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REVENUE LOSSES FROM CORPORATE TAX AVOIDANCE: ESTIMATIONS FROM THE UNU-WIDER GOVERNMENT REVENUE DATASET

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Revenue losses from corporate tax avoidance: estimations from the UNU-WIDER Government Revenue Dataset

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Abstract:
Corporate profit shifting to tax havens negatively impacts corporate tax revenue, particularly in low-income countries. Two studies published in 2016 and 2018 have proven this correlation using data from 2013. In this paper, I use the most recent version of the UNU-WIDER Government Revenue Dataset (GRD) to estimate government revenue losses in 2019 and to observe possible changes associated with the release of the new dataset. My estimations indicate that global tax revenue losses in 2019 are around USD 480 billion, compared to USD 500 billion in 2013. In terms of GDP percentage, my estimations confirm the presence of a higher share of losses in low-income, and more generally, in non-OECD countries, and they show a higher intensity of tax avoidance practices in those countries. The results also suggest that the total level of tax revenue losses has plateaued, with no increase in losses occurring since 2013.

JEL: F21, F23, H25
Keywords: international taxation; corporate income tax; tax avoidance; tax havens; base erosion; profit shifting; income inequality; developing countries

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Section 1: Introduction

Corporate tax revenue is one of the main sources of income for governments around the world and represents an even more important share of the total tax revenues for low-income countries. However, the impact that profit shifting and tax avoidance exert on developing countries is still unclear and more difficult to quantify given the lack of data transparency and the larger informal sector in those countries compared to advanced ones. Country-specific and up-to-date estimates of global tax revenue losses are needed to properly assess today's level of tax avoidance and the level of heterogeneity between countries.

At present, the most exhaustive studies on global tax revenue losses include a paper by International Monetary Fund (IMF) researchers Crivelli, De Mooij and Keen (2016) and another – more recent and following the same model – by Cobham and Janský (2018). Both papers estimate tax revenue losses until year 2013 and present different results using the same model ideated by Crivelli et al. (2016) but using different datasets. In particular, Crivelli et al. estimate tax revenue losses of USD 650 billion in 2013, while Cobham and Janský arrive at an estimation of USD 500 billion in losses. Crivelli et al. (2016) use data extracted from the IMF database, while Cobham and Janský (2018) exploit data released by the International Centre for Tax and Development-World Institute for Development Economics Research (ICTD–WIDER) Government Revenue Database (GRD), version 2017, which is a more complete dataset of tax revenues by country and also enables a more granular analysis of the data.

Both papers employ the model introduced by Crivelli et al. (2016) to estimate global tax revenue losses using data from 173 countries over a period of 33 years (1980–2013). The model is based on three main explanatory variables: the inverse geographical distance between countries, their GDP size, and whether or not the countries are considered tax havens. As Cobham and Janský (2018) state, the main reason to calculate new estimations of global tax revenues is the availability of new and more detailed datasets. The recent UNU-WIDER Government Revenue Dataset, version 2021 with data until 2019, therefore provides a reason to calculate new estimations following the work of Crivelli et al (2016) and Cobham and Janský (2018), and to observe the developments of the most recent years.

In this paper, I exploit the most recent data available and re-estimate the results obtained by the above two studies. My headline estimation is a tax revenue loss in 2019 of around USD 480 billion, slightly lower than the USD 500 billion in 2013 calculated by Cobham and Janský (2018). Table 6 in the Appendix shows my result and illustrates how the tax revenue losses both in OECD and non-OECD countries have not increased since 2016. The lower result I obtain might be explained by the implementation of the OECD's Base Erosion and Profit Shifting (BEPS) programme in several countries in early 2016, a series of 15 actions promulgated by the OECD with the intent to avert the shifting of corporate profits to lower tax jurisdictions and increase the data transparency of capital flows. In this respect, the results I obtain may be considered a hint of the possible positive effects that the BEPS programme is having on the overall level of tax revenue losses resulting from tax avoidance practices.

This paper makes a twofold contribution to the current literature on tax avoidance and profit shifting. First, I furnish estimations of tax revenue losses based on the most recent data available, testing their robustness and the solidity of the model by Crivelli et al. (2016). Second, I provide the disaggregated results for year 2019, confirming the underlying heterogeneity within the groups of countries and the generally higher percentage of tax revenue losses among low-income countries.

The remainder of this paper is structured as follows. Section 2 provides a literature review of the most recent studies on tax revenue losses and spillover effects. Section 3 includes a description of the model, an in-depth analysis of the utilised data, and an explanation of the process I use to arrive at the final estimations. Section 4 provides the results of the model, presenting granular data on tax revenue losses and the regressions made to calculate the spillover effects. The final section summarises the main findings.

Section 2: Literature review

In recent years, there has been substantial evidence of the higher impact that tax avoidance has on low-income countries compared to developed ones (IMF, 2014). Governments in these nations are usually keener than others to rely on revenues from corporate taxation, possibly explained by a lack of alternative resources of revenues, or perhaps by a higher level of tax evasion experienced from the taxation of income or of capital. As suggested by Crivelli et al. (2016), tax competition perpetrated by other countries (both high- and low-income) should be considered the main detriment to the revenues of countries, which are often powerless when confronted with the ability of companies to take advantage of different fiscal jurisdictions and shift their profits abroad.

Over the years, researchers have attempted to classify the existence and range of revenues lost from profit shifting practices. Clausing (2016) analyses US-headquartered multinationals in depth and finds a revenue loss of between USD 77 billion and USD 111 billion. Using the same dataset as Clausing (2016), Cobham and Janský (2017) calculate revenue losses at the global level ranging between USD 130 billion and USD 200 billion. Zucman (2014) estimates a reduction in the tax bill of US-owned companies by about 20% due to profit shifting to low tax jurisdictions, stating an additional USD 200 billion in taxes that US-owned companies would have paid without the presence of tax avoidance practices (the profit shift results in a decrease in the effective tax rate from 30% to 20% between 1998 and 2013). Finally, Clausing (2009) estimates USD 60 billion in tax revenues lost due to profit shifting in 2004, resulting in a loss for the government of 35% of its corporate income tax collections. In all the above papers, the authors highlight the limitation of conducting these estimations for only one major economy, mostly motivated by the lack of data on other countries in contrast to the volume and granularity of information available for the US economy.

Focusing more on micro-data, Beer and Loeprick (2015) find evidence of profit shifting in the oil and gas sector in countries with corporate income tax as the main driver (CIT), particularly in developing countries. Fuest et al. (2011, 2013) use entity-level data from German MNEs to find a strong correlation between intra-borrowing activities and profit shifting practices, doubling in size when taking into consideration the practices in developing countries alone.

Utilizing IMF data, Blanco and Rogers (2014) discover a strong positive effect on foreign direct investments (FDI) in developing countries from FDI in nearby tax havens, suggesting the possibility of positive spillover effects between one country and another in low-income regions by the use of tax avoidance jurisdictions. However, this hypothesis may be challenged by uncertainty about the nature of the FDI, i.e., whether the investments are considered real ones or those derived from tax avoidance practices. In addition, it is important to consider the possibility that developing countries could simply borrow money from financial institutions based in tax havens in order to run their economies, which would influence the data on the FDI level in the country and from where the investments are originated.

