of royalties. We proceed as follows: for each type of withholding tax rate, first, we exclude all observations that adopt the rate recommended by the OECD Model Tax Convention; we then recalculate the *peer rate* variable; and finally re-estimate our main model. We find that the *peer rate* variable is no longer statistically significant in the case of portfolio and participation dividends. Yet, we continue to find a statistically significant and positive effect for withholding tax rates on interest and royalties. Thus, our estimates suggest that the main result is not driven by the OECD Model Tax Convention.

5. Extensions

We extend our main analysis in two directions. First, we investigate the heterogeneity in the estimated tax competition elasticities among three distinct groups of countries: OECD countries, developing countries and tax havens. Second, we analyse the network effect of source and destination countries having signed tax treaties with tax havens in their treaty networks.

We add dummy variables to our main model taking the value of unity for OECD source-country, OECD destination-country and OECD country-pair in Table 6, Columns (1) - (4); Columns (5) - (8) extend the model with their individual interaction terms with the *peer rate* variable. We note, somehow surprisingly, that destination countries negotiate slightly higher rates on participation dividends if the source country is an OECD member. One possible reason for this is the generosity of OECD countries when negotiating with

non-OECD members.[6] In contrast, OECD country-pairs agree on lower withholding tax rates on royalties.

Once we account for the different interaction terms, the results suggest that OECD countries tend to negotiate lower withholding tax rates on portfolio dividends, interest and royalties. Moreover, the results suggest that OECD countries drive destination-country tax competition, except for withholding tax rates on royalties, where the average effect of the *peer rate* variable is still significant. This is also reflected by the estimated withholding tax rate elasticities that are higher than in our baseline model. The elasticities are 0.32 in the case of interest and 0.36 in the case of royalties when both the source and destination country are OECD members.

We repeat this exercise for developing countries instead of OECD members in Table 7. We define countries as developing if they are not in the upper-middle or high-income groups according to the World Bank classification. Destination countries tend to conclude higher withholding tax rates on interest and royalties income when the source country is a developing one. However, when both the source and the destination state are developing countries, the negotiated withholding tax rates are lower on portfolio dividends, interest and royalties. Nevertheless, we stress that the magnitude of these effects is small. Somehow surprisingly, the interaction terms point to a fiercer tax competition if the source state is a developing country. More interestingly, we observe a strong differential effect in the case of withholding tax rates on interest and royalties whenever the destination state is a developing country. The estimates elasticities are perhaps lower than in the case of OECD members, but still higher than the baseline model at around 0.28 in the case of royalties.

In contrast to the previous two tables, we see little heteregenous effects in the case of tax havens (Table 8).[7] Neither the dummy for tax haven pairs (note that source and destination tax haven dummies are both absorbed by the fixed effects), nor the interaction terms suggest any differential effect of tax havens countries. The noticeable exception

[6] For example, a closer look at the dataset reveals several cases of primarily Scandinavian countries agreeing on higher destination country withholding tax rates (especially if the destination country is a less developed one), while unilaterally lowering their own withholding tax rates.

[7] We adopt a common tax haven list across the entire time period following Dyreng and Lindsey (2009).

is the strong result on withholding tax rates on interest income when both source and destination state are tax havens. In this single case, we find an elasticity in the negotiated withholding tax rates of more than 0.64. Thus, for a 10% points decrease in the average peer withholding tax rate, the observed destination country would react by decreasing their negotiated withholding tax rate by 6.4% points.

We account for all three groups of countries in Table 9. In particular, we extend the main model with dummies for OECD source and destination states and pairs; developing destination and source countries and pairs; tax haven pairs; and their interaction terms of the *peer rate*. The results confirm the findings from the previous three tables: tax competition in negotiated withholding tax rates is primarily driven by OECD country-pairs (in the case of interest and royalties); and destination states that are developing countries (all types of passive income except participation dividends). In contrast, tax havens are not different from the average effect, except for withholding tax rates on interest income when both states are classified as tax havens.

Our second set of extensions focuses on the network effect of tax haven treaties. We isolate the effect of tax treaties signed between source and destination countries with tax havens other than the observed treaty partner. In particular, we add two dummies to our model taking the value of unity if the source state, respectively the destination state, has concluded a treaty with any tax haven prior to concluding the observed treaty with a given source state in Table 10, Columns (1) - (4), and their interaction terms with the *peer rate* variable in Columns (5) - (8). We note the statistically significant and positive interaction terms on the destination country in the case of interest and royalties and a statistically significant, but negative coefficient on the destination country dummy for participation dividends and royalties income. We interpret these results as suggesting that destination countries that have concluded a treaty with a tax haven prior to the observed treaty are more aggressive, compete fiercer, and negotiate lower withholding tax rates.

In Table 11, we replace the dummy with a variable indicating the numbering of treaties concluded with tax havens in the source-, respectively destination-country's treaty network.

The statistically significant results are now limited to the withholding tax rates on interest and royalties income. We interpret these results in twofold: in line with Table 10, the statistically significant results on the destination country suggest that destination countries that have concluded a treaty with a tax haven prior to the observed treaty are more aggressive, compete fiercer, and negotiate lower withholding tax rates. Moreover, source countries with tax haven-treaties in their network induce fiercer competition for the conduit capital flowing through these countries from the tax havens.

We conclude the second set of extensions by replacing the tax haven treaties network variable with the average withholding tax rate concluded by the source-state, respectively the destination-state in their tax treaties with tax havens - Table 12. The results of the dummies and the interaction terms are again consistent. Destination countries that have higher (lower) negotiated withholding tax rates with tax havens, negotiate higher (lower) withholding tax rates in their observed tax treaties. Simultaneously, the same destination countries compete much fiercer on their negotiated withholding tax rates on portfolio dividends and interest income.

6. Robustness tests

We perform a range of robustness tests in Table 13 to Table 16. First, we address the potential endogeneity due to sample selection in Table 13. Second, we relax one of the main assumptions underlying our empirical model and allow for endogeneity in the *peer rate* variable. We resort to a spatial autoregressive model and estimate the long-run equilibrium elasticity in Table 14. Table 15 and Table 16 present a diversity of regression results alternating the specification of the baseline weight matrix. This allows us both to investigate the dynamic nature of tax competition in withholding tax rates and assess to what extent our results are unique to the chosen geographical level of the analysis.

Since negotiated withholding tax rates are observable only for country-pairs with a signed tax treaty, our sample is subject to sample selection. We verify that this restriction does not bias our results by estimating the Heckman sample selection model (Table 13). We

construct the first stage sample by including all country-pairs with a tax treaty in its year of signature and for the remaining country pairs the observation for the final year in our sample, i.e. 2012. In this way, we allow countries a maximum time to conclude a double taxation agreement. For country pairs with multiple tax treaties, we keep only the most recent one. We satisfy the exclusion restriction by including common language as predictor of tax treaty formation in the first stage, but not as of negotiating withholding tax rates.[8] Once we control for sample selection, we observe highly significant and positive correlations between *peer rate* variable and each of the withholding tax rates. Thus, we are confident that our main results are not driven by sample selection.

Our baseline empirical specification claims the exogeneity of the *peer rate* variable. Indeed, as explained in section 3, in the absence of temporal correlation, the spatial lag of the dependent variable from a different point in time than the observed dependent variable will be exogenous with respect to that dependent variable (Anselin, 2019). However, if countries were perfectly forward-looking in negotiating their double tax treaties, our estimates could potentially suffer from endogeneity of the *peer rate* variable.

We address this problem by estimating a spatial autoregressive model (SAR) throughout the entire time dimension of our dataset (Table 14). Thus, the *peer rate* variable will contain both tax treaties concluded prior to the observed tax treaty as well as after it. We adopt a sample of 4,508 directed country pairs for which we observe all four withholding tax rates. Notice that we are unable to separate out the effect of previously concluded tax treaties. In particular, including a spatial lag of the dependent variable that takes into account only previously concluded agreements creates the problem of missing explanatory variables in the case of the first tax treaties signed by any given combination of the destination country region and the observed source country. By construction, the first tax treaty will have no peer treaty to consider. Thus, our results can be interpreted as the long-run equilibrium elasticity in negotiated withholding tax rates.x

[8] Ligthart, Vlachaki and Voget (2011) show that common language is a strong predictor of two countries signing a tax treaty. We verify that common language does not influence negotiated withholding tax rates by including this variable as an additional regressor in our main model. Indeed, we find no correlation with our dependent variable - results available upon request.

Furthermore, econometric considerations prevent us from including source and destination country average rates. First, both variables operate as spatial lags of the dependent variable themselves, each with its own spatial weight matrix. Yet, models that account for multiple spatial lags of the dependent variable are rare. Second, as with the peer rate variable, we are unable to account for the space-time dimension of both variables without running into the problem of estimating a sample that is a subset of the sample used to create the spatial weighting matrix. For each source and destination country, the first signed tax treaty has a missing prior average. Third, estimating with a simple country average rate across all years, is collinear with our set of country fixed effects. For these reasons, we estimate the spatial lag model with a reduced set of explanatory variables and control for domestic treaty policy through fixed effects.

In line with the spatial econometric literature, we estimate the model by maximum likelihood to account for the endogeneity of the spatial lag of the dependent variable, i.e. *peer rate*. To ensure convergence of the results, we include source and destination country fixed effects and year fixed effects in our model. The results point to tax competition in withholding tax rates that is significant at the 1% level for each of the withholding tax rate types. Moreover, the estimated effect is slightly higher than the baseline effect suggesting that the inter-temporal effect estimates the lower bound. Thus, we are confident that our baseline results are not biased by potential endogeneity of the *peer rate* variable.

In Table 15, we perform a number of tests exploring and validating the initial choice of the weight matrix. For briefness, we present each time only the estimates of the *peer rate* variable.[9] In Column (1), we allow the spillover effect from past treaties to vary with their age. We speculate that more recent treaties concluded by a given destination country's geographical peers may be more relevant as a benchmark to compete against than older tax treaties concluded by the same peers. To this end, we adapt our empirical specification by weighting our *peer rate* variable inversely by the number of years that each of the past treaties has been been in force in the signature year of the observed tax treaty. We find

[9] Full results remain available upon request.

that the results are statistically significant, but their magnitude is not different from our baseline model.

