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Estimating the Scale of Corporate Profit Shifting: Tax Revenue Losses Related to Foreign Direct Investment

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Abstract

Corporate taxation of multinational enterprises (MNEs) plays an important role in revenue mobilization efforts, and these are hampered when MNEs avoid paying corporate taxes. In this paper, we estimate the scale of international corporate tax avoidance using foreign direct investment data. We use and extend the methodology developed by the United Nations Conference on Trade and Development to estimate tax revenue losses related to inward investment stocks as directly linked to tax havens and offshore financial centres. For the first time, we provide detailed country-level estimates. This enables us to study the effects of tax avoidance practices on individual countries' government revenues as well as to compare their impact on European Union countries and lower-income countries.

Keywords: corporate income tax; international taxation; tax avoidance; BEPS; foreign direct investment

JEL classification: F21, F23, H25

1 Introduction

Corporate taxation of multinational enterprises (MNEs) plays an important role in revenue mobilization efforts, and these are hampered when MNEs avoid paying corporate taxes. Our objective as researchers is to identify the scale of this problem and provide updated estimates of the revenue foregone due to tax avoidance by MNEs. We estimate tax revenue losses at the country level to understand who is losing or gaining the most from the current practice of international corporate tax avoidance. For example, are all developing countries or all European Union members losing tax revenue? Are the estimates consistent with the notion that Mauritius and Luxembourg exploit the current international tax system loopholes at the expense of Mozambique and Latvia? Furthermore, with estimates for individual countries we are also able to track the impact of international corporate tax regulatory innovations as they continue to develop over the years.

In this paper, we estimate the scale of international corporate tax avoidance through profit shifting, using data on foreign direct investment (FDI). We use and extend the methodology developed by the United Nations Conference on Trade and Development to estimate tax revenue losses related to inward investment stocks as directly linked to tax havens. For the first time, we provide detailed country-level estimates and use alternative approaches to define tax havens. This enables us to study the effects of tax avoidance practices on individual countries' government revenues as well as to compare their impact on European Union countries, developing countries and tax havens. We discuss trends in the estimated scale of corporate tax avoidance over time and what the effect of certain recommendations, already implemented or currently proposed, might be. We compare the strengths and weaknesses of this methodological approach, provide robustness checks and propose alternative approaches.

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The paper's empirical contribution is presented in the following three stages. First, we re-estimate and at the same time critically review the work of UNCTAD (2015). Second, for the first time we provide country-level results of the estimated tax revenue losses. Third, we develop an alternative method using the FDI data and compare all the estimates with the results of similar studies.

We begin with a brief literature review of previous similar estimates in Section 2 and an overview of the data used in Section 3. We describe our empirical methodology in Section 4 and present the results in Section 5. Finally, Section 6 provides a discussion of the implications of the results and concludes.

2 Literature review

In this literature review, we first discuss recent literature related to corporate profit shifting and the resulting tax revenue losses and then discuss the research by UNCTAD (2015) on which we will build in this paper. There is a growing research literature on international corporate tax avoidance that aims to identify and quantify MNEs' specific tax avoidance mechanisms, as discussed recently by Janský (2016). Three main profit shifting channels are recognised: debt shifting, location of intangible assets and intellectual property, and strategic transfer pricing. All three are motivated by the MNEs' assumed desire to reduce their total amount of tax paid by at least nominally transferring their profits and thus tax bases to lower-tax jurisdictions, i.e. those with lower effective tax rates. This transfer can be implemented, for example, through often unnecessary loans at high interest rates from one MNE unit located in a low-tax jurisdiction to another profitable unit. Alternatively, intangible assets and intellectual property such as brands or research and development can be stationed artificially at a subsidiary in a tax haven, to which high service fees are then paid by other parts of the MNE. The third main channel for profit shifting is to inflate or deflate the prices of goods or services being transferred between the various foreign parts of an MNE in such a way as to minimise the tax burden faced in all the countries put together.

The quantitative evidence of MNEs shifting profits and debt and locating their headquarters or intellectual property in such a way as to avoid taxes is substantial. For example, a number of studies have provided evidence of profit shifting, especially on how tax rate differentials affect reported pre-tax profits, and on the strategies MNEs employ to reallocate profits within their groups. Dharmapala (2014) reviews the literature on how reported income changes with respect to tax rate differences across countries, represented by Hines Jr & Rice (1994), Huizinga & Laeven (2008) and Dharmapala & Riedel (2013). However, findings on the implications of this tax avoidance for government revenue are rather limited. The existing academic and policy studies provide useful guidance on what can be quantified. For example, academics often do not develop their estimates of profit shifting into estimates of revenue impacts. Three recent exceptions to this are Clausing (2009) and Zucman (2014) who provide estimates for the United States, and Clausing (2016), who adds a speculative extension to the world.

Furthermore, some policy papers and international organisations have recently developed estimates of the budgetary impact of international corporate tax avoidance. However, these studies often make a number of strong assumptions and have to deal with a lack of any realistic counterfactual, i.e. what the tax base would be in the absence of profit shifting. A few studies have been influential in the policy debate, all of which include an answer to how much governments lose because of international corporate tax avoidance: OECD (2015), IMF's Crivelli et al. (2015), UNCTAD (2015), International Monetary Fund (2014), and EPRS (2015). In most cases these studies provide worldwide estimates; the last is focused on the European Union.

In the present paper, we extend the research of the United Nations Conference on Trade and Development (UNCTAD 2015). In their 2015 World Investment Report, they estimate tax revenue losses related to inward investment stocks as directly linked to offshore hubs, focusing specifically on developing countries. They develop and estimate a foreign direct investment-driven approach to measuring the scale and economic impact of base erosion and profit shifting (BEPS). Their investment perspective on tax avoidance puts the spotlight on the role of offshore investment hubs (tax havens and special-purpose entities in other countries) as major global investment players and enables them to estimate the magnitude of this type of tax avoidance. UNCTAD (2015) estimates that some 30 percent

of cross-border corporate investment stocks are routed through offshore hubs before they reach their destination as productive assets. Their preferred estimate of annual revenue losses for developing countries, the focus of their study, is 90 billion USD; extending that estimate globally results in 8% of CIT and USD 200 billion lost in government revenue in 2012.

UNCTAD's (2015) estimation approach, first of all, establishes the fiscal contribution of multinational enterprises and especially the corporate tax paid by their foreign affiliates, which creates the baseline from which corporate tax is avoided. They estimate that around 3% of total tax revenues in developing countries are derived from MNEs' corporate income tax (i.e. around USD 220 billion using their contribution method and USD 200 billion using their FDI-income method; both methods involve restrictive assumptions which, if altered, could affect the results). They then identify 42 jurisdictions that are sources of investment as either tax havens or special-purpose entities and show that over time, corporate investment flows from these offshore hubs to developing countries increased, reaching a 2010-2012 average of 26%. For the United States, using data from the Bureau of Economic Analysis, they show that foreign affiliates of US MNEs based in this group of countries pay comparatively low taxes (2 and 3% as a share of pre-tax net income) compared with affiliates based in other locations (17%).

UNCTAD (2015) then estimates, using a regression analysis, that an additional 10% share of inward investment stock originating from offshore investment hubs is associated with a decrease in the rate of return of 1-1.5 percentage point. UNCTAD (2015) estimates the tax revenue losses through appropriate assumptions about the profitability gap (how much foreign direct investment income is missing due to investments from offshore investment hubs; the amount of corporate profits shifted from developing economies is about $450 billion) and the average corporate tax rate (a weighted average effective tax rate across developing countries at 20 percent). This results into annual tax revenue losses of some $90 billion (which is almost half of the tax actually paid; with sensitivity analysis results ranging from $70 to $120 billion). The impact on developed countries is relatively smaller; UNCTAD (2015) estimates it in the order of $100 billion.

UNCTAD's (2015) estimation approach can be summarized and simplified as follows (with their headline numbers for developing countries):

CIT revenues lost due to profit shifting for developing countries
$= \text{average offshore hub exposure of total inward FDI stock (46\%)}$
$\times \text{responsiveness of reported rate of return on offshore investment (15.8\%)}$
$\times \text{reported FDI stock (USD 5,000 billion)}$
$\times \text{transforming the aftertax values to pretax values (1.25)}$
$\times \text{weighted average effective tax rate (20\%)}$
$= \text{USD 91 billion}$

Their estimates of the relationship between reported rate of return and offshore investment seem rigorous, but it is not clear whether what they estimate is actually profit shifting, as they claim, or what its profit shifting channels are. To be clear, we are not disputing that an additional 10% share of inward investment stock originating from offshore investment hubs is associated with a decrease in the rate of return of 1-1.5 percentage point, and the role of offshore hubs does seem to be distinct, but we do not see what the likely channels of profit shifting associated with the lower returns might be and this research lacks detail and persuasiveness in this respect. Potentially, due to its methodology, UNCTAD's approach might be estimating avoidance of capital gains and withholding tax or tax treaty shopping rather than corporate income tax avoidance. If that were the case, the revenue estimates for developing countries would seem quite large (in comparison to the assumed revenue from these taxes) and they should not be derived, as they were in the formula above, from the amount of corporate income tax revenue (since they relate to taxes other than corporate income tax).