With regard to research on strategic spillovers, four studies are noteworthy: Devereux et al. (2008), Klemm and Van Parys (2012), Crivelli et al. (2016), and Naitram (2022). Except for Crivelli et al. (2016) and Klemm and Van Parys (2012), the others concentrate on the OECD area, leaving out the effects on low-income countries. Devereux et al. (2008) estimate that, among OECD countries, a 10% decrease in the statutory CIT rate leads to a consequent cut of 7% by other member countries. Klemm and Van Parys (2012) study the economies of Sub-Saharan Africa and the Caribbean, reporting a smaller but still significant spillover among the countries of around 2.5-3%. Using more recent data and focusing on the totality of non-OECD countries, Crivelli et al. (2016) estimate strategic spillovers ranging between 3% and 7% but highlight the uncertainty over these measures given the lack of data for developing countries. Finally, Naitram (2022) utilizes the most recent data available and develops a model using the bilateral foreign investments between countries and the number of tax reforms occurring in each country over a number of years. The results suggest a correlation between a tax reform occurring in one country and the will of that country's government to adapt its system to the current tax competition so as to attract more FDI (Naitram, 2022).

Despite the lack of data for developing countries, some literature finds evidence of higher revenue costs for low-income countries resulting from profit shifting activities. Reuter (2012) and Johannesen and Pirttilä (2016) find evidence of larger profit shifting for developing countries by testing for the correlation between a lower corporate tax rate and an increasing level of debt generated by the subsidiary of a multinational company located in a developing country, finding a positive correlation and larger effect compared to subsidiaries in developed countries. Furthermore, Johannesen, Tørsløv, and Wier (2017) find the same evidence in studying low-income countries, justifying the phenomenon by the lack of other sources of income for these states, as previously stated by other authors. Finally, analysing the liberalisation of trading systems and tax reforms in developing countries, Gnannon and Brun (2019) argue that the level of tax revenues developing countries are able to collect depends directly on the extent to which their economy is open to the global trade system, suggesting therefore a direct impact from the tax reforms each country implements.

Section 3: Methodology

From a theoretical point of view, this paper exploits the model used to calculate long-run revenue costs ideated by Crivelli et al. (2016) using IMF data. The equation of the calculation for the spillovers is as follows:

$$(1)\ b_{it} = \gamma\tau_{i,t\text{-}1} + \beta W_{\text{-}i}\tau_{\text{-}it} + \zeta X_{it} + a_i + c_t + \varepsilon_i$$

where τ_{it} stands for the statutory tax rate in country *I* at time *t,* b_{it} is the corporate tax base in country *i* and time *t,* the $W-_{it}$ represents the weighted average of various tax rates in different countries *i*. X_{it} is a vector control, namely a series of variables used to include variables other than tax competition and affect the statutory tax rate; in this case we use agriculture share, the logarithm of GDP per capita, trade openness and inflation. a_i and c_t are country and time specific effects used to correct the heterogeneity possibly present for either unobserved countries or years. Regarding $W-_{it}$, in this model, they are differentiated by three different tax rates: 1) the GDP-weighted tax rate, computed by weighting the tax rate of each country by the share of GDP of all countries; 2) the haven unweighted tax rate, computed as an unweighted average of tax rates present in countries defined as tax havens – in this case we use the same list as Cobham and Jansky (2018), which considers a list of countries created by Cobham and Jansky (2017) and another one by Gravelle (2013); and 3) the distance weighted average tax rates, computed by weighting the tax rate of each country with the inverse distance of the countries' capitals – in this way, the tax rate should be able to detect the effect of distance to tax competition.

In estimating the spillover effects for this research, I used different variables to verify the possibility of using more statistically significant data from those identified by Crivelli et al. (2016). These results, however, proved inconclusive and I thus decided to employ the original variables. Nevertheless, theoretically there is room to improve the model if more sophisticated data on tax avoidance drivers are used.

In obtaining the estimations derived from these equations, it is possible to calculate the revenue losses at the country level. In this paper, profit shifting estimations are achieved by excluding the effect of tax havens on the tax bases, resulting in the difference between this new obtained tax base and the original one. Thus, the change in the tax base should be considered the revenue loss incurred in each country. The short-run, lost revenue is calculated by country *i* and time *t* using the following formula:

$$(2)\ L = \tau_{it}\,\hat{\varphi}(\tau_{it} - W^{h}\tau_{-it})$$

where φ is the estimated coefficient used to set equally the coefficients on their own and the spillover effects, while $W^{h}\tau_{-it}$ is specifically used to represent the haven-weighted average tax rate. Regarding the long-run revenues, it is possible to compute the estimations as:

$$(3)\ LL_{it} = \frac{t_{it}\hat{\varphi}\ (t_{it} - W^{h}t_{-it})}{1-\hat{\lambda}}$$

where $\hat{\lambda}$ is the coefficient used to estimate the lagged corporate tax base.

In both of the papers revisited for this research (Crivelli et al., 2016; and Cobham and Janský, 2018), the authors describe the technique of using endogenous variables as assumptions to estimate the spillover effects as being potentially insufficiently robust to furnish precise results.

In the initial phase of estimation, I attempted to use different variables from those in the vector model (GDP per capita, agriculture % of GDP, inflation %, openness %) to observe possible improvements in the solidity of the results. The main alternatives are financial services % of GDP, manufacturing % of GDP, and FDI % of GDP. Given the lack of different results, I decided to remain with the same model used by other authors in the past to allow for comparisons. Nonetheless, it is worth mentioning several critiques of the methodology of the model itself. The main drawback of the model is its reliance on an endogenous variable usually not strongly correlated with the spillover effects present for each country – an issue already mentioned by Crivelli et al. (2016), who find that allowing all the variables to be endogenous leads to comparable results. Additionally, the CIT rates variable based on tax havens is binary and therefore unweighted, not allowing any differentiation of importance between tax havens or almost tax havens, again skewing the results of the estimations.

Data

In Cobham and Janský (2018), the dataset used with the model by Crivelli et al. (2016) contains from 49 to 120 countries (depending on the variable) over the 1980-2013 period and the paper uses the same approach to group subdivision as applied by Crivelli et al. (2016). In my paper, the count of countries is between 51 and 152 (again depending on the variable), to which I also add tax rate series for the years with missing data and update available data on corporate income taxation, total GDP, and various variables within the vector controls. Distance between the capitals remains the same using data from the CEPII and further calculations by Cobham and Janský (2018)[1]. Similar to Crivelli et al. (2016), I divide the countries into wealth categories, distinguishing between upper middle-income countries, lower middle-income ones, and low-income ones. I do not include the category of resource-rich countries, in line with Cobham and Janský (2018), given the possibility to encounter different kinds of profit drivers and tax policies with different goals from those I am attempting to capture (Cobham and Janský, 2018). Nonetheless, the tax rates of resource-rich countries are still used to calculate overall average tax rates used as explanatory variables[2]. The list of tax havens is the same as that used by Crivelli et al. (2016) taken from Gravelle (2013), adding the changes that Cobham and Jansky input in their research, i.e., the addition to the tax haven list of six major profit misalignment jurisdictions (the Netherlands, Ireland, Luxembourg, Bermuda, Switzerland and Singapore) identified for US-headquartered multinationals by Cobham and Janský (2017). According to Crivelli et al. (2016) and Cobham and Janský (2018), the list has its drawbacks since it does not contain a number of tax havens, such the Cayman Islands (a country about which there is lack of data in any case). However, there are other advantages possibly crucial to capturing the activities of tax havens. Cobham and Janský (2018) highlight the benefits of including only the tax havens in which branches of multinational companies operate, therefore probably accounting for the majority of the profit shifting – an effect that could be diluted by including smaller tax havens in the list.

[1]As stated by Cobham and Janský (2018), the data on distances are taken by CEPII and then recalculated to create the inverse distance weighted tax rates. Some countries' distances are not available, and in those cases, the authors assigned one of the neighbouring countries with the closest capitals instead: Montenegro (Bosnia and Herzegovina), Kosovo (Macedonia) and San Marino (Italy). In addition to this, they used the World Bank's World Development Indicators data to fill the extended sample of data. I keep the same distances to be applied with the new CIT for the 2014-2019 period.