In Column (2), we repeat the same exercise, but allow only the most recently concluded peer treaty to exacerbate an effect on observed withholding tax rates. Despite being statistically significant, the coefficients are lower in magnitude than the ones in our baseline model. In Column (3), we allow destination countries to compete only against the peer treaty with the lowest withholding tax rate in their intermediate region. However, the estimates are statistically insignificant. Overall, the results suggest a rather static picture of the regional spillovers in tax treaty formation.

In Columns (4) - (6), we validate the sensitivity of our results with respect to chosen time lag of the *peer rate* variable. We note that the *peer rate* on portfolio dividends is no longer significant and that the *peer rate* on participation dividends remains statistically significant only for *peer rate* values lagged by 3 years. However, the results on interest and royalty withholding tax rates remain significant across all tested values of the time lag.

In Columns (7) and (8), we change the definition of spatially connected countries to contiguity - Column (7) - and common sub-region - Column (8).[10] When we restrict the spatial dimension of the *peer rate* only to neighbouring countries in Column (7), the *peer rate* is no longer significant in the case of portfolio and participation dividends. However, we continue to observe strong correlation between the *peer rate* and the negotiated withholding tax rates in the case of interest and royalties. We find fairly identical estimates to our main results assuming common sub-regions in Column (8). The *peer rate* variable is positive and statistically significant for each of the withholding tax rate types.

To corroborate the last two results, we construct placebo *peer rates* assigning countries a random intermediate region, and thereby changing its peers.[11] We take 200 random draws, and show in Figure 3 the distribution of the t-statistics of the placebo *peer rates* for

[10] Contiguity, defined as countries sharing a common border, is one geographical level below intermediate regions. Sub-regions are one geographical level above intermediate regions.

[11] Since our main results hold using a spatial lag defining similarity at the sub region, we condition the random draw on countries being assigned an intermediate region within different world regions, which are methodologically equivalent to continents.

each of the withholding tax rates across all 200 random draws. We find that the *peer rate* variable is statistically significant in less than 5% of the draws (10% in the case of *peer rate* on interest withholding tax rate). The number of statistically significant and negative *peer rates* varies around 10% for each of the types, with the number of insignificant *peer rates* being more than 80% for all but interest withholding tax rates. Moreover, we note that none of the draws results in all four *peer rate* estimates to be individually statistically significant at the same time.[12] With these results, we are confident that our main results are unique to the actual, real-world, distribution of countries across the globe.

We further assess the extent to which our results are unique to the chosen geographical level of the analysis in Table 16. In particular, we re-estimate our baseline model by re-weighting the intermediate-region *peer rate* by four economic indicators in Columns (1) - (4). We refrain from the geographical dimension entirely in Columns (5) - (8), and re-estimate our baseline model defining destination countries' peers solely in an economic meaning.

The four economic indicators come all from Cassette and Paty (2008). We construct the GDP weight matrix - Columns (1) and (5) - based on the inverse of the difference between GDP per capita of destination country j_1 and destination country j_2, where each element is defined as:

$$w_{j_1 j_2}^{GDP} = \frac{(|GDP_{j_1}/POP_{j_1} - GDP_{j_2}/POP_{j_2}|)^{-1}}{j \sum (|GDP_{j_1}/POP_{j_1} - GDP_{j_2}/POP_{j_2}|)^{-1}}$$

Whereas the *GDP* weight matrix considers the case where competition occurs between two destination countries similar in economic characteristics, the *GDP Lead* matrix considers the case of an economic leader - Columns (2) and (6). The weight matrix takes the form:

$$w_{j_1 j_2}^{GDPLEAD} = \frac{(|GDP_{j_2}/POP_{j_2}|)^{-1}}{j \sum (|GDP_{j_2}/POP_{j_2}|)^{-1}}$$

[12] Results available upon request.

The same logic applies to the two population-based matrixes, with:

$$w_{j_1 j_2}^{POP} = \frac{(|POP_{j_1} - POP_{j_2}|)^{-1}}{j \sum (|POP_{j_1} - POP_{j_2}|)^{-1}}$$

and

$$w_{j_1 j_2}^{POPLEAD} = \frac{(|POP_{j_2}|)^{-1}}{j \sum (|POP_{j_2}|)^{-1}}$$

Weighting the intermediate-region weighted peer rates by each of the economic indicators has only a modest impact on the estimate *peer rate* effect. Except for Column (1), the *peer rate* effect is no longer statistically significant in the case of portfolio and participation dividends. Conversely, the estimated *peer rate* effect on interest and royalties withholding tax rates is lower than the baseline effect for each of the four economic indicators.

When refraining from the geographical dimension entirely in Columns (5) - (8) and weighting the *peer rate* variable exclusively by the four economic indicators, the effect is more noticeable. In particular, the *peer rate* effect remains statistically signifiant only in 3 out of 16 model specifications. Altogether, Table 16 strongly suggests that tax competition in withholding tax rates is unique to the geographical dimension and countries do not consider economic indicators when observing their peers.

7. Conclusions

It has long been established that countries engage in tax competition for internationally mobile capital by setting their corporate income tax rates below their competitors (Wilson, 1986; Zodrow and Mieszkowski, 1986). This paper argues that countries also engage in bilateral tax competition by reducing total repatriation taxes on profits for investors from a particular (source) country of residence, holding all other total repatriation taxes unchanged. We have called this phenomenon bilateral tax competition.

This paper gives ample empirical evidence for the existence of bilateral tax competition.

We look at the evolution of withholding tax rates on dividends, interest and royalties (the bilateral component of total repatriation taxes) contained in approximately 3,000 double tax treaties signed since 1930. We find - in line with the standard tax competition literature - that withholding tax rates have fallen over time, as previous reductions in withholding tax rates of a country lead to further reductions in new or amended double tax treaties of that country.

More importantly, this paper also demonstrates bilateral tax competition, as countries will further reduce their withholding tax rates if their peers (or competitors) have reduced their withholding tax rates previously. Surprisingly, the strongest effects are neither measured among tax havens, nor among the OECD countries - which otherwise maintain that competition is a force for the good - but rather between developing countries, which apparently compete fiercely over scarce global investment capital. Double tax treaties are not a means to eliminate double taxation, but rather an instrument of bilateral tax competition, which is avidly used around the world.

Appendix

Devereux and Griffith (1999, 2003) define $EATR$ for an international investment as:

$$T_l = \frac{R_l^* - R_l}{E(1+\psi_l)p_l(1+i)^{-1}} \tag{1}$$

where R_l^* is the pre-tax economic rent; R_l is the net present value of the economic rent generated by the perturbation of the subsidiary's capital stock; E is the expected exchange rate in period $t+1$; ψ_l is the expected inflation in location l; p represents the financial return; and i is the nominal interest rate in the presence of tax.

The net present value of the economic rent generated by the perturbation of the subsidiary's capital stock, R_l is defined as the sum of: (i) the rent attributable to the investment in the subsidiary financed by the retained earnings (R_l^{RE}); (ii) the additional cost of the parent raising external finance in the source country h (F_h); and (iii) the additional cost

of the subsidiary of raising finance from the parent (F_l). Thus, the economic rent earned from an investment by the subsidiary is given by:

$$R_l = R_l^{RE} + F_h + F_l \tag{2}$$

where only R_l^{RE} and F_l depend on cross-border taxes. From Eqs. (1) and (2) it follows that:

$$T_l = \frac{R_l^* - R_l^{RE} - F_h - F_l}{E(1+\psi_l)p_l(1+i)^{-1}} \tag{3}$$

In accordance with Devereux and Griffith (1999, 2003), we define finance from retained earnings as

$$\begin{aligned} R_l^{RE} &= -\gamma(1-\sigma_{hl})(1-A) \\ &\quad + \frac{\gamma(1-\sigma_{hl})}{(1+\rho)}\{E(1+\psi_l)(p_l+\delta)(1-\tau_l) + E(1+\psi_l)(1-\delta)(1-A_l)\} \end{aligned} \tag{4}$$

where γ is a term measuring the tax discrimination between new equity and distributions; A is the new present value of tax allowances per unit of investment; ρ is the ultimate shareholder's nominal discount rate; δ is the economic depreciation rate. Most importantly, σ_{hl} is the overall tax rate on dividend payments from the subsidiary located in country l to the parent resident in country h, which in turn, depends on the applicable withholding tax rate in the destination country l and the applicable method of double tax relief in the source country of the parent h.

F_l depends on the source of subsidiary finance: retained earnings, new equity and debt. In particular, (with φ standing for tax depreciation),

$$F_l(retained\ earnings) = 0 \tag{5}$$

$$F_l(new\ equity) = \frac{\gamma\sigma_{hl}}{(1+\rho)}(1-\varphi_l\tau_l)[E-(1+\rho)] \tag{6}$$

$$F_l(debt) = \frac{\gamma(1-\varphi_l\tau_l)}{(1+\rho)}\{\sigma_{hl}[E(1+i(1-\tau_l))-(1+\rho)]-E\omega_{hl}i\} \tag{7}$$

Similarly to σ_{hl}, $\omega_{hl}i$ is the overall tax rate on interest payment from the subsidiary to the parent that depends on the withholding tax rate in the country of the subsidiary l and methods of double tax relief in the source country of the parent h.

Assuming a constant exchange rate E, it can be shown that R_l^{RE} and F_l both decrease with the applicable withholding tax rate of the destination country l. Formally,

$$\frac{\partial R_l^{RE}}{\partial\sigma_{hl}} = -\frac{\gamma}{(1+\rho)}\{E(1+\psi_l)(p_l+\delta)(1-\tau_l)+E(1+\psi_l)(1-\delta)(1-A_l)\} < 0 \tag{8}$$

$$\frac{\partial F_l(new\ equity)}{\partial\sigma_{hl}} = \frac{\gamma}{(1+\rho)}(1-\varphi_l\tau_l)[E-(1+\rho)] < 0 \tag{9}$$

$$\frac{\partial F_l(debt)}{\partial\omega_{hl}} = -\frac{\gamma Ei(1-\varphi_l\tau_l)}{(1+\rho)} < 0 \tag{10}$$

Thus, a reduction in destination country's l withholding tax rate on dividends decreases its $EATR$ on inbound foreign investments financed out of retained earnings and new equity.[13] A reduction in destination country's l withholding tax rate on interest payments decreases its $EATR$ on inbound foreign investments financed by debt. Moreover, as long as the

[13]Note that when a tax treaty between destination country l and source country h is signed in period t, it becomes effective only in period $t+1$. Hence, the first term of Eq. (8) is not relevant for its derivative. If we disregard the timing of the tax treaty, the theoretical predictions hold unambiguously for a greenfield investment not financed out of retained earnings.

personal taxes in the residence country on capital gains are equal to or higher than the personal taxes in the residence country on interest income, a reduction in destination country's l withholding tax rate on dividends decreases also the $EATR$ of a subsidiary financed by debt.[14]

This implies a strategic complementarity of withholding tax rates. In other words, destination countries can compete for inbound foreign investment by reducing their withholding tax rates.