UNCTAD (2015) does acknowledge on page 201 that its estimates do not include the full effects of international corporate tax avoidance; their profit shifting and tax revenue estimates are mostly confined to those associated with tax avoidance schemes that exploit a direct investment relationship through equity or debt. For example, trade mispricing does not require a direct investment link, since MNEs can shift profits between any two affiliates based in jurisdictions with different tax rates. UNCTAD (2015)

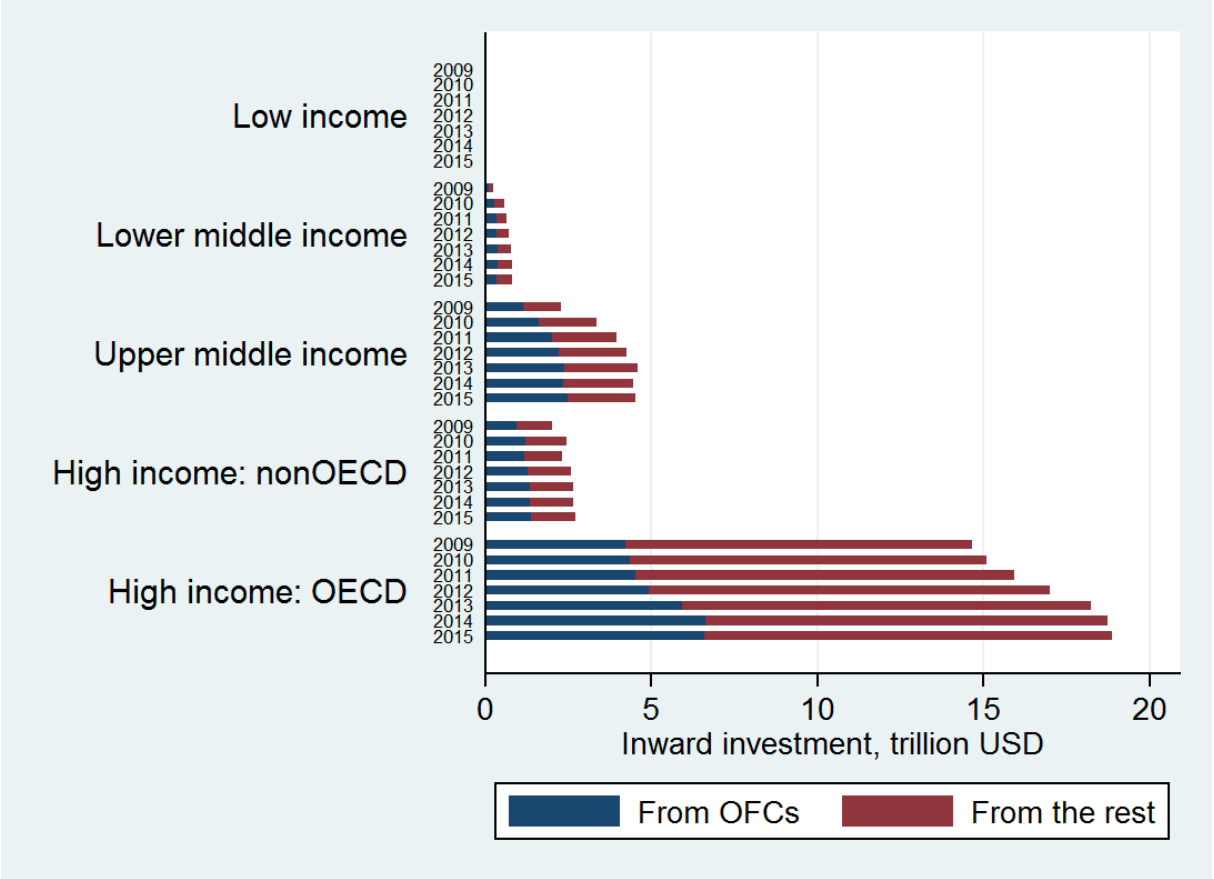
does not publish country-level results and this is one of the reasons why we re-estimate their methodology with new data and uncover the heterogeneity across countries.

3 Data

Data used in this paper can be classified into three categories. In this section, we detail these three categories. First and most important, we use data on foreign direct investment stocks on a bilateral level from the IMF's Coordinated Direct Investment Survey (CDIS), which contains data for around 100 countries between the years 2009 and 2015. For stocks of direct inward investment, we use the variable "Inward Direct Investment Positions, US Dollars (IIW_BP6_USD)". As a complement, in some limited cases where we do not need bilateral investment data, we use UNCTAD's unilateral FDI database for its better coverage of countries.

The volume of total global stock of international investment rose substantially over the observed time period. Figures 1 and 2 show this development for countries classified into income groups (Figure 1) and regions (Figure 2). While in 2009 the total foreign direct investment stock amounted to 19.26 trillion USD, in 2015 it was 26.94, a 40% increase. All groups increased their FDI stock except one – Middle East & North Africa lost 69% of its FDI stock, likely due to the combination of declining oil prices, the Arab spring and military conflicts in the region. The significant increase (by 1,382%) in South Asia's FDI stock between 2009 and 2015 is caused by the lack of data for India in 2009 – if we use India's 2010 value to compute the difference over the observed time period, we arrive at a modest 43% increase.

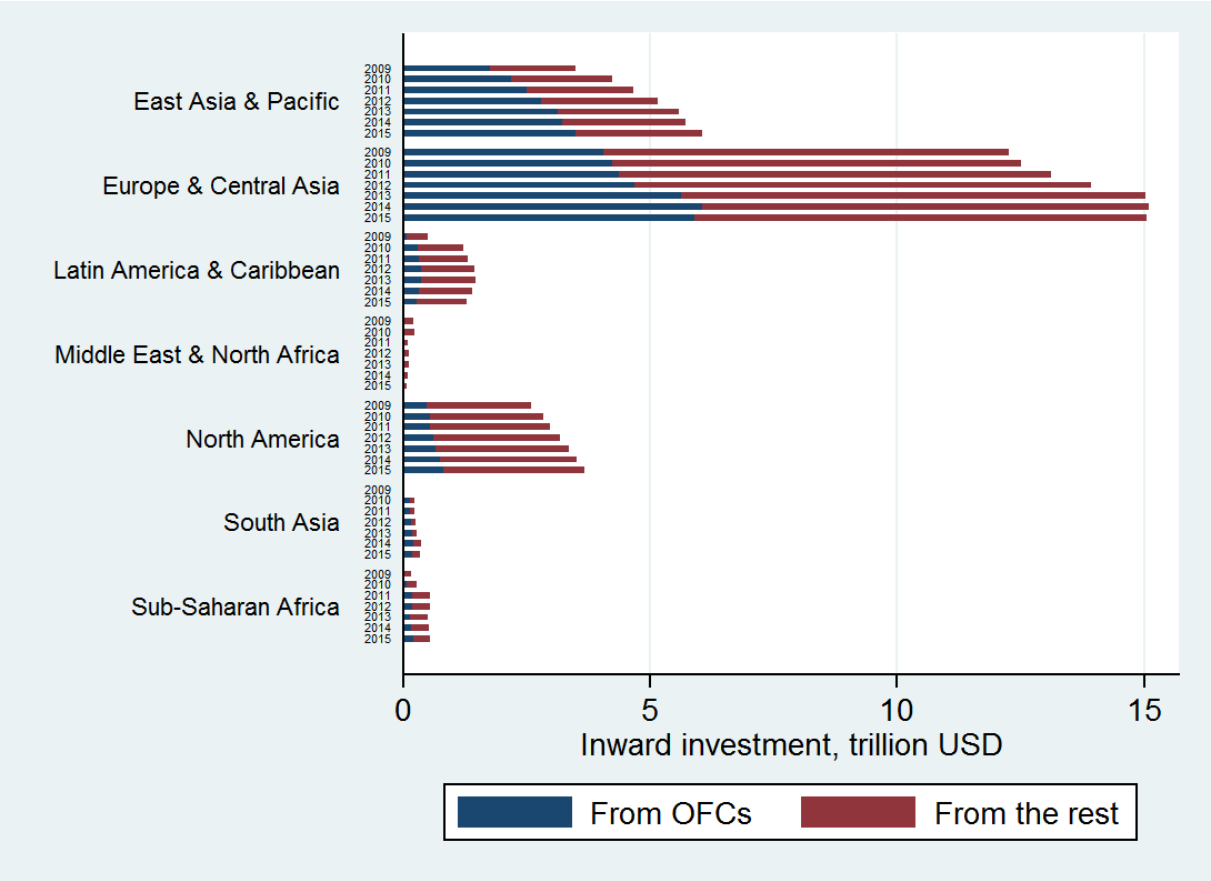
Figure 1: Development of the volume of total international investment stock between 2009 and 2015 (by income group).



Source: Data from IMF CDIS, classification by the World Bank, authors' construction.

Note: Offshore financial centres (OFCs) follow UNCTAD's (2015) definition – see methodology below.

Figure 2: Development of the volume of total international investment stock between 2009 and 2015 (by region).



Source: Data from IMF CDIS, classification by the World Bank, authors' construction.

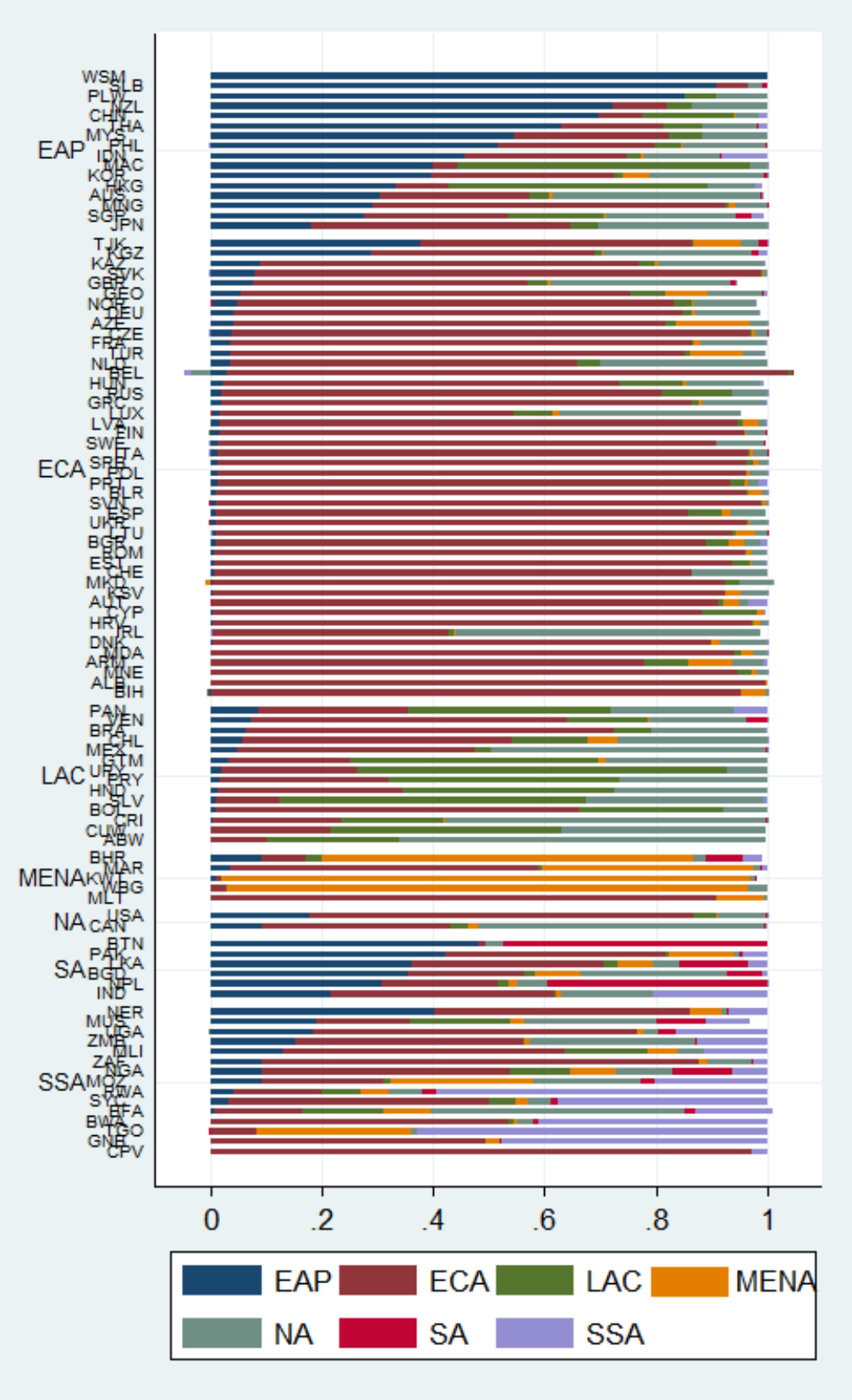
Note: Offshore financial centres (OFCs) follow UNCTAD's (2015) definition – see methodology below.