[2] These are defined as: Bahrain, Chad, Republic of Congo, The Islamic Republic of Iran, Kazakhstan, Kuwait, Libya, Mexico, Nigeria, Norway, Oman, Russian Federation, Saudi Arabia, Syrian Arab Republic, Trinidad and Tobago, United Arab Emirates, Venezuela, and Yemen. In contrast to Cobham, Jansky (2018), I include Ecuador, Equatorial Guinea, Angola, and Australia in this group since I do not see any reason not to include them and given the sufficient amount of data available for these countries.

Regarding quality of datasets, improvements were made to the UNU-WIDER Government Revenue Dataset published in 2021. As Cobham and Janský (2018) note, the creation of this dataset with the combination of data from various institutions, such as the IMF, the OECD and the World Bank, allows a more comprehensive visualisation of the data available on tax revenues for individual countries, especially for low-income countries. This major improvement has already been adopted in the analyses by Crivelli et al. (2016) and Cobham and Jansky (2018). In recent years, the dataset has seen minor changes in the methodology, but it has been constantly updated, reaching 2020 as the last year of data available for the countries (in the research, I consider up to year 2019 because of the still-incomplete list of data for 2020). The inclusion of data from OECD revenue statistics has allowed researchers to distinguish between total revenue and non-tax revenue data, thus leading to a more precise categorisation of the revenues per country (McNabb, Oppel and Chachu, 2021).

Table 1 Descriptive statistics

	Obs.	*Mean*	*Std. dev.*	*Variance*
Corporate Income Tax Rate (%)	6,077	.30665	.10520	.01106
Total CIT revenue (%)	6,077	2.0707	1.5108	2.2716
Tax haven unweighted CIT rate (%)	6,077	.28574	.04255	.00181
GDP weighted CIT rate (%)	6,077	.30727	.10067	.01013
Inverse-distance-weighted CIT rate (%)	6,077	.30326	.05358	.0028
GDP per capita	5,820	9212	15113	2.2808
Agriculture % of GDP	4,990	.12232	.11692	.01367
GDP	5,131	3.1411	1.2812	1.6324
Openness (%)	5,083	.83562	.55777	.31111
Inflation (%)	4,235	.28649	3.1540	9.9483

Table 1 shows the descriptive statistics used for this research. By comparing them with the descriptive statistics in the previous papers by Cobham and Janský (2018) (Table 1 in the Appendix), it is possible to notice similarities and differences related to the higher number of observations (given the greater number of years and countries considered) and lower means for the various categories of corporate income tax rate. The difference can be possibly explained by the addition of low taxation countries in the datasets and by the continuous general reduction of CIT in several countries ongoing also in recent years. Appendix tables 2, 3, 4 and 5 show the development of tax revenues, the CIT ratesdivided by wealth categories, and the revenue losses by looking at the time series. These simple charts clearly confirm the hypothesis tested by Crivelli et al. (2016) and Cobham and Janský (2018), namely the downward trend of CIT rates around the world over the last 40 years and the higher losses for low-income countries in terms of % of GDP from corporate taxation.

Section 4: Results

In this section, I present the regression estimates resulting from the equation used by Crivelli et al. (2016) to determine the spillover effects. Table 2 shows the main results divided by the three weights used for the equation, presenting the baseline spillover effect and its statistical significance. Appendix tables 9, 10 and 11 show the same typology of regressions for each category subdivided between non-OECD and OECD countries. The approach is similar to that used by Cobham and Janský (2018), though without making the comparison with the IMF data results provided by Crivelli et al. (2016). In line with the results obtained by Cobham and Janský (2018), also here the significance of the regressions is not always consistently linear. GDP weighted tax rates are not always significant and the same can be said for the haven unweighted tax rates. Agriculture share of GDP appears to be less significant, although for consistency with the model of Crivelli et al. (2016), I decided to keep it in the vector. Differentiation between OECD and non-OECD results is more enlightening and significant: the tax haven unweighted tax rate regression is more significant for OECD countries, possibly highlighting the weight that nations like Ireland, Luxembourg or the Netherlands have in the panel of data. The same logic can explain the higher level of significance present for the GDP weighted tax rate in OECD countries. Tax havens able to capture high amounts of foreign assets will end up having high levels of GDP and, above all, GDP per capita. It is no surprise, then, to see a correlation between how much wealth is 'stored' in a country and its spillover on the CIT, a phenomenon partly visible by the amount of mutual funds present in rich OECD tax haven countries managing high inflows of external assets, possibly in part coming from poorer countries as Zucman (2013) states in "*The missing wealth of nations*".

Table 2 GMM Estimators

	(1)	*(2)*	*(3)*
CIT	.2596***(.0091)	.2777*** (.0075)	.2460***(.0078)
wtinvdist	.0666**(.0337)		
wthaven		.0865** (.0368)	
wtgdp			.0011*(.0038)
agriculturegdpshare	-.0357*(.0359)	-.0088 (.0144)	-.0538*(.0345)
openness	-.0002**(.0047)	.0013*(.0020)	.0018(.0045)
inflation(log)	.0004(.0004)	-.0002**(.0001)	.0008*(.0007)
GDPpercapita(log)	-.0000(.0031)	.0007*(.0012)	.0061***(.0022)
constant	.6121*(.0397)	.6313**(.0309)	.6640*(.0228)

Number of observations =	3,206	3,245	2,829
Arellano-Bond test AR(1): Pr > z =	0.057	0.016	0.484
Arellano-Bond test AR(2): Pr > z =	0.774	0.803	0.610

Sargan test of over-identifying restrictions: chi2=10,089.79 Prob > chi2 = 0.000

Hansen test of over-identifying restrictions: chi2= 114.08 Prob > chi2 = 1.000

Notes: (1) = inverse

Results from the same model for Crivelli et al. (2016) and Cobham, Janský (2018):

Table 3. Base spillovers by income level, 'haven'-weighted tax rates

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Base	Base	Base	Base	Base	Base
Data for base	IMF	IMF	IMF	GRD	GRD	GRD
CIT base, lagged	0.906*** (.0623)	0.768*** (0.0552)	0.873*** (0.0692)	0.971*** (0.0599)	0.770*** (0.0522)	0.840*** (0.0680)
CIT rate	−0.0918** (0.0193)	−0.0596 (0.108)	−0.123* (0.0525)	−0.0926** (0.0345)	−0.0673 (0.133)	−0.135* (0.0572)
CIT rate, haven weighted	0.352** (0.0300)	0.342* (0.0528)	0.515* (0.0684)	0.289* (0.0832)	0.254 (0.158)	−0.00734 (0.983)
Inflation (log)	0.144 (0.688)	−0.0625 (0.793)	0.136 (0.732)	0.725* (0.0936)	−0.102 (0.650)	0.293 (0.521)
Trade openness	0.0403** (0.0373)	−0.0211 (0.137)	0.00758 (0.651)	0.0120 (0.441)	−0.0246** (0.0181)	0.00860 (0.606)
GDP per capita (log)	0.0924 (0.945)	0.448 (0.711)	1.334 (0.403)	0.394 (0.705)	0.574 (0.633)	2.114* (0.0510)
Agriculture		−0.134 (0.311)			−0.113 (0.400)	
Time trend	0.165** (0.0325)	0.157* (0.0615)	0.267** (0.0430)	0.131* (0.0987)	0.0893 (0.222)	0.0842 (0.591)
Constant	−339.5** (0.0349)	−321.5* (0.0712)	−554.5** (0.0407)	−271.4 (0.101)	−184.4 (0.225)	−179.8 (0.577)
Observations	1687	624	949	1602	649	829
Number of countries	103	28	72	101	29	69

Notes: We tested, similarly to Crivelli et al. (2016), the restriction that $\hat{\varphi} = -\gamma$ with the null hypothesis that the base spillover and the own-tax effects are identical but with opposite sign. The p-values from the testing for the six specifications are 0.0977, 0.0939, 0.1734, 0.8138, 0.5983 and 0.9825. The null hypothesis is not rejected for any of the regressions in Table 3 at the 0.05 significance level and only barely in two cases at the 0.10 significance level. Imposing the restriction, which should then lead to an improvement in efficiency in most cases and is significant at the 0.05 level for four out of the six specifications. GDP, gross domestic product; GRD, Government Revenue Database; IMF, International Monetary Fund. Source: Authors' calculations based on data from Crivelli et al. (2016) and the GRD.