Next, we want to see how the $EATRs$ driven by a change in the withholding tax rates affect the locational choices of countries. Following Davies and Voget (2008), each firm locates in the region offering it the greatest equilibrium profits. Similar to the derivation of the Logit estimator (see Green (2007)), the probability that any given firm n locates in foreign location l among the set of possible foreign locations K (denoted L_l) is:

$$L_l = \frac{exp[(1-T_l)\tilde{\Pi}_l]}{\sum_{m=1}^{K} exp[(1-T_k)\tilde{\Pi}_m]}, \tag{13}$$

with $\tilde{\Pi}_l$ and $\tilde{\Pi}_m$ standing for the equilibrium gross profits in countries l and m respectively. Differentiating with respect to country's l effective average tax rate T_l and country's m effective average tax rate T_m yields:

$$\frac{\partial L_l}{\partial T_l} = (L_l - 1)P_l\tilde{\Pi}_l < 0 \tag{14}$$

[14]Formally,

$$\frac{\partial F_l(debt)}{\partial \sigma_{hl}} = \frac{\gamma(1-\varphi_l\tau_l)}{(1+\rho)}[E(1+i(1-\tau_l)) - (1+\rho)] < 0, \tag{11}$$

with

$$\rho = \frac{(1-m^i)i}{1-\zeta}, \tag{12}$$

where m^i is the residence country's personal tax rate on interest income; and ζ is the residence country's personal tax rate on capital gains.

$$\frac{\partial L_l}{\partial T_k} = L_l L_k \tilde{\Pi}_k > 0 \tag{15}$$

i.e. the probability of country l hosting firm n falls with its own effective average tax rate T_l and increases with the other country $k's$ effective average tax rate T_k.

Aggregating across the large number of firms implies that (in expected value) the equilibrium number of firms that location l hosts is L_l and its tax revenues are:

$$T_l L_l N \tilde{\Pi}_l \ , \tag{16}$$

where N is the total number of firms.

Governments simultaneously choose tax rates in order to maximise their own tax revenues. For country l, this yields an optimal value of tax:

$$T_l = (1 - L_l)^{-1} \tilde{\Pi}_l^{-1} \ , \tag{17}$$

where L_l depends on the tax rates of all countries m. From this, the best reaction function for country l with respect to the tax rate of country $k \neq l$ can be defined as:

$$\frac{\partial T_l}{\partial T_k} = \frac{L_l L_k \tilde{\Pi}_k}{(1 - L_l)^2 \tilde{\Pi}_l} > 0 \tag{18}$$

which indicates that tax rates are strategic complements.

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Table 1: Germany - Host Withholding Tax Rates on Royalties and Peer Rates

Time Period	Tax Treaties in Force			Peer Rates	
...				Indonesia:	.
				Malaysia:	.
				Philippines:	.
⋮				Singapore:	.
				Thailand:	.
1966				Vietnam:	.
1967	1967	Germany - Thailand:	15%	Indonesia:	15%
				Malaysia:	15%
				Philippines:	15%
⋮				Singapore:	15%
				Thailand:	.
1971				Vietnam:	15%
1972	1967	Germany - Thailand:	15%	Indonesia:	7.5%
	1972	Germany - Singapore:	0%	Malaysia:	7.5%
				Philippines:	7.5%
⋮				Singapore:	15%
				Thailand:	0%
1976				Vietnam:	7.5%
1977	1967	Germany - Thailand:	15%	Indonesia:	8.33%
	1972	Germany - Singapore:	0%	Malaysia:	8.33%
	1977	Germany - Indonesia:	10%	Philippines:	8.75%
⋮	1977	Germany - Malaysia:	10%	Singapore:	11.67%
				Thailand:	6.67%
1982				Vietnam:	8.75%
1983	1989	Germany - Thailand:	15%	Indonesia:	8.75%
	1972	Germany - Singapore:	0%	Malaysia:	8.75%
	1977	Germany - Indonesia:	10%	Philippines:	8.75%
⋮	1977	Germany - Malaysia:	10%	Singapore:	11.25%
	1983	Germany - Philippines:	10%	Thailand:	7.5%
1989				Vietnam:	9%
1990	1989	Germany - Thailand:	15%	Indonesia:	8.75%
	1972	Germany - Singapore:	0%	Malaysia:	10%
	1977	Germany - Malaysia:	10%	Philippines:	10%
⋮	1983	Germany - Philippines:	10%	Singapore:	12.5%
	1990	Germany - Indonesia:	15%	Thailand:	8.75%
1994				Vietnam:	10%

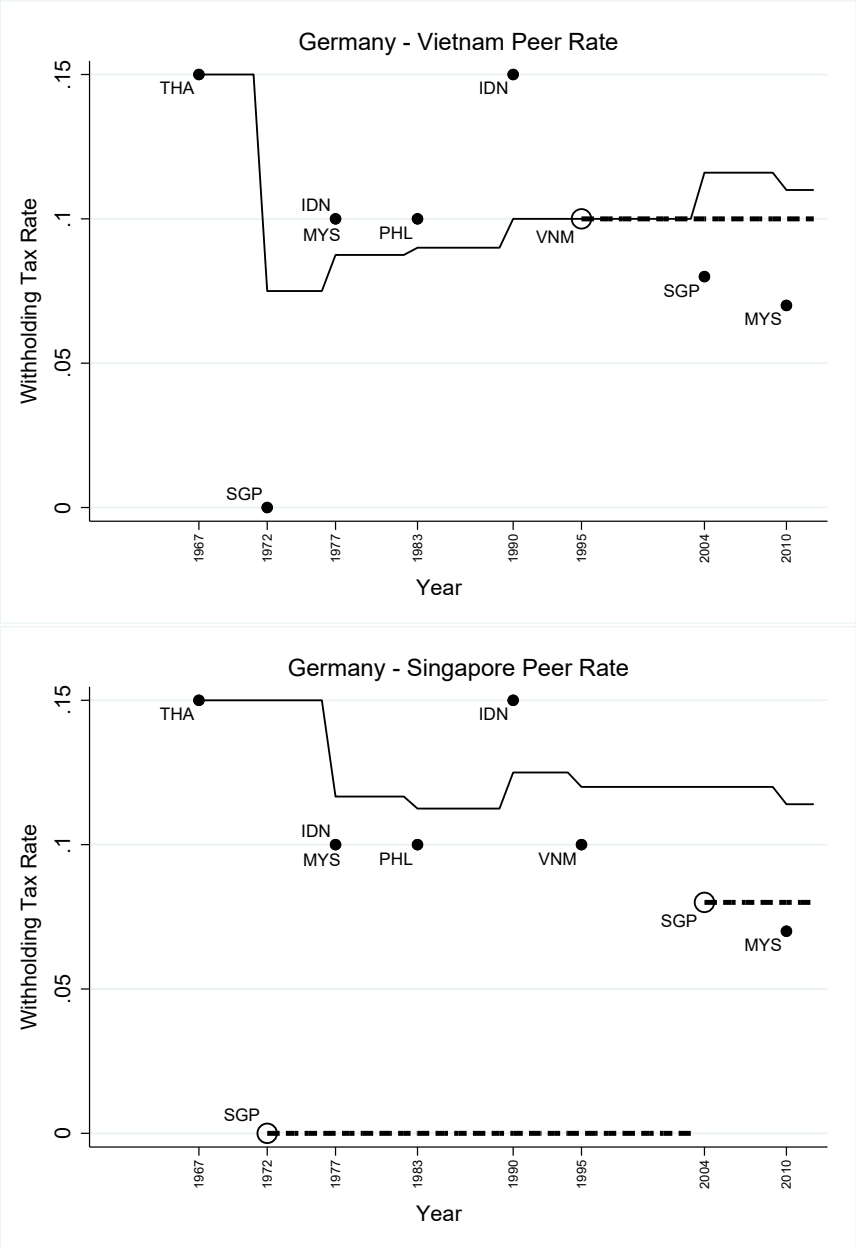

Figure 1: Germany - Hosts Peer Rates

Note: Solid line depicts Vietnam (upper graph) and Singapore (lower graph) peer rates vis-à-vis Germany. Withholding tax rates negotiated in double tax treaties between Germany and destination countries shown by solid dots. Vietnam (upper graph) and Singapore (lower graph) tax treaties indicated by hollow circles. Continuous dashed lines indicate the withholding tax rate throughout the duration of Vietnam's, respectively Singapore's treaties. Notice how the peer rate averages with each new tax treaty being added to the region. Yet, the peer rate does not respond to the conclusion of a tax agreement between Germany and Vietnam (upper graph) and Singapore (lower graph).