The total FDI stocks are divided into two categories based on their origin – offshore financial centers (OFCs) and other countries. This classification is based on the methodology by UNCTAD (2015) and its construction is explained in detail in Section 4. We observe that the increase in total FDI stock was caused by investment from both OFC countries and other countries.

Figure 3 shows the composition of sources of foreign direct investment by region for all the observed countries. We observe that investment largely takes place within the geographical groups. Sub-Saharan African countries have the most diversified composition of inward investment, even though the total volumes are rather low (see Figure 2 above).

As far as the EU countries are concerned, Finland and Poland are the most integrated countries investment-wise, with more than 90% of their inward investment originating from the rest of the EU, but these levels can be considered very high for most European countries. Countries traditionally perceived as tax havens (Cyprus, Ireland and the United Kingdom) and countries that enable special-purpose entity investment (as reported by UNCTAD (2015): Hungary, Luxembourg, Austria and the Netherlands) receive large portions (more than 10%) of their inward investment from non-EU offshore financial centres. The four countries that receive the lowest shares of inward investment from European countries at the same time enjoy large shares of investment from the US, which pinpoints their role as intermediaries for US companies to route profits to low-tax jurisdictions (Zucman 2014; Gravelle 2015).

Figure 3: Composition of foreign direct investment by country of origin, 2015



Source: Data from IMF CDIS, authors' construction.

Note: EAP: East Asia & Pacific, ECA: Europe & Central Asia, LAC: Latin America & Caribbean, MENA: Middle East & North Africa, NA: North America, SA: South Asia, SSA: Sub-Saharan Africa.

The second category of used data is composed of FDI flows from the IMF's Balance of Payments data. Specifically, for FDI flows we use the variable called "Current Account, Primary Income, Investment Income, Direct Investment, Debit, USD (BMIPID_BP6_USD)". We compute the rates of return on foreign direct investment as shares of FDI flows on total FDI stocks in each country. We see at least two potential drawbacks of this step. First, while investment from different countries may yield different returns across countries, the FDI flows data are only available at country level (and not at a bilateral level), which hides some of the information that could potentially be used to obtain better estimates of the size of corporate profit shifting. Second, the sources (for FDI flows and FDI stocks) are combined into a single number (rate of return on FDI), but may potentially be using slightly inconsistent methodologies.

The last category of data contains data sources that are auxiliary to the main analysis. These include data on corporate tax rates from KPMG[2] and the World Bank (2016), UNCTAD's FDI data[3] which are used for a robustness check, lists of tax havens from various sources, and data on GDP from the World Bank, complemented by the CIA's World Factbook[4].

4 Empirical strategy and methodology

For obvious reasons, it is impossible to measure the scale of corporate profit shifting directly; a number of approaches have, however, been developed to estimate the size of certain aspects of profit shifting indirectly. In this paper, we follow and extend the FDI-driven approach outlined by UNCTAD (2015).

By design, the FDI-driven analysis focuses only on those tax avoidance schemes that require a direct investment link. These include primarily (but not exclusively) intra-company loans, with deductibles playing the key role in profit shifting. The increased availability of data ensured both by continuing extensive data collection and the increased scope of the relevant data sources enable us to refine the results. The IMF CDIS data currently includes yearly observations for around 100 countries between 2009 and 2015.

4.1 Constructing the offshore indicator

Following UNCTAD (2015), we consider the so-called offshore financial centres (or offshore investment hubs) in three categories. The first group is a simple list[5] of 38 *tax haven jurisdictions* compiled by UNCTAD (2015) based on OECD's (2000) initial list of 41 jurisdictions[6]. The whole stock

[2] Corporate tax rates table, available at: https://home.kpmg.com/xx/en/home/services/tax/tax-tools-and-resources/tax-rates-online/corporate-tax-rates-table.html [Accessed February 4, 2017]

[3] UNCTAD FDI statistics, available at: http://unctad.org/en/Pages/DIAE/FDI%20Statistics/FDI-Statistics.aspx [Accessed February 4, 2017]

[4] The latest data are available at: https://www.cia.gov/library/publications/the-world-factbook/ [Accessed February 12, 2017]

[5] Anguilla, Antigua and Barbuda, Aruba, Bahamas, Bahrain, Belize, Bermuda, British Virgin Islands, Cayman Islands, Cook Islands, Cyprus, Dominica, Gibraltar, Grenada, Guernsey, Isle of Man, Jersey, Liberia, Liechtenstein, Malta, Marshall Islands, Mauritius, Monaco, Montserrat, Nauru, Netherlands Antilles, Niue, Panama, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, San Marino, Seychelles, Turks and Caicos Islands, US Virgin Islands, Vanuatu.

[6] A number of lists and classifications have been produced in the literature to refer to selected jurisdictions as tax havens. Hines Jr and Rice (1994) use the Internal Revenue Manual's list of 29 tax haven countries for purposes of U. S. businesses and complement it with a few other lists to arrive at 41 jurisdictions. OECD (2000) lists 41 jurisdictions that fulfil its earlier definition of tax havens (OECD 1998). Hines (2010) uses his own list of 52 jurisdictions, Zucman (2013) uses a list of 45 jurisdictions with special attention given to some other jurisdictions (such as Switzerland). Johannesen and Zucman (2014) compile a list of 52 tax havens to study the effects of the G20 tax haven crackdown (their list is drawn from work undertaken by the OECD over the course of many years, which the authors have adjusted in vague terms). IMF's Crivelli et al. (2016) used the list compiled by US government's Gravelle (2013) and we use the later version by Gravelle (2015). Major misalignment jurisdictions highlighted by Cobham, Janský, and Meinzer (2015): either four (the Netherlands, Ireland, Bermuda,

of investment from these jurisdictions is considered as offshore-hub investment. The second is a group of the so-called *self-declared Special Purpose Entity (SPE) countries*, which comprises four countries: Luxembourg, Austria, Hungary and the Netherlands. SPE countries are those that "act as financial centres or investment hubs for MNEs due to a favourable tax and investment regime, typically granted through the option to operate by means of SPEs." (UNCTAD 2015, p. 8 of Annex II). The choice of these four countries by UNCTAD was based on the availability of data for 2012 from the countries' central banks on the share of inward investment operated through SPEs.[7] The share of stock of investment from these countries that is considered offshore-hub investment is given by the share declared by the central banks as investment routed via SPEs in 2012. The specific shares for each country for inward investment are given in Table 1.

Table 1: Shares of SPE inward investment for self-reporting SPE countries

Country	SPE share in inward stock
Austria	40%
Hungary	58%
Luxembourg	96%
The Netherlands	83%

Source: UNCTAD (2015) based on data from central banks' statistics, based on 2012 figures updated as of April, 2014.

The third group of offshore financial centres is called *other SPE countries* and is based on the so-called implied investment method developed by UNCTAD (2015). The method proceeds in two steps. First, it identifies countries that act as global offshore investment hubs. Rather than selecting these countries ex-ante based on a given set of characteristics (as done in the case of tax havens), this step sets criteria that identify ex-post those jurisdictions that have been successful in becoming important offshore financial centres. Following UNCTAD (2015), we classify a country as *other SPE country* if, as of 2015 data, it ranks in the first quartile in terms of inward FDI stock and has a ratio of inward FDI stock to GDP of more than 1. Based on 2012 data, 27 countries comply with the first criterion and 13 with the second, the intersection of which results in 7 countries falling into the *other SPE countries* category. Out of these, Hungary, Luxembourg and the Netherlands were already included in the *self-declared SPE countries* category, so that only the remaining four countries fall into the *other SPEs* group (Hong Kong, Mauritius, Ireland and Singapore). For 2015 data, we obtain 26 countries complying with the first criterion and 13 with the second, with 8 countries at the intersection of these two groups (thus complying with both criteria). Excluding self-reported SPE countries results in five countries classified into the final *other SPE countries* group (i.e. Hong Kong, Mauritius, Ireland, Singapore and Switzerland).

In the second step, we consider these five countries and calculate the level of investment "implied" by the size of their economy (based on a simple OLS cross-country regression of reported inward investment on GDP in 2015). The difference between the actual FDI stock and the predicted FDI stock is then added towards the offshore indicator as described in the following paragraph.

We follow UNCTAD (2015) to construct the so-called offshore indicator as the ratio of investment from offshore financial centres (consisting of the three groups described above) on all investment. The general idea that underlies the analysis is that a higher share of offshore financial centre investment is associated with a higher volume of profit shifting practices, resulting in an artificially deflated rate of return. Therefore, a higher offshore indicator is hypothesized to be associated with a lower rate of return on inward foreign direct investment. This effect is further hypothesized to be more pronounced for equity investments than debt instrument-related investment, since generally only the equity component of the FDI income is subject to corporate taxation, and also more pronounced for lower-income countries that generally do not have strong enough institutions to combat profit shifting effectively.

Luxembourg), six (plus Switzerland and Singapore) or seven (Hong Kong) or eight (adding Cayman Islands for which they do not have detailed data).

[7] The selection process for classifying jurisdictions into this group may thus potentially be improved by using newly available data from other countries' central banks.