Inflation and openness do not appear to have a high level of significance in either the regressions of OECD or non-OECD countries. The only case where the relationship is significant is between the inverse distance weighted tax rate and the level of openness of an economy.

Given the results of the GMM estimator, in order to estimate the revenue costs of BEPS (Base Erosion and Profit Shifting), I follow the further equations stated in the methodology section. By dividing the data panels between OECD countries and non-OECD countries, I create restricted coefficients estimates (in the formula stated as λ). I then use the coefficients to estimate short and long revenue losses by combing the results for OECD and non-OECD countries.

Revenue loss estimates

In this section, I describe and analyse the results of long-term estimates of revenues (in equation 3 defined as LL_{it}) in 2019 (in per cent of GDP), subcategorising them by country. Appendix tables 11, 4 and 5 show the results of the estimates, indicating a flattening trend in revenue losses in % of GDP for every category during the most recent decades, reaching their all-time low of tax revenue losses in the last years, as evident in the estimations of Cobham and Janský (2018).

Table 8 in the Appendix shows the data in absolute numbers, testifying to how the revenue losses increased for a prolonged period and then stabilised in recent years despite the growth of GDP. In particular, looking at the subdivision between OECD countries and non-OECD countries, it is possible to notice how the non-OECD countries experience rapid growth in revenue losses in the twenty years between 1994 and 2014, and then finally flatten in the last period, possibly a sign of a plateau. Janský and Cobham's results are quite similar from this point of view, likewise observing rising profit shifting at least until 2013 but estimating slightly higher total revenue losses (USD 494 billion in 2013) than the calculations I obtain in this paper (USD 480 billion in 2019, USD 449 billion in 2013).

Table 12 describes the granular results in detail. According to the long-run revenue estimates, in 2019, 35 countries experienced positive net income/losses from tax avoidance, despite not all of them being considered tax havens (e.g. Finland, Uzbekistan, Brazil), 21 countries faced losses greater than 1% of GDP, and the others remained at around 0 and 1%, showing a great concentration in this area where revenue losses are contained. As in the results of Cobham and Jansky (2018), the countries that usually lose tax revenues are part of the low-income or middle-income countries, confirming the trend of developing countries being more exposed to tax avoidance practices, while tax havens are usually more present in the list of countries gaining revenues.

Finally, to define the grade of uncertainty in my estimations, I follow the approach of Crivelli et al. (2016) approximating the standard errors underlying the country-specific revenue estimates. To do so, I compute the standard errors of the estimated parameters used for the estimation of revenue costs and compare the two standard errors estimates with the short-run and long-run estimates and then with the OECD and non-OECD countries.

In the case of OECD countries, the standard deviation for the short-run revenues is between -0.0004324 and 0.084467, around the actual point estimate of 0.0376844. For non-OECD countries, the range lies between 0.098747 and 0.200472, around the actual point estimate of 0.112235.

Regarding the evaluation of uncertainty vis-à-vis long-run revenues, I take into account the standard error from the same regression and use the part of equation 3 $\frac{\varphi}{1-\lambda}$ to obtain the approximations of the standard errors. Under this hypothesis, the results obtained provide a grade of uncertainty for the long-run revenues for OECD countries between -0.00553489 and 0.3989784 around the point estimate of 0.13472584, while for non-OECD countries the range is between 0.3627460 and 2.42217694, around the point estimate of 0.73241970. The results do not differ much from those obtained by Crivelli et al. (2016) and Cobham and Janský (2018); they all remain in fairly large confidence bands, especially for long-run revenue estimates. Thus, the results are not unexpected and indicate a level of uncertainty that is probably not possible to overcome with this model.

In short, the main takeaway from the data is that OECD countries are the biggest losers in absolute terms but not in % of GDP. Several reason might explain this difference. Cobham and Jansky (2018) mention the commodity boom the 2000s as a possible correlation in the phenomenon. However, the cause might also be attributed to the increasing internationalisation of financial institutions in those years, with consequent increasing sophistication of the branches of multinational companies present in tax havens (Palan, Murphy, Chavagneux, 2010).

On another note, the main driver of the change in tax revenue losses remains the non-inclusion of the effect of tax havens on the tax bases, thereby reducing the possible revenues derived from tax avoidance; hence the revenue losses. On this point, Cobham and Jansky (2018) note how the tax haven variable is independent of the CIT revenues both in terms of singular year and country, given the creation of the weighted average based on the CIT of the specific country in year *t*. In table 6 of the Appendix, I account for this change, showing the average difference between the corporate tax rate and haven-unweighted average CIT. The table shows how the decreasing gap between the two variables coincides with the decreasing cost of BEPS as a share of GDP – numbers first verified by Cobham and Janský (2018) and confirmed here for the period from 2013 to 2019. The authors observed that the figure is possible proof of a correlation between lower tax rates and lower tax avoidance, though mentioning different studies showing the contrary, i.e., an increasing trend of profit shifting despite the fall in global corporate tax rates (Cobham and Janský, 2017) (Clausing, 2016).

More specifically, in Cobham and Janský (2017) the authors extensively studied the effective tax rates between 0 to 5% for US-headquartered multinationals present in major jurisdictions to where most profit is shifted, comparing them later with jurisdictions applying a 15-20 per cent rate in the US or in other economies on average. Cobham and Janský (2017) observed that the underlying cause of the decreasing difference between the corporate tax rate and haven-unweighted average CIT is a methodological one, stating the possibility of obtaining different results using effective tax rates (ETR) instead of average CIT.

Currently, data on ETR are still incomplete and the OECD has only recently started collecting them (the current dataset only goes back to 2017). Studies propose various methodologies for calculating the ETR, but in this paper, I follow the macro-backward-looking method, which computes effective tax rates by extrapolating data at the micro level and then aggregated at the national level, i.e., the ratios of taxes paid by the corporations aggregated to obtain the amount of aggregate corporate profit or corporate gross operating surplus present in the country (Nicodème, 2001). For the computation, I use data from the Bureau of Economic Analysis and aggregate them with the most recent data from the OECD. The result (in table 7) I obtain by calculating the difference between ETR and the weighted tax haven effective tax rates does effectively show a change in the development trend of revenue losses. However, it is difficult to rely on these data because of the high level of uncertainty behind their computation; being based on aggregated data, the calculation of the

ETR lacks granularity and specifications regarding how the effective tax rate changes by income group at the national level. Furthermore, even by relying solely on recent data on ETR from the OECD, it is possible to notice how the percentage difference between the two tax rates does not move far away from the difference presented in table 6, at least from 2017 onwards, making the hypothesis of using ETR to obtain different conclusions possibly still too difficult to answer or just inconclusive.