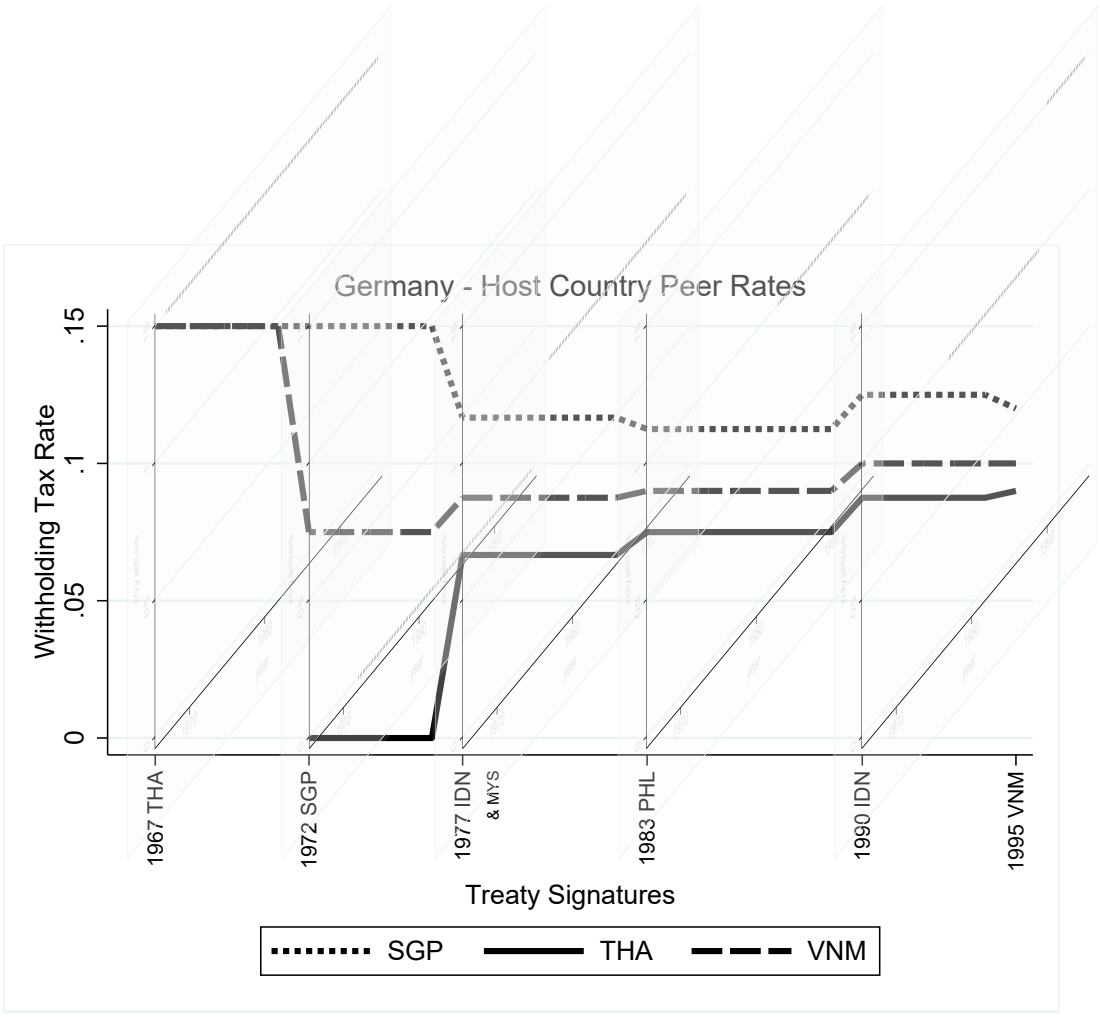

Figure 2: Germany - Hosts Withholding Tax Rates and Peer Rates

Note: The XY plane plots the peer rates of selected destination countries vis-à-vis Germany. The ZY plane plots the individual double tax agreements between Germany and each of the destination countries. Notice how each of negotiated withholding tax rates remains constant over time throughout the entire duration of the agreement. The peer rates continue to average among the up-to-this-point signed tax treaties between Germany and other destination countries.

Table 2: Control Variables

	(1) Port. Div.	(2) Part. Div.	(3) Interest	(4) Royalties
source_avg	-0.0782	-0.0627	0.137**	0.126**
	(0.0652)	(0.0590)	(0.0535)	(0.0501)
destination_avg	0.0655	0.151**	0.147***	0.169***
	(0.0635)	(0.0603)	(0.0568)	(0.0507)
LNgdp_source	-0.0151	0.0151	0.00650	0.0112
	(0.0117)	(0.00917)	(0.00851)	(0.00941)
LNgdp_destination	-0.00311	0.0241***	0.00919	0.0122
	(0.0117)	(0.00884)	(0.00850)	(0.00940)
LNgdpcap_source	0.00867	-0.0162*	-0.00694	-0.0161*
	(0.0115)	(0.00880)	(0.00827)	(0.00926)
LNgdpcap_destination	0.00297	-0.0208**	-0.00982	-0.0170*
	(0.0114)	(0.00846)	(0.00820)	(0.00927)
Observations	4,336	4,404	4,396	4,493
R-squared	0.682	0.728	0.758	0.740
Source FE	YES	YES	YES	YES
Destination FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
SourceRegion*Year FE	YES	YES	YES	YES
DestinationRegion*Year FE	YES	YES	YES	YES

Note: c Dependent variable: withholding tax rate on Portfolio Dividends (Column 1); Participation Dividends (Column 2); Interest (Column 3); and Royalties (Column 4). Robust standard errors clustered by country pairs in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent confidence level.

Table 3: Main Results - Peer Rate

	(1) Port. Div.	(2) Part. Div.	(3) Interest	(4) Royalties
peer_rate	0.0476*	0.0513**	0.170***	0.189***
	(0.0252)	(0.0240)	(0.0252)	(0.0251)
source_avg	-0.0394	-0.0567	0.123	0.124
	(0.0928)	(0.0878)	(0.0885)	(0.0782)
destination_avg	0.0620	0.186**	0.187**	0.149**
	(0.0804)	(0.0786)	(0.0735)	(0.0607)
LNgdp_source	-0.00981	0.0154	0.0102	0.0126
	(0.0154)	(0.0117)	(0.0107)	(0.0131)
LNgdp_destination	-0.00171	0.0183*	0.00805	0.0251**
	(0.0130)	(0.00998)	(0.00939)	(0.0103)
LNgdpcap_source	-0.00269	-0.0176	-0.0135	-0.0209
	(0.0150)	(0.0111)	(0.0103)	(0.0128)
LNgdpcap_destination	0.00168	-0.0132	-0.00794	-0.0275***
	(0.0126)	(0.00940)	(0.00910)	(0.0103)
Observations	3,060	3,114	3,111	3,213
R-squared	0.699	0.746	0.786	0.774
Source FE	YES	YES	YES	YES
Destination FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
SourceRegion*Year FE	YES	YES	YES	YES
DestinationRegion*Year FE	YES	YES	YES	YES

Note: Dependent variable: withholding tax rate on Portfolio Dividends (Column 1); Participation Dividends (Column 2); Interest (Column 3); and Royalties (Column 4). Robust standard errors clustered by country pairs in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent confidence level.

Table 4: Main Results - Extensions I

	(1) Average WHT	(2) Minimum WHT	(3) Reduced Part. Div.	(4) Treaty FE
peer_rate	0.0578***	0.109***	0.0699*	0.102***
	(0.0206)	(0.0223)	(0.0370)	(0.0183)
part.div_dum				-0.0115***
				(0.00221)
interest_dum				-0.0114***
				(0.00259)
royalties_dum				-0.00716***
				(0.00265)
peer_rate*part.div_dum				0.0130
				(0.0164)
peer_rate*interest_dum				0.128***
				(0.0202)
peer_rate*royalties_dum				0.104***
				(0.0200)
source_avg	0.0823	0.0217	0.133	0.380***
	(0.0630)	(0.0821)	(0.169)	(0.0215)
destination_avg	0.0753	0.180**	0.240*	0.550***
	(0.0570)	(0.0740)	(0.137)	(0.0225)
LNgdp_source	0.00347	0.00892	0.00574	
	(0.00835)	(0.00934)	(0.0201)	
LNgdp_destination	0.0143*	0.0185**	0.0360**	
	(0.00748)	(0.00827)	(0.0153)	
LNgdpcap_source	-0.00973	-0.0159*	-0.00337	
	(0.00816)	(0.00918)	(0.0183)	
LNgdpcap_destination	-0.0137*	-0.0204**	-0.0281*	
	(0.00731)	(0.00808)	(0.0146)	
Observations	3,275	3,275	1,362	14,402
R-squared	0.806	0.792	0.802	0.748
Source FE	YES	YES	YES	NO
Destination FE	YES	YES	YES	NO
Year FE	YES	YES	YES	NO
SourceRegion*Year FE	YES	YES	YES	NO
DestinationRegion*Year FE	YES	YES	YES	NO
Treaty FE	NO	NO	NO	YES

Note: Dependent variable: Average treaty withholding tax rate (Column 1); Minimum treaty withholding tax rate (Column 2); Reduced withholding tax rate on Participation Dividends (Column 3); and Treaty withholding tax rates (Column 4). Robust standard errors clustered by country pairs in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent confidence level.

Table 5: Main Results - Extensions II

	Renegotiated Tax Treaties				Non-OECD Rates Treaties			
	(1) Port. Div.	(2) Part. Div.	(3) Interest	(4) Royalties	(5) Port. Div.	(6) Part. Div.	(7) Interest	(8) Royalties
peer_rate	0.0607**	0.0383	0.109***	0.120***	0.00683	0.0533	0.149***	0.123***
	(0.0266)	(0.0279)	(0.0280)	(0.0274)	(0.0437)	(0.0383)	(0.0372)	(0.0334)
treaty_reneg.	0.00958	-0.0121***	-0.0160***	-0.0201***				
	(0.00753)	(0.00397)	(0.00358)	(0.00340)				
peer_rate*treaty_reneg.	-0.0706	0.0534	0.164***	0.172***				
	(0.0530)	(0.0414)	(0.0349)	(0.0339)				
source_avg	-0.0386	-0.0548	0.152*	0.157**	0.0666	-0.260*	-0.198*	0.278**
	(0.0929)	(0.0871)	(0.0893)	(0.0782)	(0.179)	(0.144)	(0.109)	(0.109)
destination_avg	0.0624	0.178**	0.168**	0.138**	-0.0572	-0.0242	0.0571	0.193**
	(0.0801)	(0.0784)	(0.0737)	(0.0602)	(0.136)	(0.126)	(0.0992)	(0.0879)
LNgdp_source	-0.0110	0.0157	0.0104	0.0123	0.0104	0.0157	-0.00126	0.0160
	(0.0154)	(0.0116)	(0.0106)	(0.0136)	(0.0199)	(0.0291)	(0.0154)	(0.0137)
LNgdp_destination	-0.00138	0.0179*	0.00652	0.0230**	0.00126	0.0294	-0.00316	0.00322
	(0.0130)	(0.00996)	(0.00938)	(0.0105)	(0.0165)	(0.0194)	(0.0126)	(0.0111)
LNgdpcap_source	-0.00164	-0.0178	-0.0142	-0.0213	-0.00853	-0.0375	0.0124	-0.0188
	(0.0150)	(0.0109)	(0.0102)	(0.0134)	(0.0189)	(0.0291)	(0.0154)	(0.0132)
LNgdpcap_destination	0.00130	-0.0124	-0.00599	-0.0251**	-0.00444	-0.0288	0.0118	-0.00413
	(0.0126)	(0.00939)	(0.00906)	(0.0105)	(0.0157)	(0.0184)	(0.0124)	(0.0107)
Observations	3,060	3,114	3,111	3,213	904	1,400	1,158	2,136
R-squared	0.699	0.748	0.789	0.778	0.821	0.847	0.938	0.742
Source FE	YES	YES	YES	YES	YES	YES	YES	YES
Destination FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
SourceRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES
DestinationRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: Dependent variable: withholding tax rate on Portfolio Dividends (Columns 1 & 5); Participation Dividends (Columns 2 & 6); Interest (Columns 3 & 7); and Royalties (Columns 4 & 8). Robust standard errors clustered by country pairs in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent confidence level.

