Macro approach to profit shifting: methods and challenges of re-estimation

Katarzyna Perez[a], Katarzyna Schmidt-Jessa[b], Tomasz Kaczmarek[c]

[a] ORCID: 0000-0003-3331-8456, corresponding author katarzyna.perez@ue.poznan.pl

[b] ORCID: 0000-0002-5310-1038

[c] ORCID: 0000-0003-1828-100X

[a, c] Investment and Financial Markets Department, Institute of Finance, Poznan University of Economics and Business, Poland
[b] Money and Banking Department, Institute of Finance, Poznan University of Economics and Business, Poland

Abstract

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1. Introduction

Profit shifting plays an important role in tax base erosion. It appears when corporate income is taxed at different rates in different countries. As a result, multinational enterprises face incentives to reallocate accounting profits internationally in order to reduce their worldwide corporate tax liability. International profit shifting efforts, if effective, should reduce multinational enterprise profits reported in high-tax countries (Huizinga & Laeven, 2008). As profit shifting affects tax revenues collected by the state and undermines competition between companies there is a large body of research where authors try to estimate the scale of the corporate profit shifting and tax revenue losses (Clausing, 2020; Cobham & Janský, 2018; Garcia-Bernardo et al., 2022; Garcia-Bernardo & Jansky, 2023; Tørsløv et al., 2023; Wier & Zucman, 2022). They do it according to two main approaches (Dharmapala, 2019): 1) microeconomic approach, that is based on the micro-data obtained from the financial statements of individual multinational companies (MNCs) (such data can be found in the Amadeus and Orbis databases compiled by the Bureau van Dijk) and 2) macroeconomic approach, that is based on the aggregate country-level data from the national accounts, balance of payments (BoP) statistics, and the amounts of the foreign direct investments (FDI) and/or aggregated tax statistics. In this article we pay attention to the second approach, in which the macro data is an important indicator of a domestic economy describing its relations with the foreign countries. The more open the domestic economy the stronger its foreign relations but also the greater the possibility of underestimating the actual value of BoP or FDI. This underestimation may be caused by reporting lower values of profits by foreign (or multinational) enterprises who shift these profits to tax havens in order to avoid paying domestic corporate income tax. Such behavior results in domestic government tax revenue losses. As OECD reports in 2015 around 400 billion US dollars of profits shifted and around 100-240 billion US dollars of tax revenues equal to 4-10% of the global corporate income tax revenue were lost (OECD, 2023). As far as the percentage of GDP is concerned the lower-income OECD countries lose more than the higher-income OECD countries. This may be a result of their lower possibilities of tax control and weaker mechanisms limiting this phenomenon.

The main goal of this study is explore the relation between increase in profit shifting value and macro variables such as GDP, the size and income of a country and compare these relations among countries. Before this we re-estimate profit shifting value according to the methods based on the macro approach of UNCTAD (2015a, 2015b) and Janský and Palanský (2019).

These studies cover various time frames between 2009 and 2016, so they end in a year when the OECD/G20 Inclusive Framework on Base Erosion and Profit Shifting (IF on BEPS) was initiated. Between 2016 and 2023 the number of countries and jurisdictions participating in the OECD/G20 IF on BEPS has risen from over 60 to over 140. They collaborate on the implementation of 15 Actions (measures) to tackle tax avoidance, improve the coherence of international tax rules and ensure a more transparent tax environment. In this study we want to revise the profit shifting methods for a large sample of countries in order to see how much of it there has been in later years and which countries are the most important sources of it.

The reminder of the study is as follows. Section 2 revises the literature on the pioneer methods for profit shifting estimation. Section 3 describes the methodology, data and results of the macro approach studies we utilize in order to re-estimate the value of profit shifting. Section 4 presents the results and challenges faced in the research, and Section 5 concludes.

2. Literature review on profit shifting estimation

The pioneer studies in the subject of estimating profit shifting were conducted by Grubert and Mutti (1991) and Hines and Rice (1994) who were investigating US-based multinational enterprises (MNEs) and their possible income shift from the US to their foreign affiliates.

Using aggregated 1982 Treasury data Grubert and Mutti (1991) tested the model where the amount of capital that a U.S. MNE will locate in a foreign affiliate is a function of host country taxes, represented by the average effective tax rate (*Avg. ETR*), and a matrix of exogenous variables. They showed that U.S. multinational real business activity was concentrated in countries with low effective tax rates, suggesting taxation plays a first order role in determining not only the location of international profits, but also in determining the location of U.S. business activity abroad.