Section 5: Conclusion

In this paper, I re-estimate the results of Crivelli et al. (2016) and Cobham and Janský (2018) by using the same model conceived by Crivelli and the most recent data on tax revenues from (ICTD–WIDER) GRD. My re-estimations confirm the effectiveness of the model and explore the possible changes in revenue losses that may have occurred since the above studies were undertaken. My results are generally similar to those of Crivelli et al. (2016) and Cobham and Janský (2018), highlighting the lack of a significant increase in tax revenue losses since the late 2010s. In particular, my results indicate estimated losses in tax revenues of around USD 480 billion in 2019, compared to USD 500 billion in 2013 as estimated by the two authors. In terms of percentage of GDP, my results confirm the presence of a higher share of losses in low-income, and more generally, in non-OECD countries. Thus, I confirm the higher intensity of tax avoidance practices in these countries, in part because of their high reliance on CIT revenues, and in part because of other factors marginally mentioned in this paper. The results also reflect the attainment of a plateau with respect to the total level of tax revenue losses, which have not increased since 2013. The granular data on tax revenue losses country-by-country indicate that the situation at the continental level (for almost every continent) is quite fragmented; in the space of several hundred kilometres, it is possible to find countries that are able to take advantage of tax avoidance practices implemented by multinational companies and others that are not. The estimators of spillover effects in this regard reveal how each continent and country can be substantially affected by singular variables, indicating the possible presence of endogenous roots of the tax avoidance phenomenon.

The findings contribute to the research on revenue losses from corporate tax avoidance at global level and may serve as a source of data for future research. In view of further challenges and the certain development of more complete datasets in the coming years, two important points emerge from my paper with sufficient broad evidence: 1) lower-income countries in general suffer more intense corporate tax avoidance, and 2) there are substantial variations among countries by income and by region, such that policymakers should pay close attention to their specific situation. In the international context, countries and their policymakers should assess whether the enforcement of a new tax regime at the global level can benefit countries that are more impacted by tax avoidance practices. Looking ahead, insights could be gained by considering the granular data in this paper when researching countries more and less impacted by government tax gains/losses with a view to better understanding the causes behind cases in individual countries.

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Appendix

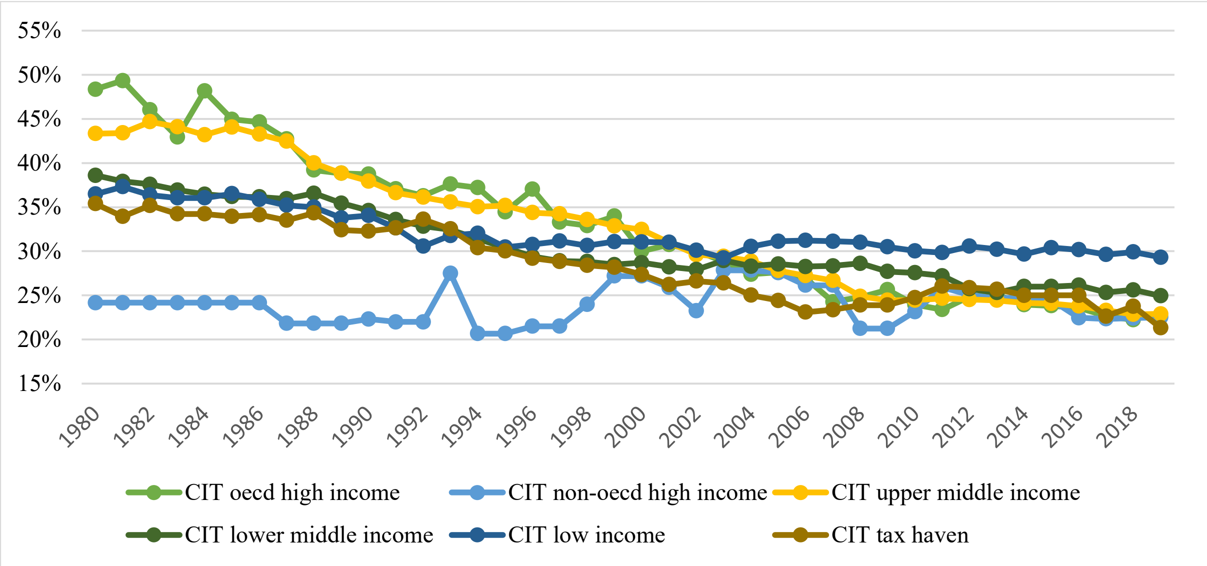
Table 1, Crivelli et al. (2016) and Cobham, Jansky (2018) descriptive statistics

Table 1. Descriptive statistics

	Observations	Mean	Max.	Min.	Std. Dev.
Crivelli et al. (2016)					
Statutory CIT rate, in per cent	2185	33.33	61.80	2.00	9.65
GDP-weighted average tax rate, in per cent	2185	38.56	48.04	29.16	4.82
Haven-weighted average CIT rate, in per cent	2185	28.24	35.39	21.34	4.20
Inverse-distance-weighted average CIT rate, in per cent	2185	31.32	41.21	18.60	4.64
CIT revenue, per cent of GDP	2185	2.73	16.54	0.00	1.73
OECD countries	893	2.80	8.02	0.26	1.26
Non-OECD countries	1292	2.68	16.54	0.01	1.98
CIT base, per cent of GDP	2185	9.03	70.97	0.00	6.75
OECD countries	893	8.75	29.99	1.06	4.61
Non-OECD countries	1292	9.22	70.97	0.00	7.89
AETR, in per cent	391	22.86	40.27	−11.61	9.19
GDP-weighted AETR, in per cent	391	21.26	23.74	19.00	1.49
Agricultural value-added, per cent of GDP	1847	11.74	64.05	0.04	10.74
GDP per capita, 2000 USD	1995	13 235	87 717	127	15 298
Trade openness, per cent of GDP	1999	78.87	436.95	6.32	45.03
Inflation, in per cent	1950	36.10	11749.64	−4.47	366.03
Additional data					
CIT revenue, per cent of GDP (GRD)	2129	2.57	11.20	0	1.48
OECD countries (GRD)	962	2.76	7.87	0	1.29
Non-OECD countries (GRD)	1167	2.41	11.20	0.01	1.61
CIT base, per cent of GDP (GRD)	2129	8.60	64.88	0	6.08
OECD countries (GRD)	962	8.74	29.11	0	4.68
Non-OECD countries (GRD)	1167	8.49	64.88	0.02	7.02

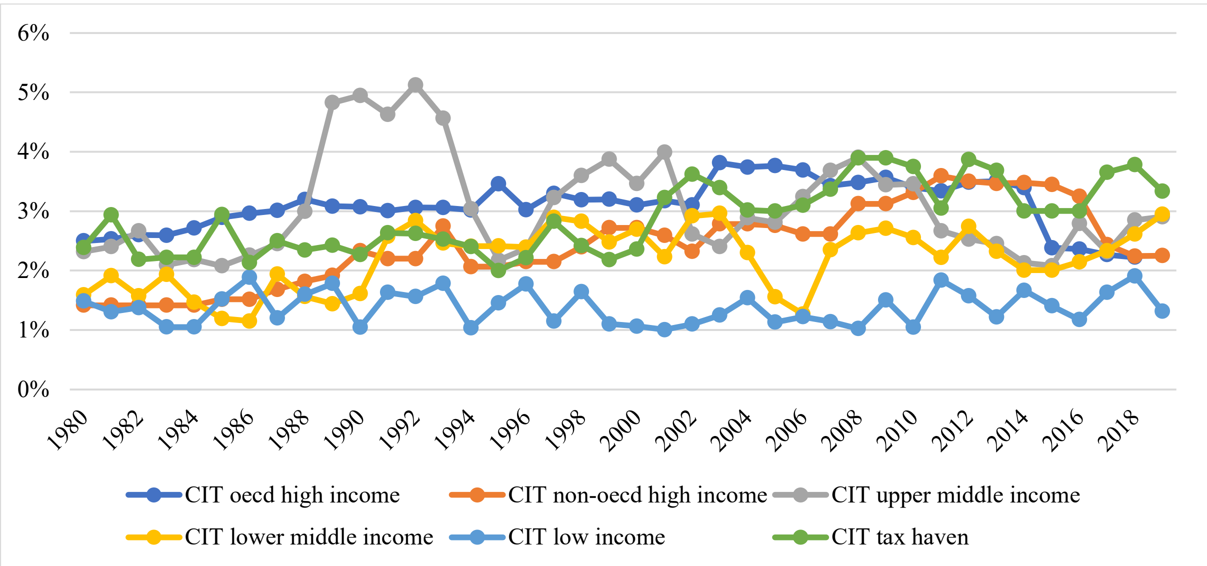
Notes: Showing observations for non-resource-rich countries. AETR, average effective tax rates; GDP, gross domestic product; GRD, Government Revenue Database; OECD, Organization for Economic Co-operation and Development. Source: Authors' calculations based on data from Crivelli et al. (2016) and the GRD.