Unfortunately, data on bilateral foreign direct investment are only available on the country level, which prevents further precision of estimation of the relationship between the offshore indicator and the rate of return on FDI. There thus remain concerns about, for example, potentially more profitable investment being routed more through offshore hubs, which would make our estimates biased upward. Conversely, investment into developing countries may be more likely to be routed through offshore hubs, but may also be likely to yield higher profits, which would make our estimates biased downward.

4.2 Developing the model

We first re-estimate the methodology employed by UNCTAD (2015), but using newly available data (so that the sample covers 7 yearly observations between 2009 and 2015). Following their notation, the regression model, estimated using OLS with regional- and time-fixed effects, looks as follows:

$$y_{it} = \beta x_{it} + \sum_{s=2009}^{2015} \delta_s z_{s,i} + \sum_{k=1}^{7} \phi_k d_{k,i} + \varepsilon_{it}$$

where y_{it} is the rate of return on investment in country i in year t, x_{it} is the offshore indicator, $z_{s,i}$ are year-fixed effects and $d_{k,i}$ are regional fixed effects based on World Bank classifications. The rationale behind using regional fixed effects is straightforward in light of the discussion of Figures 2 and 3 – some regions share common characteristics that have significant effects on both the explanatory and the dependent variable. A first-best model may be one that includes country-level effects, however, the low levels of variation of inward investment stock and rate of return on these investments prevent a country-fixed effects model from having enough explanatory power.

To ensure the comparability of our results to those achieved by UNCTAD, the regression model is first estimated using the same list of 72 countries, but the full sample in terms of time. This increases the sample in the general formulation from 265 to 477 observations. The model is then divided into two subcategories, for developing and developed countries, and into three alternatives for the dependent variable – rate of return, rate of return on equity and rate of return on debt (i.e. interest).

In the second part of the empirical section, we develop an extended model which looks as follows:

$$y_{it} = \alpha x_{it} + \sum_{m=1}^{5} \beta_m * x_{it} * inc_{m,i} + \sum_{k=1}^{7} \gamma_k * x_{it} * d_{k,i} + \sum_{m=1}^{5} \delta_m inc_{m,i} + \sum_{k=1}^{7} \phi_k d_{k,i} + \sum_{s=2009}^{2015} \theta_s z_{s,i} + \varepsilon_{it},$$

where $inc_{m,i}$ are dummy variables for income groups (classification by the World Bank). The remaining notation is kept from the previous model.

The model makes four innovations over UNCTAD's (2015) approach. First, we use a more granular definition for lower-income countries, which is based on the World Bank's classification of countries by income. Specifically, we add controls for income groups in our model, using a dummy variable in the full-sample regression rather than splitting the sample for developing and developed countries and performing the regressions separately (as seen in UNCTAD, 2015). Second, our model allows for effects that are heterogeneous across regions and income groups to influence the relationship between the offshore indicator and rate of return. This is enabled by the fact that we include not only dummy variables for income groups, regions and years, but also interaction terms for income groups and regions. The regional and income-group effects are thus implicitly divided into those that affect the examined relationship and those that do not. The rationale behind this is that the countries within these groups share some common characteristics that have a specific effect on the behaviour of the MNEs that route their investment through offshore hubs. Our approach enables capturing these effects. Third, we estimate the country-level results using specific corporate tax rates for each country rather than an average for the whole sample. This, together with the inherent fixed-effects heterogeneity, yields more accurate

results at the country level. Fourth, our sample covers not only a longer time period than seen in (UNCTAD, 2015), but also a significantly larger number of countries.[8]

5 Results

5.1 UNCTAD (2015) replication

In Table 2 we re-estimate the results reached by UNCTAD (2015). We use the same sample of 72 countries and include new data for 2013-2015, which increases the examined time period to 7 years. Similarly to UNCTAD (2015), we find a negative, statistically significant relationship between the offshore indicator and the rate of return on FDI stock, with slightly smaller coefficients in absolute value. For example, in the first column we obtain -0.0475, while UNCTAD (2015) obtained -0.097. These estimates can be considered superior to those obtained by UNCTAD (2015), since we apply the same methodology to data for more years (and the R-squared increases as a result).

Consistent with UNCTAD's methodology, we use regional and time-fixed effects, which markedly increase the model's explanatory power, pointing, potentially, to the importance of externalities within the regions. For both the rate of return and the rate of return on equity we find a stronger negative, statistically significant effect for developing countries. We find no statistically significant (though still negative) effect for developed countries.

Table 2: Re-estimation of the regression from UNCTAD (2015)

	Dependent variable: FDI rate of return			Dependent variable: equity component of FDI rate of return			Dependent variable: debt component of FDI rate of return		
	All	Developing	Developed	All	Developing	Developed	All	Developing	Developed
Offshore indicator	-.0475*** (.0167)	-.0901*** (.0261)	-.049 (.0429)	-.0629*** (.0172)	-.109*** (.0261)	-.0557 (.0437)	.0103*** (.0035)	.0153*** (.0058)	.0079 (.0066)
No. of obs.	477	215	188	464	209	181	402	160	175
R^2	0.283	0.302	0.102	0.315	0.317	0.109	0.239	0.184	0.152
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: Data from IMF CDIS and UNCTAD FDI database, authors' construction based on methodology by (UNCTAD 2015).

*Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.*

As argued above, this observed negative relationship can be attributed, at least in part, to missing profits due to profit shifting. Naturally, once we have estimated the volume of missing profits due to profit shifting, we can then estimate missing tax revenues due to profit shifting simply by multiplying this volume by the average effective corporate tax rate. In this section, we use our results from the extended time period sample to re-estimate the revenue losses using common average effective corporate tax rates and a common estimate of the relationship between the offshore indicator and rate of return across all developing countries. In the following section, we propose an extension to the methodology to obtain more precise results at the country level.

[8] The sample includes the following 86 countries: Albania, Armenia, Australia, Bangladesh, Barbados, Belarus, Belgium, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Brazil, Bulgaria, Burkina Faso, Canada, Cape Verde, Chile, Costa Rica, Croatia, Curacao, Czech Republic, Denmark, El Salvador, Estonia, Finland, France, Georgia, Germany, Ghana, Greece, Guatemala, Honduras, Israel, Italy, Japan, Jordan, Kuwait, Kyrgyz Republic, Latvia, Lebanon, Lithuania, Macedonia, Mali, Mexico, Moldova, Mongolia, Montenegro, Morocco, Mozambique, Nepal, New Zealand, Niger, Norway, Pakistan, Palau, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Saudi Arabia, Senegal, Serbia, Sint Maarten, Slovak Republic, Slovenia, Solomon Islands, South Africa, South Korea, Spain, Sri Lanka, Sweden, Switzerland, Tajikistan, Tanzania, Thailand, Togo, Turkey, Uganda, Ukraine, United Kingdom, United States, Uruguay, Venezuela, Zambia.

UNCTAD (2015) reports the total exposure of developing countries to offshore hub investment to be 46%, which, together with the estimate of -0.115 in column 2 of model 1 leads to an estimated profitability gap of 5.3 percentage points for the rate of return, while the estimate of -0.158 in column 2 of model 2 leads to an estimated profitability gap of 7.2 percentage points for the rate of return on equity (see the first two rows of Table 3). Using an average corporate effective tax rate of 20%, they arrive at an estimate of 331 to 450 billion USD of profit shifted from developing economies. In 2015, the total global exposure to offshore hub investment reached 40%; for developing countries this was 52% and for developed countries 37%. Combining this with our estimates from Table 2 and the reported FDI stock in 2015 (6.279 trillion USD in developing countries, 12.91 trillion USD in developed countries), we obtain the numbers reported in the third to sixth rows of Table 3. For developing countries, our estimates are thus roughly in line with those of UNCTAD at 367.3 to 445 billion. The number for FDI stock in developing countries, 6.279 trillion USD, is higher than that of UNCTAD (at 5 trillion USD), which is due to an increase in investment into developing countries between 2012 and 2015, as reported earlier in Figure 1. While our estimated profitability gap is lower than that obtained by UNCTAD, this decrease is compensated by a higher total FDI stock, ultimately leading to estimates of similar magnitude as those reached by UNCTAD.

Table 3: Estimating the size of profit shifting, 2015.

		A	B	C = A*B	D	E = D*C	F	G=E/(1-F)
		Estimate from the regression	Exposure to offshore hub investment	Estimated profitability gap	Reported FDI stock (billion USD)	Simulated profit shifting (after-tax, billion USD)	Average corporate tax rate	Simulated profit shifting (pre-tax, billion USD)
Developing countries	UNCTAD (2015) – rate of return	0.115	46%	0.053	5,000	265	20%	331
	UNCTAD (2015) – rate of return on equity	0.158	46%	0.072	5,000	360	20%	450
	Our results – rate of return	0.0901	51.99%	0.0468	6,279	293.85	20%	367.3
	Our results – rate of return on equity	0.109	51.99%	0.0567	6,279	356.02	20%	445
Developed countries	Our results – rate of return	0.049	36.67%	0.018	12,910	232.38	27.7%	321.4
	Our results – rate of return on equity	0.0557	36.67%	0.0204	12,910	263.36	27.7%	364.3

Source: Data from IMF CDIS, UNTAD FDI database, the first two rows and methodology based on UNCTAD (2015), authors' construction.

Note: The regression results for developed countries are not statistically significant and therefore we include these estimates for information only.

Once we have obtained the estimated volume of shifted profit, computing the size of its negative impact on tax revenues is a trivial task given that we know the effective tax rate. UNCTAD (2015) use a 20% average effective tax rate for developing countries, which leads to an estimate of between 66 (for the rate of return method) and 90 (rate of return on equity method) billion USD of tax revenue losses in 2012. Using the same average effective tax rate and multiplying it by our estimated volume of shifted profit, we obtain an estimate of 73.5 to 89 billion USD in lost tax revenue for developing countries in 2015. Our results are thus in line with UNCTAD's estimates. For developed countries, our estimates

using this method place the tax revenue losses at 89 to 101 billion USD, adding up to a global estimate of 162.5 to 190 billion USD in lost tax revenues due to profit shifting in 2015. However, the regression results for developed countries are not statistically significant even at the 10% level and therefore these estimates must be regarded with caution.

5.2 Extended model

Table 4 presents the results of the estimation of the extended model described in Section 4. We use three specifications that differ in their dependent variable – the first is the overall rate of return on inward investment (i.e. the ratio of FDI income to FDI stock) and the second and third are its equity and debt components, respectively. In line with the hypotheses outlined above, we observe a statistically significant, negative relationship between the offshore indicator and the first two dependent variables and a statistically insignificant, low coefficient for the debt component of the rate of return. All specifications include controls for income-, region- and year-fixed effects. The baseline country is a high income, OECD country from the Europe & Central Asia region (i.e. most of the EU countries).