Table 6: Heterogeneity - OECD Countries

	(1) Port. Div.	(2) Part. Div.	(3) Interest	(4) Royalties	(5) Port. Div.	(6) Part. Div.	(7) Interest	(8) Royalties
peer_rate	0.0458*	0.0466*	0.169***	0.185***	0.0241	-0.00335	-0.0182	0.0683*
	(0.0252)	(0.0242)	(0.0252)	(0.0251)	(0.0376)	(0.0372)	(0.0404)	(0.0387)
oecd_source	-0.00917	0.0105**	-0.00528	0.000145	-0.0150*	0.00778	-0.0127*	-0.00281
	(0.00632)	(0.00506)	(0.00544)	(0.00552)	(0.00889)	(0.00621)	(0.00693)	(0.00695)
oecd_destination	-0.0116*	0.00940*	-0.00284	-0.00300	-0.0165*	0.00133	-0.0225***	-0.0195***
	(0.00606)	(0.00500)	(0.00571)	(0.00535)	(0.00867)	(0.00662)	(0.00661)	(0.00675)
oecd_pair	-0.00441	-0.00793**	-0.00503	-0.00954***	0.0121	-0.00316	-0.00931	-0.0174***
	(0.00360)	(0.00316)	(0.00320)	(0.00321)	(0.0127)	(0.00692)	(0.00629)	(0.00606)
peer_rate*oecd_source					0.0539	0.0342	0.107**	0.0134
					(0.0543)	(0.0476)	(0.0486)	(0.0481)
peer_rate*oecd_destination					0.0439	0.105*	0.221***	0.160***
					(0.0535)	(0.0564)	(0.0432)	(0.0411)
peer_rate*oecd_pair					-0.130	-0.0613	0.105	0.209***
					(0.0933)	(0.0809)	(0.0643)	(0.0676)
source_avg	-0.0420	-0.0520	0.126	0.130*	-0.0436	-0.0687	0.0746	0.0906
	(0.0933)	(0.0880)	(0.0896)	(0.0790)	(0.0943)	(0.0887)	(0.0864)	(0.0785)
destination_avg	0.0480	0.190**	0.181**	0.143**	0.0483	0.185**	0.196***	0.157**
	(0.0809)	(0.0787)	(0.0743)	(0.0618)	(0.0810)	(0.0790)	(0.0731)	(0.0614)
LNgdp_source	-0.0112	0.0138	0.00913	0.0104	-0.0115	0.0140	0.00767	0.00966
	(0.0155)	(0.0117)	(0.0107)	(0.0131)	(0.0156)	(0.0118)	(0.0105)	(0.0128)
LNgdp_destination	-0.00262	0.0178*	0.00718	0.0241**	-0.00255	0.0181*	0.00665	0.0208**
	(0.0130)	(0.00996)	(0.00940)	(0.0104)	(0.0130)	(0.00999)	(0.00935)	(0.0104)
LNgdpcap_source	-0.000926	-0.0166	-0.0121	-0.0187	-0.000555	-0.0172	-0.0123	-0.0186
	(0.0151)	(0.0110)	(0.0103)	(0.0129)	(0.0152)	(0.0112)	(0.0100)	(0.0125)
LNgdpcap_destination	0.00337	-0.0132	-0.00666	-0.0260**	0.00320	-0.0141	-0.00549	-0.0223**
	(0.0125)	(0.00939)	(0.00912)	(0.0103)	(0.0125)	(0.00944)	(0.00907)	(0.0103)
Observations	3,060	3,114	3,111	3,213	3,060	3,114	3,111	3,213
R-squared	0.700	0.747	0.787	0.775	0.700	0.748	0.795	0.781
Source FE	YES	YES	YES	YES	YES	YES	YES	YES
Destination FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
SourceRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES
DestinationRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: Dependent variable: withholding tax rate on Portfolio Dividends (Columns 1 & 5); Participation Dividends (Columns 2 & 6); Interest (Columns 3 & 7); and Royalties (Columns 4 & 8). Robust standard errors clustered by country pairs in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent confidence level.

Table 7: Heterogeneity - Developing Countries

	(1) Port. Div.	(2) Part. Div.	(3) Interest	(4) Royalties	(5) Port. Div.	(6) Part. Div.	(7) Interest	(8) Royalties
peer_rate	0.0480*	0.0472*	0.126***	0.213***	-0.0567	-0.0427	-0.0765*	0.0346
	(0.0290)	(0.0247)	(0.0266)	(0.0279)	(0.0451)	(0.0444)	(0.0450)	(0.0426)
dev_source	0.00203	-0.00256	0.00910*	0.00953*	-0.0104	-0.0101	-0.00201	-5.53e-05
	(0.00606)	(0.00462)	(0.00536)	(0.00551)	(0.00910)	(0.00637)	(0.00717)	(0.00712)
dev_destination	-0.00706	-0.00850	0.00959*	0.00672	-0.0166*	-0.0148**	-0.0128*	-0.0203***
	(0.00628)	(0.00605)	(0.00520)	(0.00523)	(0.00939)	(0.00749)	(0.00699)	(0.00687)
dev_pair	-0.00916***	-0.00464	-0.0136***	-0.0112***	-0.0133	-0.00281	-0.0106	-0.00566
	(0.00347)	(0.00310)	(0.00302)	(0.00311)	(0.0107)	(0.00664)	(0.00652)	(0.00647)
peer_rate*dev_source					0.114*	0.104*	0.122**	0.0685
					(0.0595)	(0.0559)	(0.0526)	(0.0512)
peer_rate*dev_destination					0.0832	0.0772	0.241***	0.277***
					(0.0567)	(0.0550)	(0.0488)	(0.0483)
peer_rate*dev_pair					0.0282	-0.00960	0.0228	0.0370
					(0.0816)	(0.0752)	(0.0661)	(0.0695)
source_avg	-0.195*	-0.135	-0.0337	0.0460	-0.203*	-0.130	-0.00713	0.0426
	(0.118)	(0.0922)	(0.107)	(0.102)	(0.116)	(0.0920)	(0.107)	(0.105)
destination_avg	0.243***	0.239***	0.0369	0.0697	0.244***	0.233***	0.0330	0.0672
	(0.0906)	(0.0891)	(0.0823)	(0.0718)	(0.0906)	(0.0891)	(0.0809)	(0.0697)
LNgdp_source	-0.00247	0.0162	0.0116	0.0267*	0.00112	0.0172	0.0168	0.0278**
	(0.0161)	(0.0120)	(0.0113)	(0.0143)	(0.0166)	(0.0122)	(0.0113)	(0.0138)
LNgdp_destination	-0.0165	0.00173	0.0103	0.0309***	-0.0165	0.00218	0.0104	0.0306***
	(0.0134)	(0.0106)	(0.00954)	(0.0109)	(0.0133)	(0.0106)	(0.00937)	(0.0108)
LNgdpcap_source	-0.00813	-0.0194*	-0.0171	-0.0332**	-0.0119	-0.0207*	-0.0236**	-0.0354***
	(0.0154)	(0.0111)	(0.0105)	(0.0137)	(0.0159)	(0.0113)	(0.0106)	(0.0133)
LNgdpcap_destination	0.00788	-0.00434	-0.0129	-0.0354***	0.00743	-0.00564	-0.0128	-0.0333***
	(0.0128)	(0.00960)	(0.00910)	(0.0107)	(0.0127)	(0.00963)	(0.00897)	(0.0107)
Observations	2,565	2,588	2,611	2,655	2,565	2,588	2,611	2,655
R-squared	0.698	0.731	0.762	0.740	0.700	0.732	0.771	0.748
Source FE	YES	YES	YES	YES	YES	YES	YES	YES
Destination FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
SourceRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES
DestinationRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: Dependent variable: withholding tax rate on Portfolio Dividends (Columns 1 & 5); Participation Dividends (Columns 2 & 6); Interest (Columns 3 & 7); and Royalties (Columns 4 & 8). Robust standard errors clustered by country pairs in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent confidence level.