Table 2, corporate income tax rate (CIT) divided by category



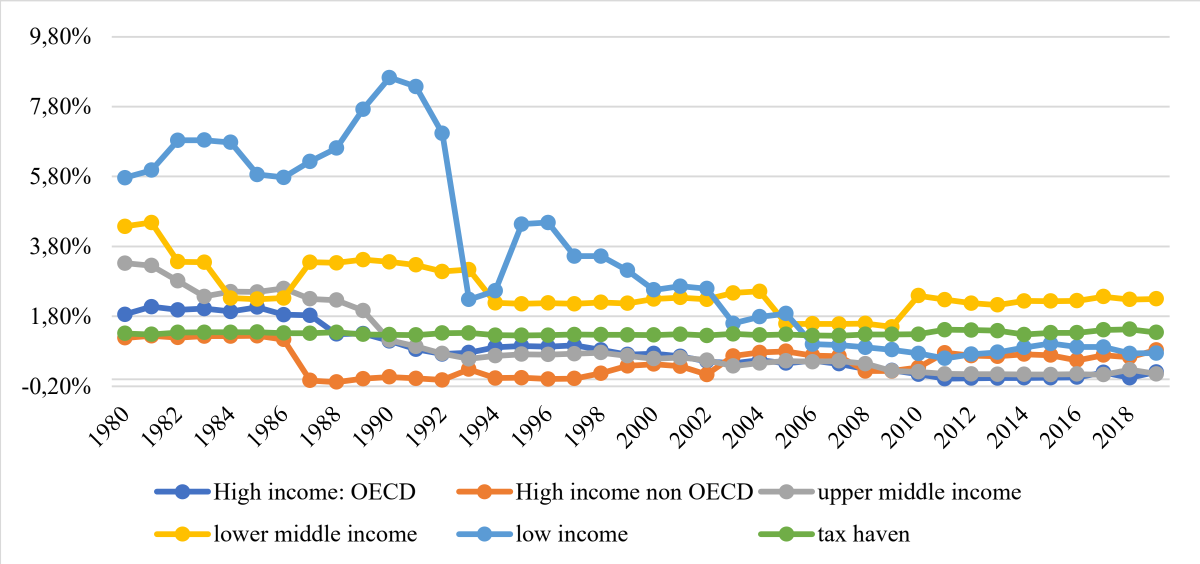
Source: Authors' calculations based on data from GRD (ICTD–WIDER) and KPMG corporate tax rates dataset

Table 3, revenues from corporate taxation dividided by category



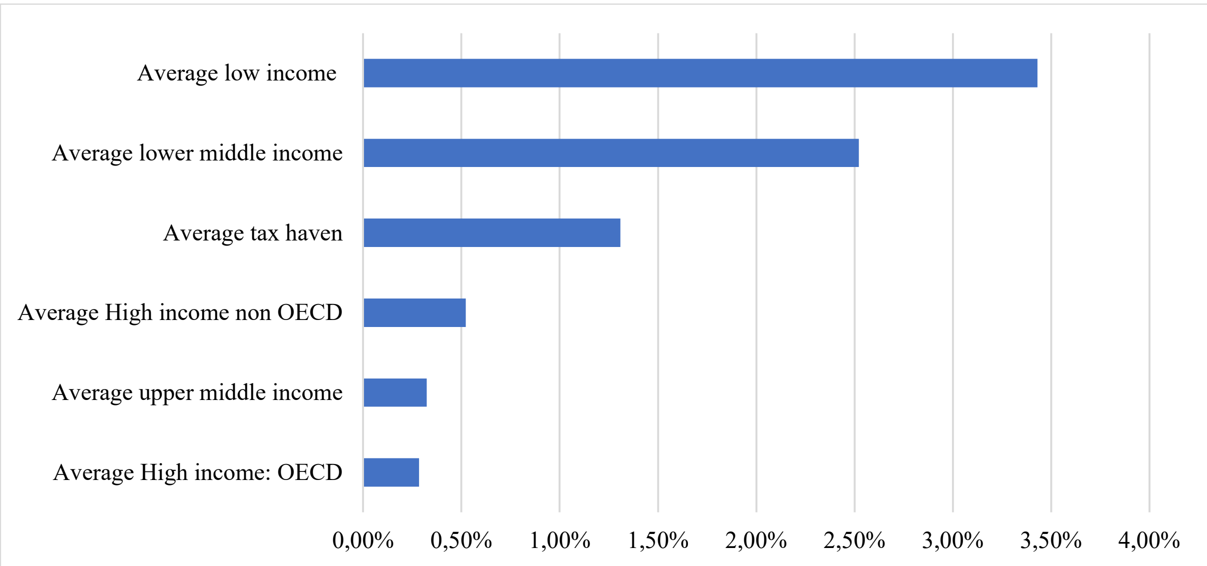
Source: Authors' calculations based on data from GRD (ICTD–WIDER)

Table 4, Revenue losses from corporate taxation divided by category (expressed in % of GDP)



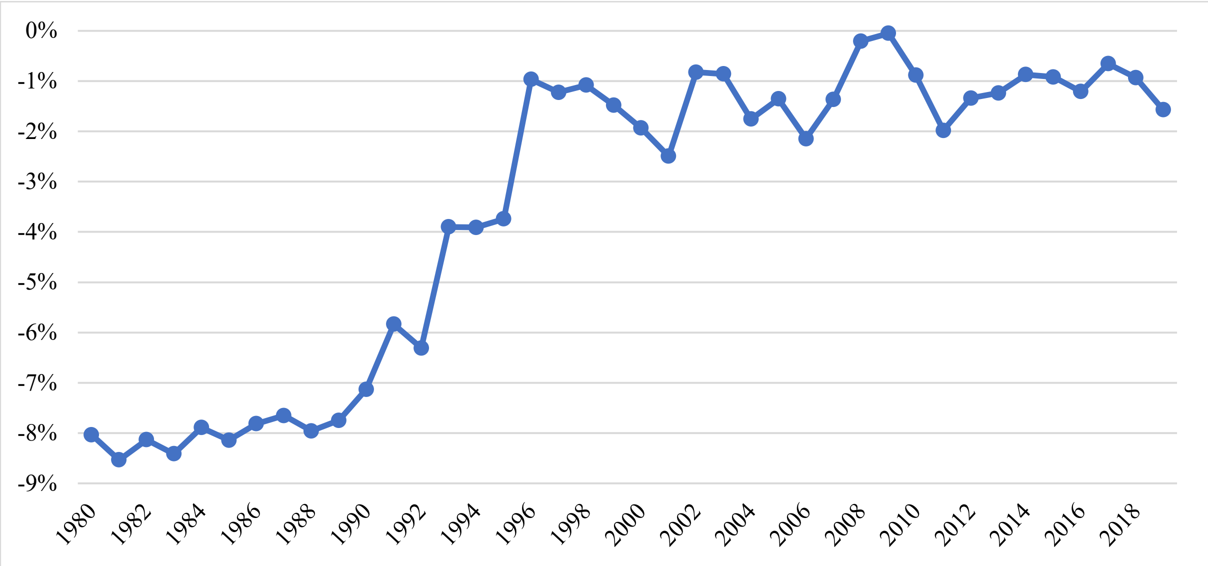
Source: Authors' calculations based on data from GRD (ICTD–WIDER)