Table 4: Estimation of the extended model

	(1) Rate of return	(2) Rate of return - equity component	(3) Rate of return - debt component
Offshore indicator (OI)	-0.139***	-0.112***	-0.0260***
	(0.0422)	(0.0401)	(0.00806)
OI*Low income	Omitted (=base)	Omitted (=base)	Omitted (=base)
OI*Lower middle income	0.207**	0.185**	0.0236***
	(0.0833)	(0.0810)	(0.00844)
OI*Upper middle income	0.266***	0.219**	0.0579***
	(0.0923)	(0.0909)	(0.00994)
OI*High income: non-OECD	0.221**	0.214**	0.0394***
	(0.0948)	(0.0940)	(0.00981)
OI*High income: OECD	0.321***	0.314***	0.0135
	(0.0937)	(0.0921)	(0.0105)
OI*Sub-Saharan Africa	Omitted (=base)	Omitted (=base)	Omitted (=base)
OI*Europe & Central Asia	-0.193**	-0.208**	0.00447
	(0.0821)	(0.0816)	(0.00470)
OI*East Asia & Pacific	-0.143*	-0.161*	0.0158
	(0.0818)	(0.0820)	(0.0102)
OI*Latin America & Caribbean	-0.266***	-0.257***	-0.0130**
	(0.0838)	(0.0839)	(0.00571)
OI*Middle East & North Africa	-0.111	-0.101	-0.00820**
	(0.0772)	(0.0754)	(0.00405)
OI*North America	-0.163*	-0.200**	0.0300***
	(0.0953)	(0.0948)	(0.00966)
OI*South Asia	-0.333**	-0.342***	-0.000360
	(0.130)	(0.127)	(0.0112)
Constant	0.0836***	0.0722***	0.0120***
	(0.0121)	(0.0117)	(0.00322)
Observations	509	498	412
R-squared	0.330	0.353	0.335
Income effects	Yes	Yes	Yes
Regional effects	Yes	Yes	Yes
Year effects	Yes	Yes	Yes

Source: Data from IMF CDIS and UNCTAD FDI database, authors' construction based on methodology by (UNCTAD 2015), extended model.
*Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.*

The combinations of coefficients for the two classifications result in estimates presented in Table 5. This approach takes advantage of the inclusion of region- and income-fixed effects and exploits the heterogeneity in the relationship between the rate of return and the offshore indicator across combinations of these classifications, thereby providing a more precise estimate of the relationship for individual countries. We use these estimates in the following section to compute estimated tax revenue losses at the country level. The estimates reported in Table 5 are used for variable A from Table 3. We then follow the same methodology that is described by Table 3, except for using actual nominal corporate tax rates for each country in column F. The resulting estimate for tax revenue losses due to profit shifting for the observed non-OFC countries is placed at between 27.5 and 29.5 billion USD, a significantly lower estimate compared to the one obtained above and by UNCTAD (2015).

Table 5: Results of the estimation of the extended model – summary for group combinations

Region	Income group	ROR method	ROR - equity component method	No. of countries
East Asia & Pacific	Lower middle income	-0.075	-0.088	5
East Asia & Pacific	Upper middle income	-0.015	-0.054	4
East Asia & Pacific	High income: OECD	0.039	0.040	4
Europe & Central Asia	Lower middle income	-0.125	-0.135	5
Europe & Central Asia	Upper middle income	-0.065	-0.101	9
Europe & Central Asia	High income: nonOECD	-0.111	-0.106	2
Europe & Central Asia	High income: OECD	-0.011	-0.006	17
Latin America & Caribbean	Lower middle income	-0.198	-0.184	6
Latin America & Caribbean	Upper middle income	-0.139	-0.150	9
Latin America & Caribbean	High income: nonOECD	-0.184	-0.155	5
Latin America & Caribbean	High income: OECD	-0.085	-0.055	1
Middle East & North Africa	Lower middle income	-0.043	-0.029	4
Middle East & North Africa	Upper middle income	0.016	0.005	4
Middle East & North Africa	High income: nonOECD	-0.029	0.000	3
Middle East & North Africa	High income: OECD	0.071	0.100	1
North America	High income: OECD	0.019	0.001	2
South Asia	Low income	-0.471	-0.455	2
South Asia	Lower middle income	-0.264	-0.270	4
South Asia	Upper middle income	-0.205	-0.236	1
Sub-Saharan Africa	Low income	-0.139	-0.112	6
Sub-Saharan Africa	Lower middle income	0.068	0.073	7
Sub-Saharan Africa	Upper middle income	0.128	0.107	2

Source: Authors' construction, extended model.

5.3 Country-level results

Since we treat each country individually, instead of using the same average corporate tax rate for the entire group of developing countries we instead use the actual corporate tax rates in each country to estimate each country's tax revenue losses (or gains) related to corporate profit shifting. We use data on nominal corporate tax rates collected by KPMG[9] and, where that is missing, complement them with data from World Bank (2014). Figure 4 presents the estimates for all the observed countries except for the United States and Brazil, which were left out of this figure for scale purposes.[10] Complete results for all

[9] Corporate tax rates table, KPMG. Available at: https://home.kpmg.com/xx/en/home/services/tax/tax-tools-and-resources/tax-rates-online/corporate-tax-rates-table.html

[10] The estimates for the United States and Brazil are (18.2-29.1) and (9.6-10.3), respectively. All numbers are in billions of USD.

countries in the sample are given in Table A1 in the Appendix. We present the estimates as intervals given by the estimates from the rate of return method and the rate of return on equity method.

Among European countries, the estimated losses are highest for Germany at 1-1.8 billion USD. Figure 5 puts these numbers into perspective by presenting the share of these losses on GDP in each observed country. This time, we group the countries by income. For scaling purposes, we leave out the two countries with the largest shares of tax revenue losses on GDP - Sint Maarten (52.6-62.4) and Mozambique (19.6-24.4). For most developing countries, the estimated tax revenue losses due to profit shifting represent between 0.1% and 0.4% of their GDP, which can be considered substantial amounts.

The results suggest that lower-income countries lose more significant portions of their GDP due to profit shifting practices. Unfortunately, the current lack of data for low income countries prevents a more thorough analysis. Even though recent efforts of international development organizations begin to make more data available, coverage of low income countries is generally very poor.

For EU countries, a similar graph to the one shown by Figure 5 is presented in Figure 6. According to these estimates, Latvia, Bulgaria, Romania and Belgium lose the most significant portions of their GDP due to profit shifting practices with a direct investment link to offshore hubs. In Table A1 in the Appendix, we provide full country-level results for all 69 countries in the sample and a comparison with results reported recently by Cobham and Janský (2017), whose approach builds on the methodology developed by IMF's Crivelli et al. (2016). Due to the lack of data availability, their estimates are for the year 2013, which makes a direct comparison impossible. The correlations between the two sets of results are presented in Table 6. Though much lower, our base results from the rate of return method are highly correlated with the ones reached by Cobham and Janský (2017) at 0.744 and 0.759 for the IMF and GRD data, respectively (see Cobham and Janský (2017) for methodology). Not too surprisingly, the correlation drops significantly for our equity component method.

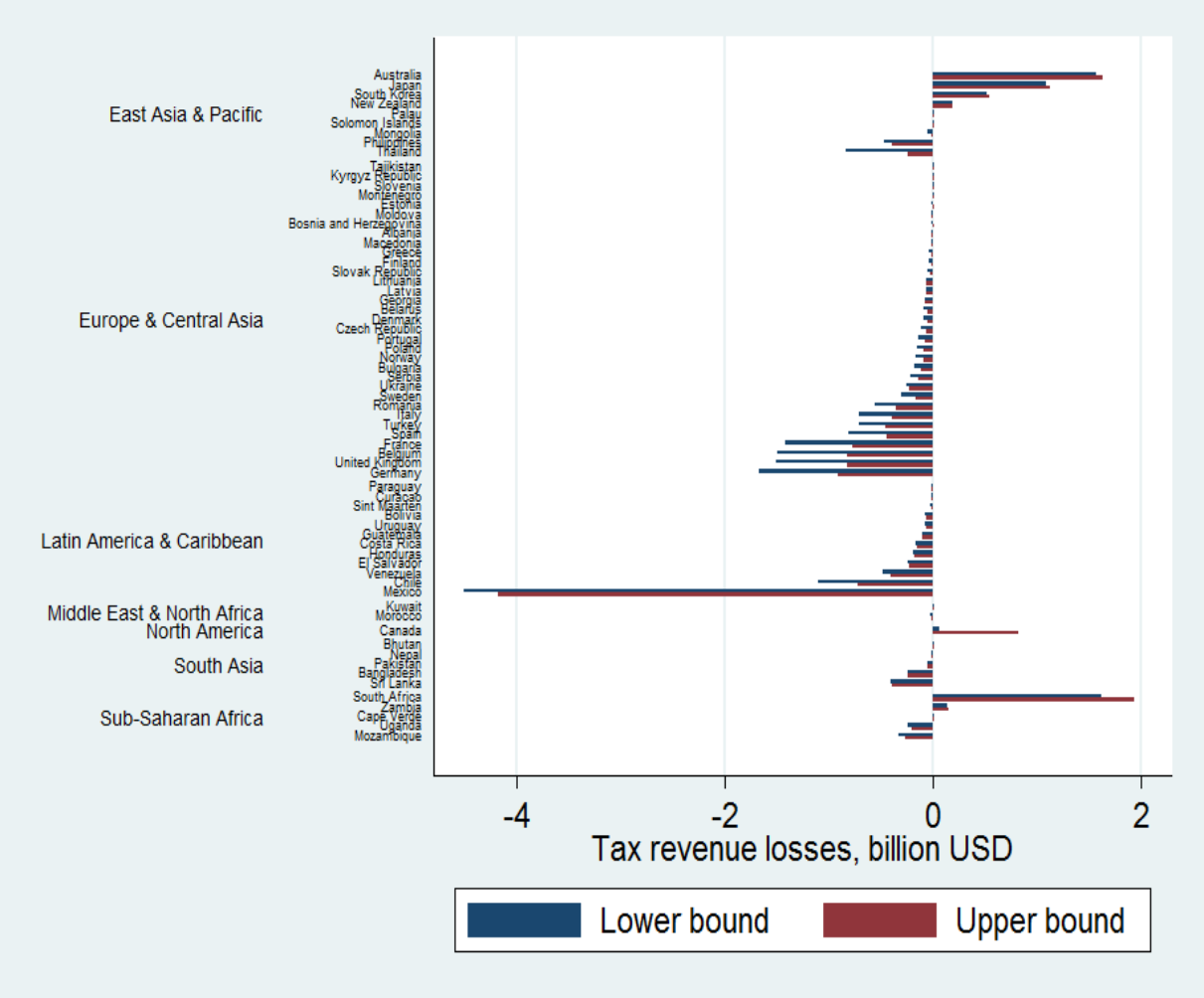
Figure A1 in the Appendix relates the estimated tax revenue losses to corporate tax revenues of countries. Due to the lack of availability of data on tax revenues in 2015, we present the estimated revenue effects as shares of 2013 corporate tax revenues, and only for countries for which corporate tax revenue data are available. From this group, the countries missing on the most significant shares of their corporate tax revenue are Balkan, East European and Caucasus countries, with estimates reaching the lower tens of per cents of corporate tax revenue. In Figure A2 in the Appendix, we present a graph that shows the estimates revenue effects of corporate profit shifting as shares of total tax revenue. Again, due to bad data availability, the sample is smaller and data on tax revenues are only available for 2013. Sub-Saharan African and Latin America & Caribbean countries are those that lose the highest shares of their total tax revenues, according to these estimates.