Following their study but this time based on aggregated 1992 Treasury tax data, Grubert and Mutti (2000) reported that the tax responsiveness of manufacturing affiliates varied across countries, especially with respect to the trade policy of the host country: in a more closed economy, taxes made less difference to a producer's competitive position, but in open economies the response to taxation was greater than in the 1982 study.

Repeating and expanding the seminal work of Gruber and Mutti (1991) but using the data on the activities of U.S. MNEs from 1989 to 2014 and a panel fixed effects framework to Mutti and Ohrn (2019) extend and update results from the 1991 paper. Mutti and Ohrn (2019) find that effective tax rates influence the business location decisions of U.S. MNEs. Their estimates

demonstrate stability over the sample period, across the various measures of MNE real business activity, and across various effective tax rate specifications. Finally, they address an early critique of the international tax literature – that effective tax rates are endogenous to business activity measures – by using changes in statutory tax rates and bases to instrument for changes in effective rates.

The second early pioneer study on profit shifting is the conceptual article of Hines and Rice (1994). They investigate the relationship between the profitability of U.S. foreign direct investment abroad and foreign tax burdens after controlling for labor and capital inputs in these countries. Using data for 1982 from the Bureau of Economic Analysis (BEA) of the US Department of Commerce, aggregated up to the country level, the Authors find that the profits reported abroad by U.S. multinationals are sensitive to national tax burdens, not least because U.S. multinationals operate in a variety of tax havens with presumably rather lax enforcement, if any, of anti-profit shifting statutes. The methodology introduced by Hines and Rice (1994) has been followed or expanded as the seminal method or a starting point for profit shifting estimation in many later studies. For example, Haufler and Schjelderup (2000) examine international tax competition in a model where countries can use the tax rate and the definition of the tax base as strategic variables. International profit shifting can explain a relatively low tax rate and a relatively broad definition of the tax base as Nash equilibrium outcomes. Demirgüç-Kunt and Huizinga (2001) find that the profitability reported by foreign-owned banks across 80 countries is negatively related to national top statutory tax rates, while similarly Bartelsman and Beetsma (2003) find that value added reported at the sectoral level in OECD countries is negatively related to statutory tax rates. Mintz and Smart (2004) have considered debt shifting in a model of a multinational with multiple subsidiaries and present evidence consistent with profit shifting within Canada to reduce provincial taxation.

The work of Hines and Rice (1994) was extended by Huizinga and Laeven (2008) who present a model of the opportunities and incentives generated by international tax differences for international profit shifting by multinationals. The model considers not only profit shifting arising from international tax differences between affiliates and parent companies, but also profit shifting arising from tax differences between affiliates in different host countries. Their model yields the prediction that a multinational's profit shifting in a country depends on both national tax rates and differences between national and foreign tax rates in all countries in which the multinational operates. In particular, they show that profit shifting into a country by a multinational is negatively related to a weighted average of international tax rate differences between this country and all other countries where the multinational is active.

Many recent studies that estimate the equation of Hines and Rice (1994) extended by Huizinga and Laeven (2008) and corrected with the quadratic (and not linear) semi-elasticity assumption of Dowd et al. (2017) do it using firm-level data. In other words, they use microeconomic approach. Beer et al. (2020) analyze this literature and write, "micro studies on profit shifting only capture avoidance behavior that affects the observed profits of a multinational company. While transfer mispricing or international debt shifting directly affect reported profitability, other avoidance channels are not necessarily captured in studies using variants of the presented model. Macro studies may capture a wider range of profit shifting channels related to statutory CIT rate differentials" (Beer et al., 2020). Motivated by these words and guided by the nature of our research goal, we decide to consider the macroeconomic approach to estimating profit shifting.

3. Methods of estimating profit shifting by macro approach

There are two methods of estimating the scale of profit shifting and tax revenue losses using the macro data we take into account:

- Method I by UNCTAD (2015a, 2015b), described in the Annex II of the World Investment Report 2015 with the technical background that was further considered by Bolwijn et al. (2018); this study is a very important turning point in the macroeconomic approach to estimating profit shifting;
- Method II of Janský and Palanský (2019) who extended the model of UNCTAD (2015a, 2015b);

3.1.Method I – UNCTAD (2015a, 2015b)

The methodology presented by UNCTAD (2015a, 2015b) and later by Bolwijn et al. (2018) is a part of the FDI-driven approach for estimating profit shifting. This approach builds on the data obtained from the Balance of Payments (BoP) of countries. The method exploits a relationship at a country level between the share of investment stock from the offshore investment hubs (tax havens, SPE-countries) and the average rate of return on total Foreign Direct Investments (FDI).