Table 5, average revenue losses from corporate taxation divided by category (expressed in % of GDP)



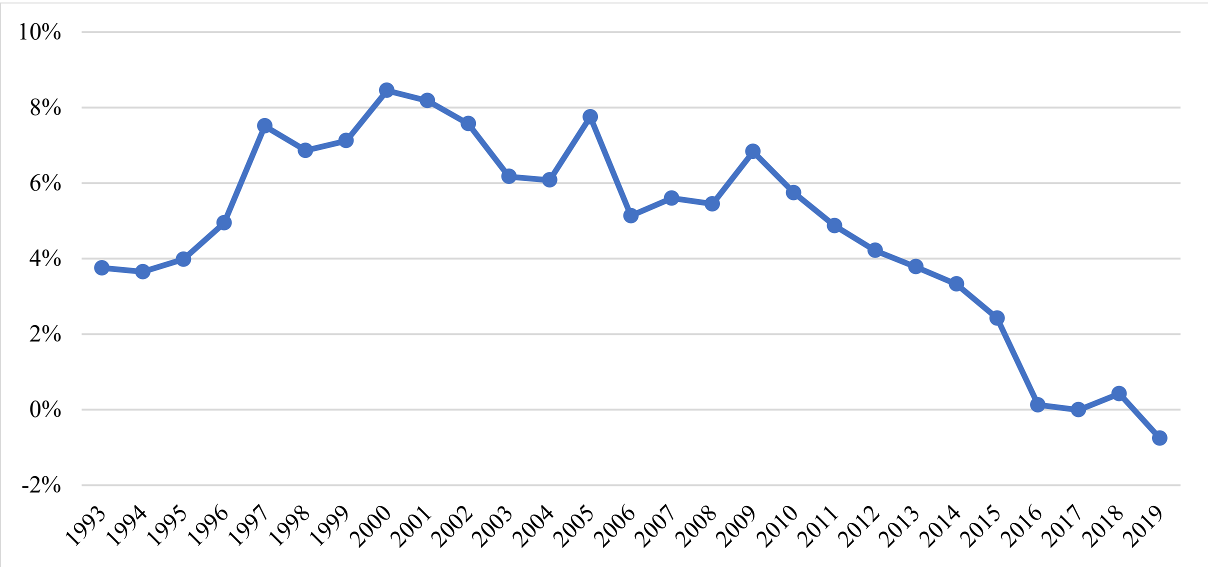
Source: Authors' calculations based on data from GRD (ICTD–WIDER)

Table 6, difference between CIT and weighted tax haven CIT



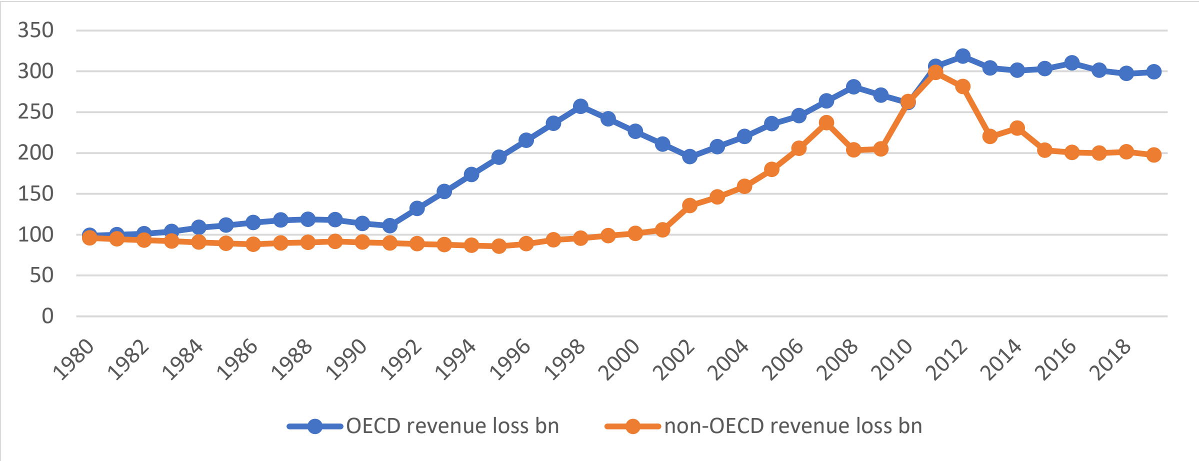
Source: Authors' calculations based on data from GRD (ICTD–WIDER)

Table 7, difference between ETR and weighted tax haven CIT



Source: Authors' calculations based on data from OECD statistics and the Bureau of Economic analysis

Table 8, Revenue losses, US$ billion



Source: Authors' calculations based on data from GRD (ICTD–WIDER)

Table 9, inverse distance weighted corporate tax OECD and non-OECD

	(1)	*(2)*
CIT	.2727***(.0179)	.2488***(.0109)
wtinvdist	.1387*(.0701)	-.0386*(.0397)
agriculturegdpshare	-.0639(.1220)	.0079 (.0236)
openness	.0070*(.0058)	.0006*(.0046)
inflation(log)	.0007*(.0069)	.0002*(.0002)
GDPpercapita(log)	-.0045**(.0035)	-.0011(.0021)
constant	.6460***(.0629)	.6312*(.0309)

Number of observations = 1,147 2,059
Arellano-Bond test AR(1): Pr > z = 0.009 0.587
Arellano-Bond test AR(2): Pr > z = 0.560 0.521
Notes: (1) = OECD countries (2) =non-OECD countries

Sargan test of over-identifying restrictions: chi2(1314) =9867.64 Prob > chi2 = 0.000

Hansen test of over-identifying restrictions: chi2(1314) = 117.44 Prob > chi2 = 1.000

Table 10, tax haven weighted corporate tax OECD and non-OECD

	(1)	*(2)*
CIT	.2811***(.0121)	.2720***(.0096)
wthaven	.2717***(.0623)	-.0187*(.0420)
agriculturegdpshare	-.1046*(.0575)	.0050(.0142)
openness	.0078**(.0039)	.0012*(.0019)
inflation(log)	.0007(.0026)	-.0001 **(.0000)
GDPpercapita(log)	-.0005(.0023)	.0008*(.0016)
constant	.5831**(.0405)	.6387**(.0212)

Number of observations =	1147	2098
Arellano-Bond test AR (1): Pr > z =	0.105	0.265
Arellano-Bond test AR (2): Pr > z =	0.244	0.613

Notes: (1) =OECD countries (2) =non-OECD countries

Sargan test of over-identifying restrictions: chi2(1314) =10,032.55 Prob > chi2 = 0.000

Hansen test of over-identifying restrictions: chi2(1314) = 111.54 Prob > chi2 = 1.000

Table 11, GDP weighted corporate tax OECD and non-OECD

	(1)	*(2)*
CIT	.2495***(.0162)	.2450***(.0116)
wtgdp	.0196***(.0052)	-.0037*(.0044)
agriculturegdpshare	-.0293*(.1061)	-.0127(.0273)
openness	-.0007*(.0058)	.0050*(.0055)
inflation(log)	.0061*(.0112)	-.0019*(.0024)

GDPpercapita(log)	.6495***(.0388)	.6210**(.0238)
constant	.5831**(.0405)	.6387**(.0212)

Number of observations = 941 1888
Arellano-Bond test AR (1): Pr > z = 0.105 0.265
Arellano-Bond test AR (2): Pr > z = 0.989 0.023
Notes: (1) =OECD countries (2) =non-OECD countries