Table 6: Correlation table, results from the extended model and from Cobham & Janský (2017)

	ROR method, 2015	ROR - equity component method, 2015	Cobham & Janský (2017) - IMF data, 2013	Cobham & Janský (2017) - GRD data, 2013
ROR method	1			
ROR - equity component method	0.764	1		
Cobham & Janský (2017) - IMF data	0.744	0.205	1	
Cobham & Janský (2017) - GRD data	0.759	0.229	0.999	1

Source: Authors' construction.

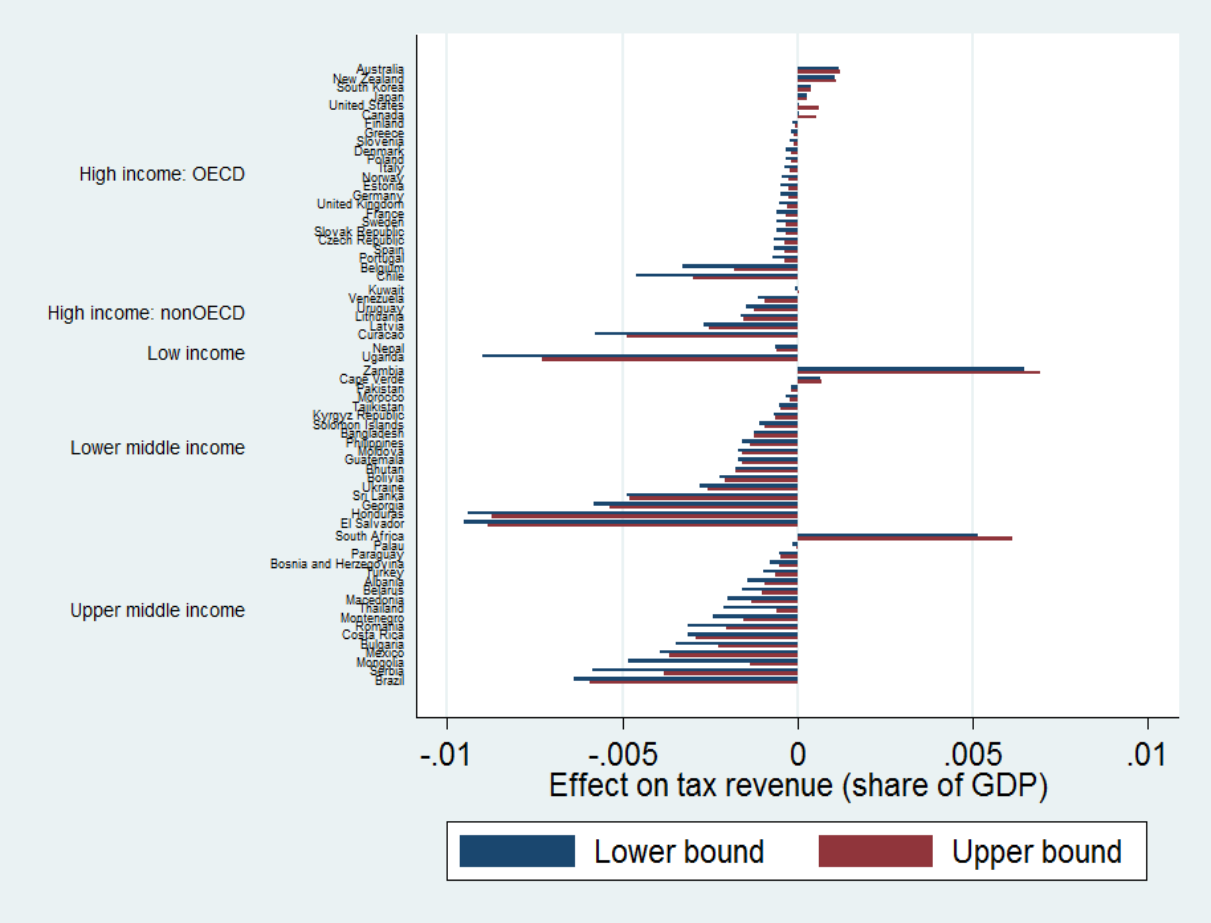
Figure 4: Estimated tax revenue effect by country and region, 2015.



Source: Data from IMF CIDS and UNCTAD, authors' construction.

Note: Estimates of the bounds are the results of the rate of return method and the rate of return on equity method. See text for methodology. For scaling purposes, we leave out the two countries with the highest estimated tax revenue effects – the United States (a gain of 0.86-10.9 USD billion) and Brazil (a loss of 10.5-11.3 USD billion). See Table A1 in Appendix for full results.

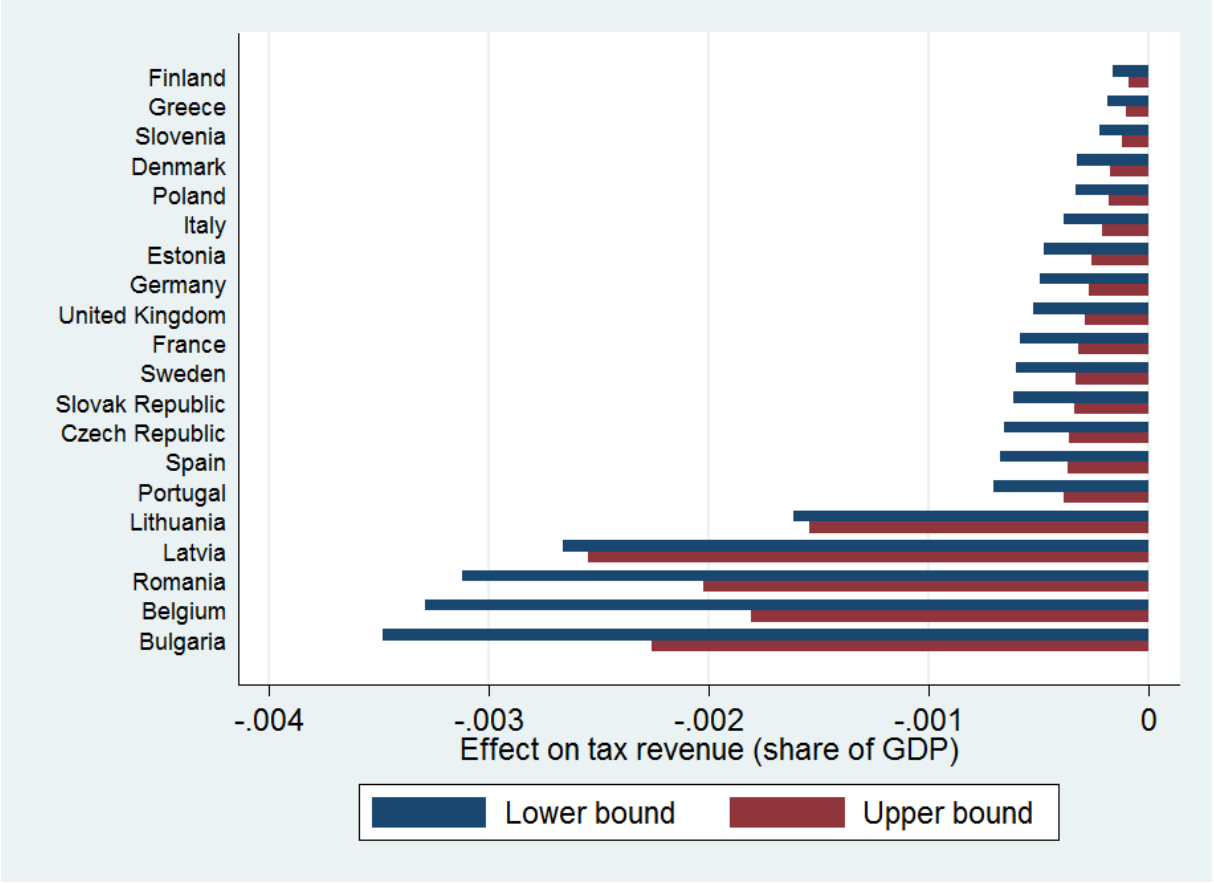
Figure 5: Share of estimated tax revenue losses on GDP by country and income group, 2015



Source: Data from IMF CDIS, UNCTAD, and the World Bank, authors' construction.

Note: Estimates of the bounds are the results of the rate of return method and the rate of return on equity method. See text for methodology. For scaling purposes, we leave out the two countries with the largest shares of tax revenue losses on GDP - Sint Maarten (5.35-6.37 per cent) and Mozambique (1.79-2.21 per cent). See Table A1 for full results.

Figure 6: Share of estimated tax revenue effects on GDP, EU countries, 2015



Source: Data from IMF CDIS, UNCTAD, and the World Bank, authors' construction.

Note: The bounds of the interval are the results of the rate of return method and the rate of return on equity method. See text for methodology.