Table 8: Heterogeneity - Tax Havens

	(1) Port. Div.	(2) Part. Div.	(3) Interest	(4) Royalties	(5) Port. Div.	(6) Part. Div.	(7) Interest	(8) Royalties
peer_rate	0.0477*	0.0508**	0.170***	0.189***	0.0375	0.0492**	0.168***	0.191***
	(0.0252)	(0.0240)	(0.0252)	(0.0251)	(0.0261)	(0.0245)	(0.0255)	(0.0257)
haven_pair	0.00176	-0.00995	0.00559	-0.00784	-0.0297	-0.0379**	-0.0370***	-0.0342
	(0.0142)	(0.0124)	(0.0115)	(0.00868)	(0.0233)	(0.0167)	(0.0136)	(0.0243)
peer_rate*haven_source					0.121	0.121	0.0634	-0.0288
					(0.103)	(0.0880)	(0.0995)	(0.102)
peer_rate*haven_destination					0.0584	-0.0949	-0.00572	-0.0312
					(0.0929)	(0.0964)	(0.106)	(0.0820)
peer_rate*haven_pair					0.490	0.469	0.476***	0.266
					(0.298)	(0.320)	(0.174)	(0.224)
source_avg	-0.0395	-0.0554	0.122	0.124	-0.0341	-0.0582	0.117	0.124
	(0.0929)	(0.0879)	(0.0885)	(0.0782)	(0.0930)	(0.0879)	(0.0885)	(0.0784)
destination_avg	0.0618	0.188**	0.185**	0.149**	0.0668	0.183**	0.184**	0.150**
	(0.0805)	(0.0786)	(0.0734)	(0.0607)	(0.0807)	(0.0787)	(0.0734)	(0.0609)
LNgdp_source	-0.00982	0.0155	0.0102	0.0127	-0.00894	0.0159	0.0108	0.0126
	(0.0154)	(0.0117)	(0.0107)	(0.0131)	(0.0154)	(0.0117)	(0.0107)	(0.0131)
LNgdp_destination	-0.00169	0.0182*	0.00807	0.0251**	-0.00208	0.0182*	0.00797	0.0249**
	(0.0130)	(0.00998)	(0.00939)	(0.0103)	(0.0130)	(0.00996)	(0.00938)	(0.0103)
LNgdpcap_source	-0.00268	-0.0177	-0.0135	-0.0209	-0.00353	-0.0181	-0.0140	-0.0208
	(0.0150)	(0.0111)	(0.0103)	(0.0128)	(0.0150)	(0.0110)	(0.0103)	(0.0129)
LNgdpcap_destination	0.00165	-0.0130	-0.00798	-0.0274***	0.00204	-0.0129	-0.00790	-0.0272***
	(0.0126)	(0.00940)	(0.00910)	(0.0103)	(0.0126)	(0.00938)	(0.00908)	(0.0103)
Observations	3,060	3,114	3,111	3,213	3,060	3,114	3,111	3,213
R-squared	0.699	0.746	0.786	0.774	0.700	0.747	0.786	0.774
Source FE	YES	YES	YES	YES	YES	YES	YES	YES
Destination FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
SourceRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES
DestinationRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: Dependent variable: withholding tax rate on Portfolio Dividends (Columns 1 & 5); Participation Dividends (Columns 2 & 6); Interest (Columns 3 & 7); and Royalties (Columns 4 & 8). Robust standard errors clustered by country pairs in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent confidence level.

Table 9: Heterogeneity - OECD & Developing Countries & Tax Havens

	(1) Port. Div.	(2) Part. Div.	(3) Interest	(4) Royalties	(5) Port. Div.	(6) Part. Div.	(7) Interest	(8) Royalties
peer_rate	0.0470	0.0412*	0.127***	0.213***	-0.0488	-0.0428	-0.0933**	0.0298
	(0.0291)	(0.0249)	(0.0267)	(0.0280)	(0.0488)	(0.0461)	(0.0455)	(0.0449)
oecd_source	-0.00961	0.0132**	-0.00869	-0.00251	-0.0140	0.0137*	-0.0116	-0.00488
	(0.00652)	(0.00519)	(0.00570)	(0.00598)	(0.0111)	(0.00710)	(0.00793)	(0.00886)
oecd_destination	-0.00733	0.0123**	-0.00592	-0.00631	0.00317	0.0102	-0.0122*	-0.00675
	(0.00665)	(0.00530)	(0.00580)	(0.00578)	(0.0105)	(0.00747)	(0.00738)	(0.00816)
oecd_pair	-0.00232	-0.00535	0.000996	-0.00359	0.0237	-0.00504	-0.0105	-0.0184**
	(0.00399)	(0.00335)	(0.00351)	(0.00343)	(0.0151)	(0.00743)	(0.00725)	(0.00768)
dev_source	0.00364	-0.00575	0.0109**	0.00946*	-0.00549	-0.0124*	0.00276	0.00272
	(0.00621)	(0.00473)	(0.00544)	(0.00559)	(0.0106)	(0.00729)	(0.00804)	(0.00848)
dev_destination	-0.00572	-0.0115*	0.0107**	0.00753	-0.0210**	-0.0157*	-0.00700	-0.0200***
	(0.00660)	(0.00626)	(0.00526)	(0.00528)	(0.0106)	(0.00810)	(0.00766)	(0.00774)
dev_pair	-0.00869**	-0.00293	-0.0140***	-0.0102***	-0.0153	-0.00229	-0.00763	0.00316
	(0.00380)	(0.00324)	(0.00319)	(0.00318)	(0.0109)	(0.00717)	(0.00724)	(0.00773)
haven_pair	0.00334	-0.00762	0.0108	-0.00568	-0.0263	-0.0323*	-0.0223	-0.0185
	(0.0143)	(0.0127)	(0.0124)	(0.00935)	(0.0227)	(0.0177)	(0.0139)	(0.0229)
peer_rate*oecd_source					0.0356	-0.00187	0.0449	0.0203
					(0.0764)	(0.0665)	(0.0680)	(0.0727)
peer_rate*oecd_destination					-0.0911	0.0282	0.0652	-0.0136
					(0.0689)	(0.0701)	(0.0588)	(0.0601)
peer_rate*oecd_pair					-0.189*	-0.00299	0.181**	0.253***
					(0.111)	(0.0916)	(0.0766)	(0.0900)
peer_rate*dev_source					0.0925	0.0886	0.0780	0.0439
					(0.0781)	(0.0728)	(0.0710)	(0.0738)
peer_rate*dev_destination					0.132**	0.0499	0.181***	0.286***
					(0.0670)	(0.0678)	(0.0647)	(0.0644)
peer_rate*dev_pair					0.0445	0.00587	-0.0248	-0.0677
					(0.0851)	(0.0832)	(0.0754)	(0.0827)

peer_rate*haven_source					0.0420	0.0895	0.0625	-0.0932
					(0.115)	(0.0976)	(0.106)	(0.116)
peer_rate*haven_destination					-0.0114	-0.0727	0.0396	-0.0646
					(0.106)	(0.100)	(0.111)	(0.0918)
peer_rate*haven_pair					0.476	0.406	0.414**	0.210
					(0.291)	(0.326)	(0.172)	(0.213)
source_avg	-0.204*	-0.132	-0.0473	0.0373	-0.180	-0.136	-0.0241	0.0498
	(0.118)	(0.0920)	(0.107)	(0.105)	(0.118)	(0.0916)	(0.104)	(0.106)
destination_avg	0.230**	0.250***	0.0201	0.0538	0.234**	0.236***	0.0101	0.0514
	(0.0913)	(0.0891)	(0.0821)	(0.0734)	(0.0912)	(0.0893)	(0.0806)	(0.0719)
LNgdp_source	-0.00372	0.0153	0.0112	0.0248*	-0.00134	0.0167	0.0157	0.0245*
	(0.0162)	(0.0120)	(0.0112)	(0.0143)	(0.0169)	(0.0121)	(0.0111)	(0.0139)
LNgdp_destination	-0.0175	0.00117	0.00988	0.0296***	-0.0166	0.00194	0.00979	0.0279***
	(0.0134)	(0.0105)	(0.00952)	(0.0110)	(0.0131)	(0.0106)	(0.00936)	(0.0108)
LNgdpcap_source	-0.00697	-0.0184*	-0.0168	-0.0312**	-0.00933	-0.0204*	-0.0224**	-0.0315**
	(0.0156)	(0.0111)	(0.0105)	(0.0138)	(0.0162)	(0.0113)	(0.0104)	(0.0133)
LNgdpcap_destination	0.00894	-0.00385	-0.0124	-0.0338***	0.00798	-0.00529	-0.0117	-0.0301***
	(0.0128)	(0.00956)	(0.00908)	(0.0108)	(0.0125)	(0.00968)	(0.00894)	(0.0107)
Observations	2,565	2,588	2,611	2,655	2,565	2,588	2,611	2,655
R-squared	0.699	0.733	0.763	0.740	0.703	0.735	0.775	0.751
Source FE	YES	YES	YES	YES	YES	YES	YES	YES
Destination FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
SourceRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES
DestinationRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: Dependent variable: withholding tax rate on Portfolio Dividends (Columns 1 & 5); Participation Dividends (Columns 2 & 6); Interest (Columns 3 & 7); and Royalties (Columns 4 & 8). Robust standard errors clustered by country pairs in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent confidence level.