Sargan test of over-identifying restrictions: chi2(1314) =10,121.98 Prob > chi2 = 0.000

Hansen test of over-identifying restrictions: chi2(1314) = 119.51 Prob > chi2 = 1.000

Table 12, revenue losses in 2019

	GRD revenue loss	GRD % GDP	GRD % revenue
Albania	-12,320,199	-0.08%	-0.03%
Argentina	4,093,593,750	0.78%	1.66%
Armenia	3,145,133	0.03%	0.68%
Australia	10,857,229,000	0.78%	1.56%
Austria	1,223,782,500	0.27%	0.56%
Azerbaijan	691,300,250	1.43%	19.61%
Barbados	-13,608,513	-0.26%	0.31%
Belarus	429,612,313	0.67%	7.39%
Belgium	3,570,375,500	0.67%	1.32%
Belize	324,334	0.02%	0.02%
Bhutan	59,827,322	0.44%	0.97%
Bolivia	112,462,117	0.27%	1.41%
Bosnia and Herzegovina	-68,684,500	-0.34%	-4.57%
Botswana	736,484	0.00%	0.00%
Brazil	-26,946,776,000	-1.43%	-8.72%
Bulgaria	-234,312,422	-0.34%	-5.12%
Burkina Faso	1,839,338	0.01%	0.20%
Cabo Verde	488,543	0.02%	0.11%
Cambodia	-21,671,520	-0.08%	0.13%
Cameroon	3,583,719	0.01%	0.04%
Canada	7,153,524,000	0.41%	0.89%
Chile	1,282,379,250	0.46%	0.35%
China	96,372,847,823	0.67%	0.99%
Colombia	2,984,832,303	0.92%	0.41%
Congo, Democratic Republic	387,312,569	0.77%	
Congo, Republic of the	4,618,334	0.04%	0.56%
Cook Islands	133,555,219	2.24%	0.16%

Costa Rica	499,768,344	0.78%	0.05%
Cote d'Ivoire	3,857,250	0.01%	0.32%
Croatia	-112,043,188	-0.18%	-0.59%
Curaçao	24,193,941	0.78%	9.88%
Cyprus	-85,324,563	-0.33%	0.76%
Czechia	-335,822,438	-0.13%	0.98%
Denmark	152,926,875	0.04%	0.87%
Dominica	125,341	0.02%	0.88%
Dominican Republic	244,588,531	0.27%	0.97%
Ecuador	38,494,223	0.04%	0.79%
Egypt	196,648,891	0.08%	0.20%
El Salvador	209,793,938	0.78%	30.79%
Estonia	-24,836,482	-0.08%	0.55%
Ethiopia	1,942,893,840	2.03%	0.89%
Fiji	13,838,221	0.25%	0.88%
Finland	-215,026,063	-0.08%	0.79%
France	24,532,542,000	0.90%	1.78%
Georgia	-49,810,184	-0.29%	-3.86%
Germany	30,328,946,000	0.78%	1.56%
Ghana	43,438,923	0.06%	0.67%
Greece	1,368,311,375	0.67%	1.45%
Grenada	3,234,974	0.27%	1.43%
Guatemala	211,805,016	0.27%	0.35%
Guyana	165,301,641	3.20%	0.72%
Honduras	68,517,680	0.27%	0.36%
Hungary	-544,543,250	-0.33%	-0.67%
Iceland	-19,886,199	-0.08%	-0.90%
India	43,087,983,000	1.50%	-0.20%
Indonesia	3,077,500,500	0.27%	0.76%
Ireland	-1,322,091,875	-0.33%	-0.88%
Israel	1,094,320,000	0.27%	0.78%
Italy	19,054,584,000	0.95%	1.67%
Jamaica	43,534,605	0.27%	0.98%
Japan	43,922,880,000	0.85%	1.41%
Jordan	4,726,523	0.01%	0.69%
Kenya	1,437,294,835	1.43%	1.99%
Kiribati	958,443	0.51%	2.78%
Korea, Republic of	3,436,941,000	0.21%	0.01%
Kyrgyzstan	140,517,047	1.58%	0.70%
Lao People’s Republic	198,378,434	1.05%	1.99%
Latvia	-97,780,047	-0.29%	-0.87%
Lesotho	2,049,893	0.09%	1.00%
Lithuania	-155,887,547	-0.29%	-0.56%
Luxembourg	-238,665,453	-0.34%	-0.98%
Macao, China	-185,488,000	-0.34%	-1.27%
Madagascar	-4,942,573	-0.04%	-0.55%
Malaysia	23,559,374	0.01%	0.76%
Maldives	-34,983,400	-0.62%	-23.72%
Mali	397,324,487	2.30%	0.00%
Malta	41,843,207	0.27%	8.37%
Mauritania	35,879,535	0.45%	1.01%
Mauritius	-40,030,559	-0.29%	-0.34%
Mexico	9,901,584,000	0.78%	1.05%

Moldova	-40,219,988	-0.34%	-0.64%
Mongolia	154,671,719	1.09%	0.01%
Montenegro	-18,457,105	-0.33%	-8.83%
Morocco	2,974,644,139	2.48%	3.66%
Myanmar	312,375,125	0.27%	0.02%
Netherlands	2,503,034,000	0.27%	0.72%
New Zealand	1,192,189,750	0.56%	0.99%
Nicaragua	98,367,500	0.78%	2.11%
Niger	24,826,333	0.19%	0.77%
Nigeria	3,495,339,000	0.78%	0.31%
North Macedonia	340,985,469	3.19%	1.61%
Norway	2,270,855,750	0.56%	0.84%
Pakistan	4,514,044,000	1.43%	0.72%
Panama	184,207,141	0.27%	14.99%
Paraguay	-128,883,617	-0.34%	-0.89%
Peru	1,782,073,000	0.78%	11.41%
Philippines	7,643,907,904	2.03%	0.00%
Poland	-781,257,750	-0.13%	-0.45%
Portugal	659,963,938	0.27%	0.78%
Romania	-639,696,938	-0.26%	-1.91%
Russian Federation	13,162,097,000	0.78%	0.34%
Rwanda	119,611,500	1.15%	0.05%
Saint Lucia	16,526,572	0.78%	2.10%
San Marino	23,753,566	1.43%	39.50%
Senegal	45,323,498	0.19%	0.00%
Serbia	-58,732,734	-0.11%	-0.72%
Seychelles	2,178,424	0.14%	1.11%
Singapore	-827,393,813	-0.22%	-7.70%
Slovakia	-22,109,752	-0.02%	-0.64%
Slovenia	-119,735,336	-0.22%	-0.31%
Solomon Islands	48,927,824	3.12%	1.67%
South Africa	1,066,819,875	0.27%	0.54%
Spain	3,830,876,250	0.27%	0.75%
Sweden	22,849,867	0.00%	0.00%
Switzerland	-3,722,866,250	-0.51%	-1.54%
Tajikistan	119,116,258	1.43%	5.62%
Thailand	-435,411,219	-0.08%	-0.12%
Togo	98,862,354	1.37%	1.78%
Tunisia	1,382,647,869	3.31%	4.65%
Turkey	-608,803,750	-0.08%	0.80%
Uganda	583,835,435	1.65%	1.98%
Ukraine	-276,989,406	-0.18%	-0.18%
United Arab Emirates	23,176,324,000	5.55%	48.64%
United Kingdom	-3,828,637,000	-0.13%	0.31%
United States	198,378,496,000	0.93%	1.67%
Uruguay	168,385,641	0.27%	0.52%
Uzbekistan	-754,856,433	-1.26%	-1.70%
Vietnam	2,042,985,500	0.78%	1.32%
Zimbabwe	143,985,798	0.75%	0.71%

Source: Authors’ calculations based on data from GRD (ICTD–WIDER)

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