6 Conclusion

In this paper, we have focused on one particular aspect of international corporate tax avoidance – profit shifting. We began by closely following the methodology of one of the leading works in the area by UNCTAD (2015), using new data to obtain updated estimates. We reach similar results, with a global estimate of lost tax revenue of around 200 billion USD, roughly evenly divided between developing and developed countries, with the former incurring much more significant losses in the relative terms. We then proceeded to provide country-level results in an approach that builds on UNCTAD's work.

We have extended UNCTAD's methodology in four major ways. First, we have used a more sensitive classification of countries by income groups. Second, our model implicitly divides the regional and income-group effects into those that affect the examined relationship and those that do not. The rationale behind this is that countries within these groups share some common characteristics that have a specific effect on the behaviour of the MNEs that route their investment through offshore hubs. Our approach has enabled us to capture these effects. Third, we have estimated the country-level results using specific corporate tax rates for each country rather than an average for the whole sample. This, together with the inherent fixed-effects heterogeneity, yields more accurate results at the country level. Fourth, our sample covers not only a longer time period than UNCTAD's (2015), but also a significantly increased number of countries.

The estimates from the extended method are significantly lower than those obtained before, with our preferred estimate between 52 and 66 billion USD for all non-OFC countries. Consistent with the

previous results, we find that the relative impact on lower-income countries is higher. We provide a direct comparison of our estimates with the ones reached by Cobham and Janský (2017) and observe a positive correlation of approximately 0.75 between the two sets of results. However, our estimates are much lower, which is consistent with the fact that our method only exploits profit shifting practices that require a direct investment link (and thus underestimate in this respect the true scale of corporate profit shifting).

Several limitations of the used approach persist. First, we have observed a statistically significant negative relationship between the share of inward investment stock originating from offshore investment hubs and the rate of return for developing countries, and in our extended model also for other countries. We believe that this relationship can be attributed in part to missing profits due to profit shifting. However, we are not able to estimate how large a part of this is due to profit shifting and other reasons of lower profitability. Furthermore, our approach does not provide an insight on what the likely channels of profit shifting associated with the lower returns might be, and it is clear that this methodological approach only estimates those international corporate tax avoidance schemes that require a direct investment relationship through equity or debt, and not other possible means of international corporate tax avoidance.

In addition to addressing these limitations, it would be desirable for further research to focus on the role of various assumptions, including those about tax rates – perhaps using average effective tax rates – and on the definition of offshore investment hubs, maybe applying various sets of definitions as a robustness check and as a means of learning about which havens are responsible for the estimated revenue losses. An alternative approach to the definition of offshore investment hubs could be to focus, rather than on dichotomous classifications of tax havens, on continuous measures of tax havenry, such as Tax Justice Network's Financial Secrecy Index.

7 References

Clausing, Kimberly A. 2009. “Multinational Firm Tax Avoidance and Tax Policy.” *National Tax Journal* 62 (4): 703–25.

Clausing, Kimberly A. 2016. “The Effect of Profit Shifting on the Corporate Tax Base in the United States and beyond.” doi:http://dx.doi.org/10.2139/ssrn.2685442.

Cobham, Alex, and Petr Janský. 2017. “Global Distribution of Revenue Loss from Tax Avoidance.” *WIDER Working Paper Series* 2017/55.

Cobham, Alex, Petr Janský, and Markus Meinzer. 2015. “The Financial Secrecy Index: Shedding New Light on the Geography of Secrecy.” *Economic Geography* 91 (3): 281–303.

Crivelli, Ernesto, Ruud De Mooij, and Michael Keen. 2016. “Base Erosion, Profit Shifting and Developing Countries.” *FinanzArchiv: Public Finance Analysis* 72 (3): 268–301.

Dharmapala, Dhammika. 2014. “What Do We Know about Base Erosion and Profit Shifting? A Review of the Empirical Literature.” *Fiscal Studies* 35 (4): 421–48. doi:10.1111/j.1475-5890.2014.12037.x.

Dharmapala, Dhammika, and Nadine Riedel. 2013. “Earnings Shocks and Tax-Motivated Income-Shifting: Evidence from European Multinationals.” *Journal of Public Economics* 97: 95–107.

EPRS. 2015. “Bringing Transparency, Coordination and Convergence to Corporate Tax Policies in the European Union: Assessment of the Magnitude of Aggressive Corporate Tax Planning.” http://www.europarl.europa.eu/thinktank/en/document.html?reference=EPRS_STU(2015)558773.

Gravelle, Jane G. 2013. “Tax Havens: International Tax Avoidance and Evasion.” *Congressional Research Service*.

———. 2015. “Tax Havens: International Tax Avoidance and Evasion.” *Congressional Research Service*. http://digitalcommons.ilr.cornell.edu/key_workplace/1378/.

Hines, J. R. 2010. “Treasure Islands.” *Journal of Economic Perspectives* 24 (4): 103.

Hines Jr, J. R, and E. M Rice. 1994. “Fiscal Paradise: Foreign Tax Havens and American Business.” *The Quarterly Journal of Economics* 109 (1): 149–182.

Huizinga, H., and L. Laeven. 2008. “International Profit Shifting within Multinationals: A Multi-Country Perspective.” *Journal of Public Economics* 92 (5): 1164–1182.

International Monetary Fund. 2014. “Spillovers in International Corporate Taxation.” IMF Policy Paper. http://www.imf.org/external/np/pp/eng/2014/050914.pdf.

Janský, Petr. 2016. “Estimating the Costs of International Corporate Tax Avoidance: The Case of the Czech Republic.” Working Papers IES 2016/21. Charles University Prague, Faculty of Social Sciences, Institute of Economic Studies. http://econpapers.repec.org/paper/fauwpaper/wp2016_5f21.htm.

Johannesen, Niels, and Gabriel Zucman. 2014. “The End of Bank Secrecy? An Evaluation of the G20 Tax Haven Crackdown.” *American Economic Journal: Economic Policy* 6 (1): 65–91.

OECD. 1998. “Harmful Tax Competition: An Emerging Global Issue.” Paris: OECD.

———. 2000. “Towards Global Tax Co-Operation: Report to the 2000 Ministerial Council Meeting and Recommendations by the Committee on Fiscal Affairs: Progress in Identifying and Eliminating Harmful Tax Practices.” Paris: OECD. http://www.oecd.org/tax/transparency/44430257.pdf.

———. 2015. *Measuring and Monitoring BEPS, Action 11 - 2015 Final Report*. Paris: Organisation for Economic Co-operation and Development. http://www.oecd-ilibrary.org/content/book/9789264241343-en.

UNCTAD. 2015. “World Investment Report 2015 - Reforming International Investment Governance.” New York, USA and Geneva, Switzerland: United Nations Conference on Trade and Development.

WB. 2016. *Doing Business 2017: Equal Opportunity for All*. Washington DC, USA: World Bank.

Zucman, Gabriel. 2013. “The Missing Wealth of Nations: Are Europe and the US Net Debtors or Net Creditors?” *The Quarterly Journal of Economics* 128 (3): 1321–1364.

———. 2014. “Taxing across Borders: Tracking Personal Wealth and Corporate Profits.” *Journal of Economic Perspectives* 28 (4): 121–48.

8 Appendix

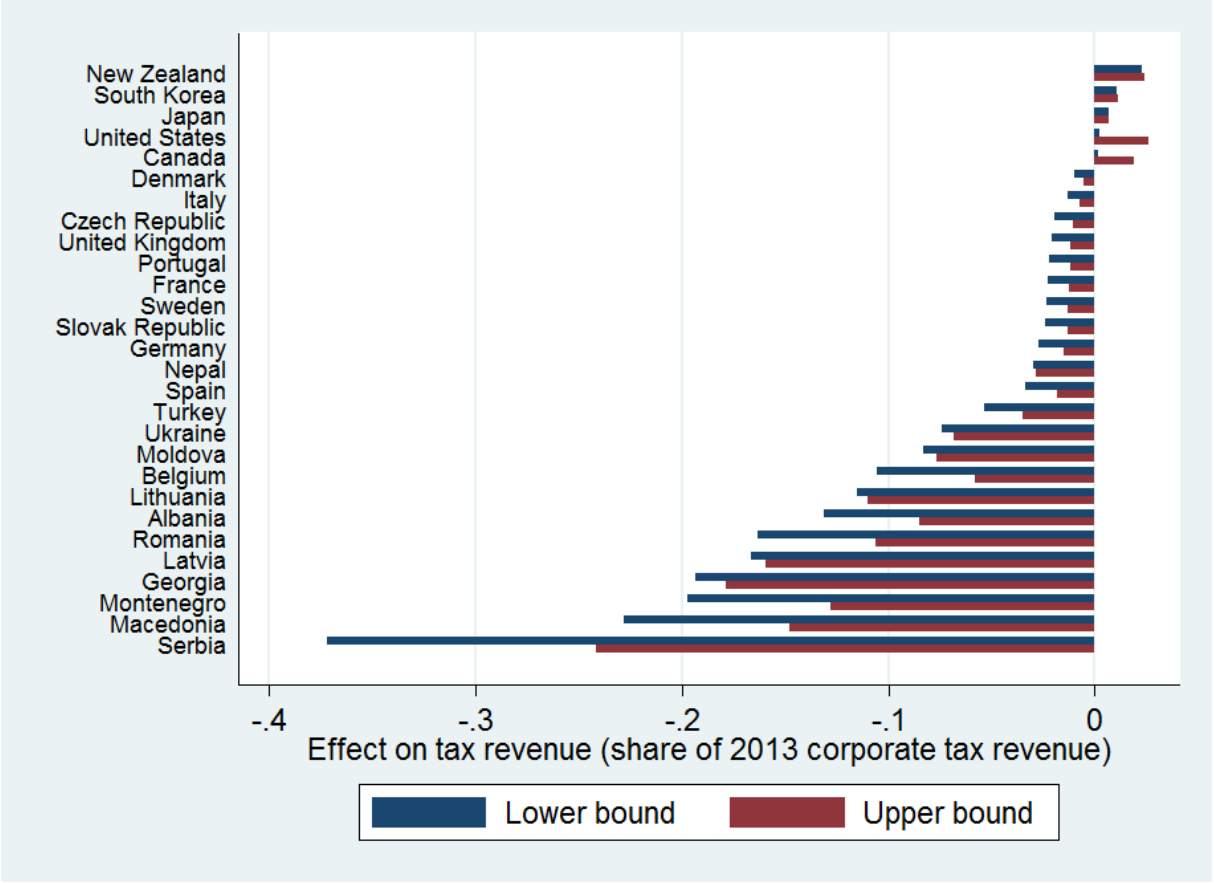
Table A1: Estimated tax revenue losses and their share on GDP, rate of return and rate of return on equity method, 2015