Table 10: Network Effects Tax Havens - Dummy

	(1) Port. Div.	(2) Part. Div.	(3) Interest	(4) Royalties	(5) Port. Div.	(6) Part. Div.	(7) Interest	(8) Royalties
peer_rate	0.0479*	0.0518**	0.171***	0.189***	0.0674	0.0260	0.131***	0.0755*
	(0.0250)	(0.0240)	(0.0252)	(0.0251)	(0.0428)	(0.0413)	(0.0407)	(0.0405)
s_network_haven_treaty	-0.00449	0.00148	0.00524*	0.00270	-0.00352	0.00199	0.00471	-0.00135
	(0.00364)	(0.00318)	(0.00293)	(0.00277)	(0.00619)	(0.00440)	(0.00452)	(0.00434)
t_network_haven_treaty	-0.0102***	-0.00281	0.00129	0.00117	-0.00696	-0.00716*	-0.00399	-0.0106***
	(0.00327)	(0.00263)	(0.00285)	(0.00271)	(0.00573)	(0.00377)	(0.00388)	(0.00375)
peer_rate*s_network_haven_treaty					-0.00797	-0.00601	0.00835	0.0444
					(0.0435)	(0.0412)	(0.0382)	(0.0357)
peer_rate*t_network_haven_treaty					-0.0281	0.0553	0.0638**	0.141***
					(0.0394)	(0.0368)	(0.0317)	(0.0323)
source_avg	-0.0508	-0.0518	0.134	0.123	-0.0483	-0.0574	0.138	0.139*
	(0.0904)	(0.0874)	(0.0880)	(0.0781)	(0.0919)	(0.0881)	(0.0909)	(0.0807)
destination_avg	0.0435	0.187**	0.192***	0.151**	0.0450	0.184**	0.194***	0.141**
	(0.0806)	(0.0783)	(0.0739)	(0.0606)	(0.0808)	(0.0780)	(0.0740)	(0.0603)
LNgdp_source	-0.00890	0.0150	0.00924	0.0120	-0.00955	0.0151	0.0101	0.0132
	(0.0153)	(0.0116)	(0.0107)	(0.0130)	(0.0154)	(0.0117)	(0.0107)	(0.0129)
LNgdp_destination	0.000776	0.0187*	0.00755	0.0247**	0.000494	0.0188*	0.00765	0.0241**
	(0.0131)	(0.0100)	(0.00940)	(0.0103)	(0.0131)	(0.0100)	(0.00944)	(0.0104)
LNgdpcap_source	-0.00369	-0.0176	-0.0132	-0.0206	-0.00299	-0.0178	-0.0142	-0.0218*
	(0.0149)	(0.0110)	(0.0103)	(0.0128)	(0.0150)	(0.0111)	(0.0103)	(0.0127)
LNgdpcap_destination	9.32e-05	-0.0132	-0.00727	-0.0271***	0.000477	-0.0135	-0.00718	-0.0256**
	(0.0126)	(0.00943)	(0.00909)	(0.0103)	(0.0126)	(0.00942)	(0.00913)	(0.0103)
Observations	3,060	3,114	3,111	3,213	3,060	3,114	3,111	3,213
R-squared	0.701	0.746	0.786	0.774	0.701	0.747	0.787	0.776
Source FE	YES	YES	YES	YES	YES	YES	YES	YES
Destination FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
SourceRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES
DestinationRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: Dependent variable: withholding tax rate on Portfolio Dividends (Columns 1 & 5); Participation Dividends (Columns 2 & 6); Interest (Columns 3 & 7); and Royalties (Columns 4 & 8). Robust standard errors clustered by country pairs in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent confidence level.

Table 11: Network Effects Tax Havens - Count

	(1) Port. Div.	(2) Part. Div.	(3) Interest	(4) Royalties	(5) Port. Div.	(6) Part. Div.	(7) Interest	(8) Royalties
peer_rate	0.0484*	0.0515**	0.172***	0.189***	0.0423	0.0204	0.0827**	0.0886***
	(0.0252)	(0.0240)	(0.0252)	(0.0251)	(0.0332)	(0.0337)	(0.0326)	(0.0324)
s_network_haven_treaties	-0.000809	0.000471	0.00245**	0.00148	-0.00117	-0.000169	0.000154	-0.00122
	(0.00143)	(0.00121)	(0.00115)	(0.00108)	(0.00234)	(0.00159)	(0.00148)	(0.00155)
t_network_haven_treaties	-0.00115	0.000108	0.00129	0.00102	-0.00144	-0.00154	-0.00275*	-0.00320**
	(0.00130)	(0.00117)	(0.00113)	(0.00110)	(0.00244)	(0.00156)	(0.00146)	(0.00148)
peer_rate*s_network_haven_treaties					0.00336	0.00858	0.0288**	0.0312**
					(0.0170)	(0.0162)	(0.0126)	(0.0140)
peer_rate*t_network_haven_treaties					0.00259	0.0231	0.0526***	0.0567***
					(0.0168)	(0.0158)	(0.0121)	(0.0129)
source_avg	-0.0481	-0.0540	0.152*	0.129*	-0.0472	-0.0552	0.168*	0.141*
	(0.0937)	(0.0878)	(0.0889)	(0.0783)	(0.0943)	(0.0878)	(0.0890)	(0.0784)
destination_avg	0.0570	0.186**	0.207***	0.159***	0.0568	0.182**	0.206***	0.152**
	(0.0813)	(0.0787)	(0.0746)	(0.0611)	(0.0817)	(0.0788)	(0.0746)	(0.0606)
LNgdp_source	-0.00875	0.0148	0.00699	0.0108	-0.00819	0.0160	0.0129	0.0125
	(0.0155)	(0.0118)	(0.0108)	(0.0130)	(0.0157)	(0.0119)	(0.0108)	(0.0128)
LNgdp_destination	-0.000415	0.0182*	0.00616	0.0240**	-0.000288	0.0188*	0.00633	0.0230**
	(0.0132)	(0.0102)	(0.00952)	(0.0104)	(0.0132)	(0.0102)	(0.00954)	(0.0105)
LNgdpcap_source	-0.00365	-0.0172	-0.0114	-0.0196	-0.00417	-0.0184	-0.0177*	-0.0219*
	(0.0150)	(0.0111)	(0.0103)	(0.0128)	(0.0152)	(0.0112)	(0.0103)	(0.0126)
LNgdpcap_destination	0.000674	-0.0130	-0.00635	-0.0265**	0.000541	-0.0139	-0.00681	-0.0255**
	(0.0127)	(0.00953)	(0.00914)	(0.0103)	(0.0127)	(0.00955)	(0.00916)	(0.0104)
Observations	3,060	3,114	3,111	3,213	3,060	3,114	3,111	3,213
R-squared	0.699	0.746	0.787	0.774	0.699	0.746	0.789	0.777
Source FE	YES	YES	YES	YES	YES	YES	YES	YES
Destination FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
SourceRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES
DestinationRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: Dependent variable: withholding tax rate on Portfolio Dividends (Columns 1 & 5); Participation Dividends (Columns 2 & 6); Interest (Columns 3 & 7); and Royalties (Columns 4 & 8). Robust standard errors clustered by country pairs in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent confidence level.

Table 12: Network Effects Tax Havens - Average Rate

	(1) Port. Div.	(2) Part. Div.	(3) Interest	(4) Royalties	(5) Port. Div.	(6) Part. Div.	(7) Interest	(8) Royalties
peer_rate	0.124*	0.136**	0.269***	0.174***	0.318***	0.250**	0.472***	0.243**
	(0.0734)	(0.0609)	(0.0523)	(0.0609)	(0.122)	(0.102)	(0.106)	(0.115)
s_network_haven_avg	-0.132	-0.0649	-0.0318	0.0823	-0.141	-0.0836	0.0481	0.0205
	(0.106)	(0.102)	(0.0931)	(0.0794)	(0.138)	(0.136)	(0.105)	(0.0862)
t_network_haven_avg	-0.00103	0.0139	0.0186	0.107	0.250*	0.108	0.0778	0.169*
	(0.126)	(0.111)	(0.0946)	(0.0867)	(0.137)	(0.130)	(0.0974)	(0.0961)
peer_rate*s_network_haven_avg					-0.124	-0.00637	-1.318*	0.854
					(0.841)	(0.922)	(0.717)	(0.735)
peer_rate*t_network_haven_avg					-2.376***	-1.586	-1.104	-1.391*
					(0.754)	(0.986)	(0.806)	(0.836)
source_avg	0.530*	0.117	0.177	-0.433	0.620**	0.228	0.289	-0.418
	(0.291)	(0.359)	(0.298)	(0.300)	(0.295)	(0.334)	(0.316)	(0.296)
destination_avg	0.891***	0.790***	0.226	-0.382	0.824**	0.817***	0.282	-0.324
	(0.331)	(0.267)	(0.310)	(0.280)	(0.350)	(0.271)	(0.317)	(0.287)
LNgdp_source	0.0197	-0.0370	0.0432*	0.0411	0.0169	-0.0397	0.0465*	0.0452
	(0.0452)	(0.0283)	(0.0246)	(0.0290)	(0.0459)	(0.0273)	(0.0243)	(0.0286)
LNgdp_destination	-0.0500	-0.0295	0.0253	0.0252	-0.0435	-0.0292	0.0253	0.0210
	(0.0451)	(0.0313)	(0.0255)	(0.0307)	(0.0422)	(0.0309)	(0.0254)	(0.0309)
LNgdpcap_source	-0.0485	0.0292	-0.0266	-0.0228	-0.0444	0.0321	-0.0288	-0.0303
	(0.0455)	(0.0287)	(0.0250)	(0.0289)	(0.0464)	(0.0273)	(0.0245)	(0.0289)
LNgdpcap_destination	0.0454	0.0228	0.000573	-0.00447	0.0365	0.0218	0.00319	-0.000741
	(0.0475)	(0.0314)	(0.0261)	(0.0300)	(0.0442)	(0.0309)	(0.0258)	(0.0302)
Observations	770	816	777	818	770	816	777	818
R-squared	0.860	0.898	0.924	0.902	0.865	0.900	0.926	0.904
Source FE	YES	YES	YES	YES	YES	YES	YES	YES
Destination FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
SourceRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES
DestinationRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: Dependent variable: withholding tax rate on Portfolio Dividends (Columns 1 & 5); Participation Dividends (Columns 2 & 6); Interest (Columns 3 & 7); and Royalties (Columns 4 & 8). Robust standard errors clustered by country pairs in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent confidence level.

Table 13: Robustness - Heckman Sample Selection

	First stage probit				Second stage OLS			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Port. Div.	Part. Div.	Interest	Royalties	Port. Div.	Part. Div.	Interest	Royalties
peer_rate	-1.9882	-2.0788	-5.5058**	-3.7449	0.0588***	0.0729***	0.1444***	0.2012***
	(2.3344)	(2.4836)	(2.7688)	(2.5117)	(0.0201)	(0.0177)	(0.0188)	(0.0200)
source_avg	-37.7884*	10.7583	-22.2571	-31.9757	-0.0124	-0.0792	0.0398	0.0965
	(21.5451)	(36.9680)	(120.7678)	(26.2294)	(0.0798)	(0.0683)	(0.0701)	(0.0651)
destination_avg	-18.6832***	-17.0524**	-23.6783	-37.5076*	0.1869***	0.2464***	0.1244**	0.1112**
	(6.6938)	(7.1233)	(97.9588)	(22.6829)	(0.0544)	(0.0488)	(0.0568)	(0.0502)
LNgdp_source	1.4278	-3.1011	0.7452	-1.5602	-0.0092	0.0142	0.0066	0.0221**
	(1.8685)	(2.7377)	(13.9945)	(2.1487)	(0.0110)	(0.0101)	(0.0096)	(0.0095)
LNgdp_destination	0.7139	1.0181	6.5407	-0.4149	-0.0130	0.0085	0.0074	0.0299**
	(1.4729)	(1.7652)	(4.5193)	(2.0655)	(0.0087)	(0.0079)	(0.0075)	(0.0073)
LNgdpcap_source	-2.3068	2.1413	-0.5675	1.4017	-0.0032	-0.0171*	-0.0116	-0.0268***
	(1.8706)	(2.5326)	(13.5602)	(2.1249)	(0.0106)	(0.0096)	(0.0093)	(0.0091)
LNgdpcap_destination	-2.0514	-0.7625	-5.0562	0.6588	0.0080	-0.0068	-0.0079	-0.0313***
	(1.5238)	(1.7246)	(7.0130)	(1.9780)	(0.0085)	(0.0076)	(0.0073)	(0.0071)
comlang_off	0.5857**	0.5674**	0.6255**	0.4327*				
	(0.2622)	(0.2612)	(0.2805)	(0.2415)				
Observations	7,279	7,306	7,282	7,363	3,092	3,139	3,146	3,213
Mills ratio	0.0091	-0.0042	0.0016	0.0034				
	(0.0061)	(0.0060)	(0.0077)	(0.0078)				
Source FE	YES	YES	YES	YES	YES	YES	YES	YES
Destination FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
SourceRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES
DestinationRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: Dependent variable: withholding tax rate on Portfolio Dividends (Column 1); Participation Dividends (Column 2); Interest (Column 3); and Royalties (Column 4). Robust standard errors clustered by country pairs in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent confidence level.

Table 14: Robustness - Spatial Lag Model (SAR)

	(1) Port. Div.	(2) Part. Div.	(3) Interest	(4) Royalties
peer_rate	0.0715***	0.0855***	0.2371***	0.1940***
	(0.0172)	(0.0166)	(0.0152)	(0.0158)
LNgdp_source	-0.0142***	0.0137***	-0.0188***	-0.0169***
	(0.0052)	(0.0049)	(0.0044)	(0.0045)
LNgdp_destination	0.0020	0.0185***	-0.0190***	-0.0168***
	(0.0051)	(0.0048)	(0.0043)	(0.0044)
LNgdpcap_source	0.0045	-0.0187***	0.0120***	0.0095**
	(0.0052)	(0.0049)	(0.0044)	(0.0045)
LNgdpcap_destination	-0.0019	-0.0178***	0.0128***	0.0121***
	(0.0052)	(0.0049)	(0.0044)	(0.0045)
Observations	4,508	4,508	4,508	4,508
Log L	8520.835	8749.5791	9250.9807	9156.0186
R-squared	0.5114	0.5551	0.6093	0.6024
Source FE	YES	YES	YES	YES
Destination FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Note: Dependent variable: withholding tax rate on Portfolio Dividends (Column 1); Participation Dividends (Column 2); Interest (Column 3); and Royalties (Column 4). Robust standard errors in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent confidence level.

Table 15: Weight Matrix Sensitivity I

W	(1) Age-Weighted	(2) Most Recent	(3) Minimum	(4) N=3	(5) N=4	(6) N=5	(7) Contiguity	(8) Sub-Regions
Port. Div.	0.0702***	0.0569***	0.0241	0.0205	0.0340	0.0192	0.00462	0.0571**
	(0.0244)	(0.0183)	(0.0164)	(0.0261)	(0.0268)	(0.0266)	(0.0235)	(0.0250)
Part. Div.	0.0603***	0.0407**	0.00691	0.0463*	0.0271	0.0372	0.0180	0.0510**
	(0.0229)	(0.0176)	(0.0206)	(0.0240)	(0.0248)	(0.0262)	(0.0213)	(0.0236)
Interest	0.159***	0.0959***	0.115***	0.177***	0.162***	0.176***	0.119***	0.160***
	(0.0247)	(0.0192)	(0.0208)	(0.0262)	(0.0273)	(0.0288)	(0.0258)	(0.0243)
Royalties	0.179***	0.118***	0.0717***	0.187***	0.156***	0.146***	0.124***	0.176***
	(0.0232)	(0.0187)	(0.0201)	(0.0262)	(0.0287)	(0.0303)	(0.0255)	(0.0242)
Source FE	YES	YES	YES	YES	YES	YES	YES	YES
Destination FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
SourceRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES
DestinationRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: Dependent variable: withholding tax rate on Portfolio Dividends (Row 1); Participation Dividends (Row 2); Interest (Row 3); and Royalties (Row 4). Robust standard errors clustered by country pairs in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent confidence level.

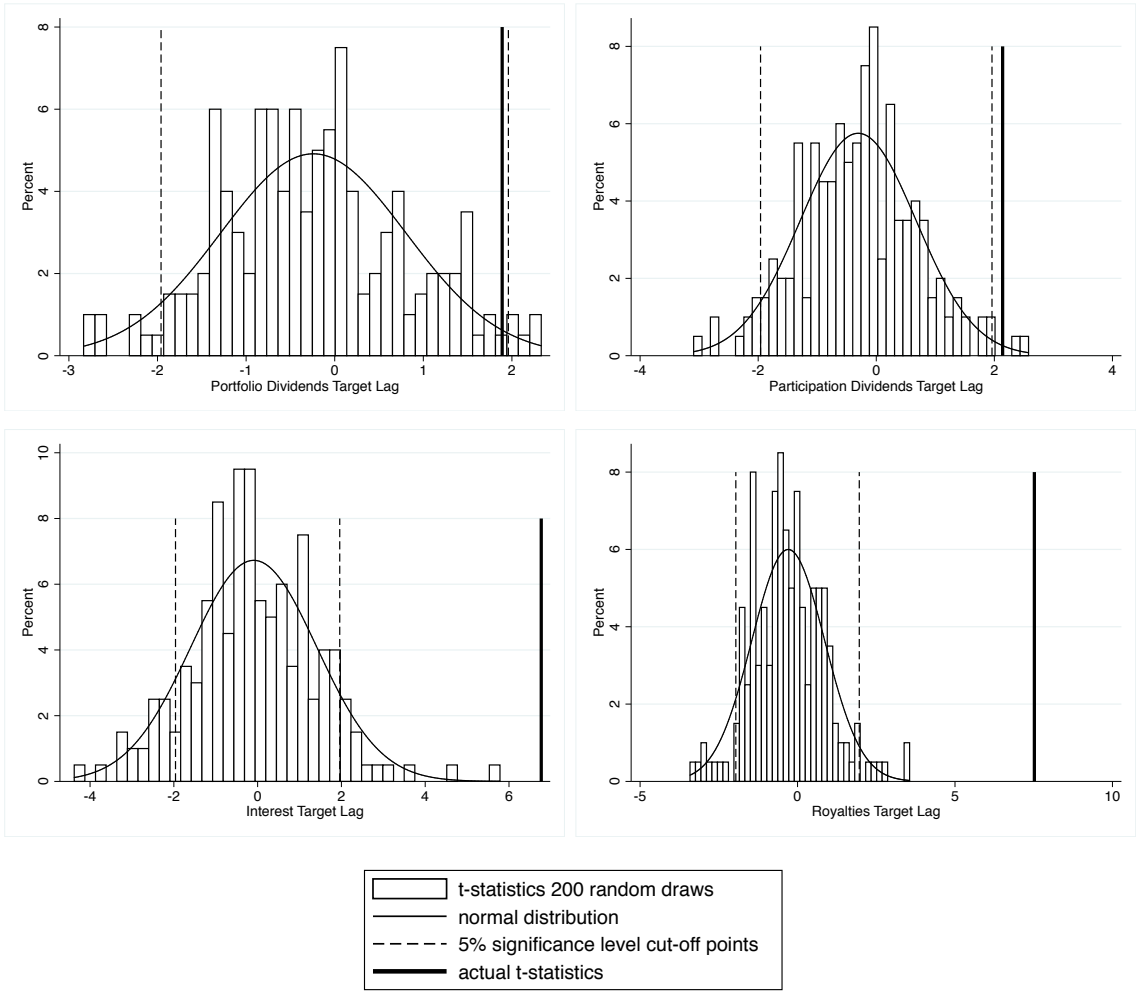

Figure 3: T-statistics placebo peer rates

Note: Distribution of t-statistics of 200 placebo peer rates indicated by bars. Normal distribution indicated by solid curve. The 5% significance level cut-off points and estimation sample t-statistics indicated by dashed, respectively solid, vertical lines.

Table 16: Weight Matrix Sensitivity II

	Weighted: Intermediate Region				Weighted: World			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
W	GDP	GDP LEAD	POP	POP LEAD	GDP	GDP LEAD	POP	POP LEAD
Port. Div.	0.0378*	0.0303	0.0386*	0.0229	0.0436	-0.163	0.0422	-0.0132
	(0.0219)	(0.0234)	(0.0207)	(0.0216)	(0.0300)	(0.118)	(0.0302)	(0.0668)
Part. Div.	0.0476**	0.0312	0.0294	0.0433**	0.0167	0.0489	0.0183	0.0762
	(0.0201)	(0.0216)	(0.0194)	(0.0198)	(0.0273)	(0.100)	(0.0264)	(0.0694)
Interest	0.169***	0.147***	0.138***	0.138***	0.192***	-0.132	-0.0114	-0.00291
	(0.0220)	(0.0230)	(0.0209)	(0.0217)	(0.0281)	(0.100)	(0.0286)	(0.0613)
Royalties	0.180***	0.151***	0.126***	0.161***	0.129***	-0.0927	0.00137	0.0954*
	(0.0218)	(0.0235)	(0.0212)	(0.0219)	(0.0267)	(0.115)	(0.0316)	(0.0495)
Source FE	YES	YES	YES	YES	YES	YES	YES	YES
Destination FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
SourceRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES
DestinationRegion*Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: Dependent variable: withholding tax rate on Portfolio Dividends (Row 1); Participation Dividends (Row 2); Interest (Row 3); and Royalties (Row 4). Robust standard errors clustered by country pairs in parentheses. ***, ** and * denote significance at the 1, 5 and 10 percent confidence level.

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