	Tax revenue effect					
Country	Rate of return method (USD million)	Rate of return method (% of GDP)	Rate of return - equity component method, 2015 (USD million)	Rate of return - equity component method, 2015 (% of GDP)	Cobham & Janský (2017) - IMF data, 2013 (USD million)	Cobham & Janský (2017) - GRD data, 2013 (USD million)
Sint Maarten	-23.30	-6.37	-19.59	-5.35	N/A	N/A
Mozambique	-327.76	-2.21	-265.15	-1.79	527.37	456.81
El Salvador	-246.56	-0.95	-228.72	-0.88	666.78	577.56
Honduras	-192.16	-0.94	-178.26	-0.87	162.87	141.08
Uganda	-247.78	-0.90	-200.45	-0.73	610.99	529.24
Brazil	-10,513.25	-0.59	-11,342.21	-0.64	-25,192.15	-21,821.30
Curacao	-18.09	-0.58	-15.21	-0.49	N/A	N/A
Georgia	-75.08	-0.54	-81.15	-0.58	-183.50	-158.94
Sri Lanka	-394.57	-0.48	-402.34	-0.49	1,237.50	1,071.92
Chile	-1,105.28	-0.46	-720.97	-0.30	-262.85	-178.79
Serbia	-141.28	-0.38	-217.67	-0.59	-502.38	-435.16
Mexico	-4,171.20	-0.36	-4,500.09	-0.39	N/A	N/A
Belgium	-1,497.55	-0.33	-823.48	-0.18	5,132.51	3,491.14
Costa Rica	-157.66	-0.29	-170.09	-0.31	1,361.62	1,179.43
Latvia	-71.98	-0.27	-68.79	-0.25	-349.43	-302.68
Ukraine	-233.10	-0.26	-251.94	-0.28	-1,074.01	-930.30
Bulgaria	-113.55	-0.23	-174.95	-0.35	-710.31	-615.26
Bolivia	-73.47	-0.22	-68.15	-0.21	257.15	222.74
Romania	-360.38	-0.20	-555.26	-0.31	-1,927.88	-1,669.92
Bhutan	-3.62	-0.18	-3.69	-0.18	57.65	49.94
Guatemala	-109.49	-0.17	-101.57	-0.16	1,691.53	1,465.20
Lithuania	-66.51	-0.16	-63.56	-0.15	-537.31	-465.41
Moldova	-10.29	-0.16	-11.12	-0.17	-104.06	-90.13
Montenegro	-6.22	-0.16	-9.59	-0.24	-58.31	-50.50
Uruguay	-78.97	-0.15	-66.39	-0.12	492.71	426.78
Mongolia	-16.13	-0.14	-56.61	-0.48	-147.35	-127.63
Philippines	-396.59	-0.14	-468.27	-0.16	7,358.37	6,373.77
Macedonia	-13.15	-0.13	-20.26	-0.20	-138.98	-120.39
Bangladesh	-241.42	-0.12	-246.18	-0.13	2,401.91	2,080.52
Venezuela	-487.79	-0.11	-410.11	-0.09	N/A	N/A
Belarus	-55.78	-0.10	-85.94	-0.16	388.73	336.72
Albania	-10.72	-0.09	-16.51	-0.14	-174.10	-150.80
Solomon Islands	-1.05	-0.09	-1.24	-0.11	29.72	25.74
Portugal	-140.74	-0.07	-77.39	-0.04	1,632.38	1,110.34
Spain	-811.30	-0.07	-446.12	-0.04	8,109.80	5,516.29
Czech Republic	-122.31	-0.07	-67.26	-0.04	-268.96	-182.95
Turkey	-460.17	-0.06	-709.00	-0.10	-766.90	-521.65
Kyrgyz Republic	-4.16	-0.06	-4.49	-0.07	-95.69	-82.89

Nepal	-13.30	-0.06	-12.83	-0.06	166.87	144.54
Slovak Republic	-53.92	-0.06	-29.65	-0.03	60.57	41.20
Sweden	-301.07	-0.06	-165.56	-0.03	31.01	21.09
Thailand	-238.12	-0.06	-835.57	-0.21	-1,690.64	-1,464.43
France	-1,413.18	-0.06	-777.09	-0.03	29,081.07	19,780.98
United Kingdom	-1,510.88	-0.05	-830.81	-0.03	1,555.23	1,057.87
Bosnia and Herzegovina	-8.33	-0.05	-12.84	-0.08	-249.57	-216.17
Germany	-1,671.89	-0.05	-919.35	-0.03	22,087.67	15,024.06
Tajikistan	-3.78	-0.05	-4.09	-0.05	73.66	63.80
Estonia	-10.70	-0.05	-5.88	-0.03	-11.25	-7.65
Paraguay	-12.86	-0.05	-13.87	-0.05	-404.21	-350.13
Norway	-172.61	-0.04	-94.92	-0.02	N/A	N/A
Italy	-708.14	-0.04	-389.40	-0.02	7,843.15	5,334.92
Poland	-159.77	-0.03	-87.86	-0.02	-695.90	-473.35
Denmark	-96.44	-0.03	-53.03	-0.02	619.18	421.17
Morocco	-32.52	-0.03	-21.63	-0.02	2,832.94	2,453.88
Slovenia	-9.56	-0.02	-5.26	-0.01	-95.89	-65.23
Greece	-37.25	-0.02	-20.48	-0.01	638.85	434.55
Pakistan	-50.27	-0.02	-51.26	-0.02	12,061.55	10,447.64
Finland	-38.15	-0.02	-20.98	-0.01	407.54	277.21
Kuwait	-6.27	-0.01	0.09	0.00	N/A	N/A
Palau	-0.01	0.00	-0.05	-0.02	N/A	N/A
Japan	1,084.28	0.03	1,127.15	0.03	68,790.48	46,791.37
South Korea	514.93	0.04	535.30	0.04	1,642.79	1,117.43
Canada	821.44	0.05	64.32	0.00	4,981.79	3,388.62
United States	10,929.83	0.06	855.85	0.00	277,609.00	188,830.00
Cape Verde	1.04	0.06	1.11	0.07	16.87	14.61
New Zealand	182.11	0.10	189.31	0.11	761.65	518.08
Australia	1,565.73	0.12	1,627.64	0.12	8,901.30	6,054.68
South Africa	1,927.55	0.61	1,614.07	0.51	6,725.49	5,825.58
Zambia	137.08	0.65	146.22	0.69	1,134.10	982.35

Source: Methodology based on UNCTAD (2015), extended model, authors' construction. The last two columns are based on the results of Cobham & Janský (2017).

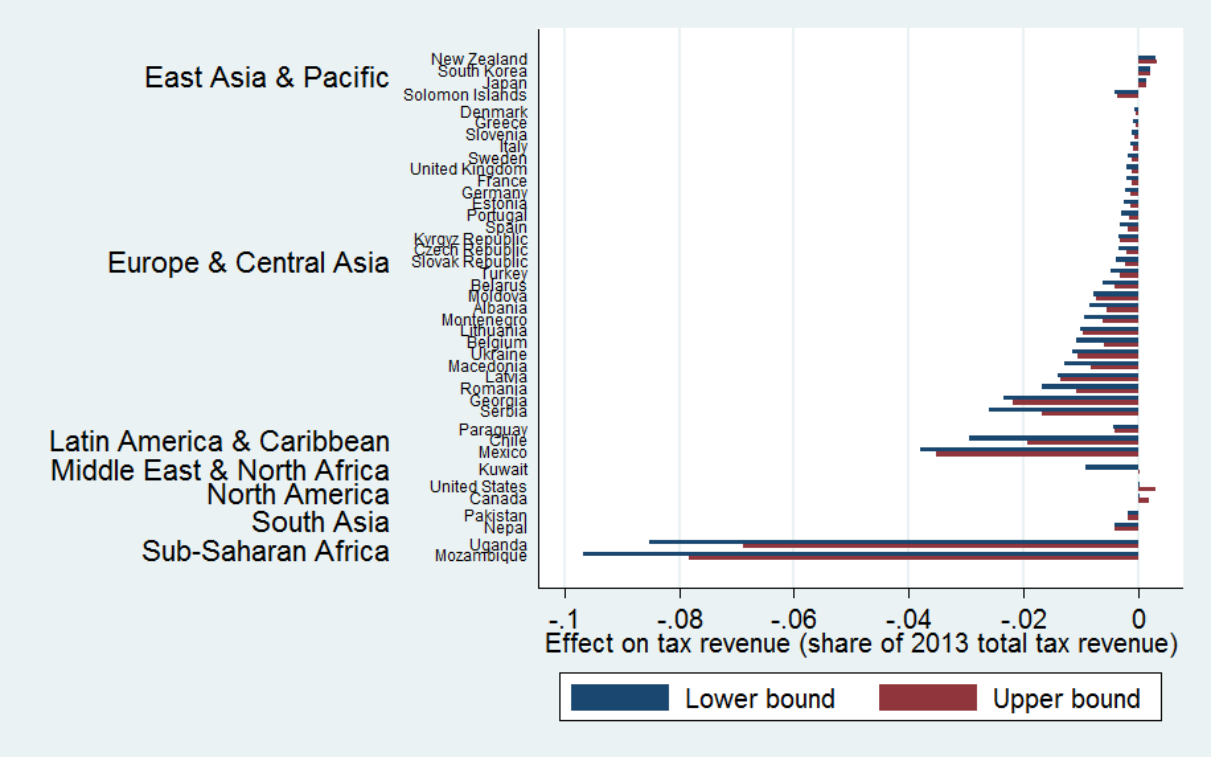
Figure A1: Share of estimated tax revenue effects on 2013 corporate tax revenues, 2015



Source: Data from IMF CDIS, GRD; methodology based on UNCTAD (2015), extended model, authors' construction.

Note: Due to the lack of data availability on corporate tax revenues in 2015, the shares are taken from 2013 data. The bounds of the interval are the results of the rate of return method and the rate of return on equity method. See text for methodology.

Figure A2: Share of estimated tax revenue effects on 2013 total tax revenues, 2015



Source: Data from IMF CDIS, GRD; methodology based on UNCTAD (2015), extended model, authors' construction.

Note: Due to the lack of data availability on tax revenues in 2015, the shares are taken from 2013 data. The bounds of the interval are the results of the rate of return method and the rate of return on equity method. See text for methodology.