The main assumption in the analysis is as follows: *There is a negative relationship at country level between the share of inward investment stock from offshore hubs and the rate of return on the total inward FDI stock.*

There are two main variables in the model, the dependent variable which is rate of return on

FDI, and the independent variable which is the offshore indicator. The rate of return is presented in three different ways, as a total rate of return on FDI, equity component rate of return and finally, the debt component rate of return. The formulas for calculating the dependent variable are presented in table 2.

Table 1. Formulas for the dependent variable calculation

	Total rate of return	**Equity rate of return**	**Debt rate of return**
Formula	$\frac{FDI\ income}{FDI\ inward\ stock}$	$\frac{FDI\ equity\ income}{FDI\ inward\ stock}$	$\frac{FDI\ debt\ income}{FDI\ inward\ stock}$

Note: The responsiveness of the equity component to exposure to offshore investment hubs is expected to be higher ("more negative") than the one of the aggregate rate of return. Conversely, the debt component is expected to be positively related to exposure to offshore hubs.

The independent variable – the offshore indicator – presents the relation between the FDI inflows to a country coming from offshore hubs and the total FDI inflows. The offshore indicator is calculated in two different ways. Firstly, taking into consideration a conservative approach and secondly, an extended approach. Within the first approach, offshore hubs are defined as a list of 37 small jurisdictions originally defined by the OECD[1], and self-declared SPE-countries. In the second approach, the offshore hubs are identified through calculations based on the assumption that the level of investment stock in countries with relevant offshore activity is outsized compared to the size of the economy. To identify the major offshore investment hubs using the extended approach two-step analysis was proceeded. Firstly, the authors check which countries host a relevant amount of FDI stock (including SPEs) and secondly, they compare whether the amount of inward FDI stock is disproportionately high compared to the size of the economy (as measured by GDP).

The model used in the UNCTAD (UNCTAD, 2015a, 2015b) is a standard linear regression model (OLS) with time and region fixed effects:

$$y_{i,t} = \beta x_{i,t} + \delta_t + \theta_k + \varepsilon_{i,t}, \quad (1)$$

where *x* denotes the offshore indicator and *y* the rate of return; each data point (*x*, *y*) is recorded for a number of countries (here in this research indexed by *i* from 1 to N=72), across four years (indexed by *t*) from 2009 to 2012; δ (indexed by *t*) represent the time fixed effect and θ (indexed by *k* from 1 to 7) represents the regional fixed effects.

[1] The full list of tax havens defined by OECD can be found in the Appendix A. Note that this list contains now 37 countries.

Estimates were obtained through a regression procedure with robust standard errors employing the Huber-White sandwich estimator. In addition, to account for potential within-country correlation between the residuals, the Authors performed an OLS procedure with (robust) clustered standard errors at the country level.

To calculate the rate of return the Authors used data from IMF BoP database (to retrieve FDI income data) and UNCTAD FDI database (to retrieve inward FDI stock).

The obtained results base on unbalanced panel of 72 countries, including 27 developed economies, 34 developing economies and 11 transition economies, covering the years from 2009 to 2012. According to the results of the regression performed by UNCTAD (UNCTAD, 2015a, 2015b) there is a support for the assumption of a negative relationship between the offshore indicator and the rate of return. The authors noticed that developing countries are relatively more vulnerable to profit shifting than developed countries.

In order to estimate the tax revenue loss, the exposure of a given group of countries of total inward stocks should be taken (for example a single country or a group of countries). In the report the estimates were made for all developing countries. It means that the share of inward stocks from offshore hubs for all developing countries were taken and multiplied by the estimated β coefficient (from the regression equation).

In UNCTAD (UNCTAD, 2015a, 2015b) exposure of developing countries of total inward stocks was 46% and β coefficient was -0.115 which gives an estimated profitability gap at the level of -5.3% (46% x -0.115). Then, the percentage obtained was multiplied by reported FDI stock in a given year. Applying these profitability gaps to the actual reported FDI stock for developing countries led to an estimate of the (after-tax) profit shifting between $330 billion and $450 billion.

3.2.Method II - Janský and Palanský (2019)

Janský and Palanský (2019) present their contribution to the literature on the profit shifting and tax havens in the following five stages:

1. using new and updated data sources they re-estimate and critically review the work of UNCTAD (2015a, 2015b) that they call the “baseline model”;
2. they further develop an “extended model” which improves the UNCTAD model in a number of aspects;

3. for the first time using this methodological approach they report country-level estimated tax revenue losses for all the countries in the world that have available data (that is 79 countries);
4. they compare their results with 4 other studies that provide country-level tax revenue loss estimates and they are pioneers in doing such a comparison;
5. they focus on the distributional impact of profit shifting and compare the revenue losses across countries from different income groups using their estimates and the ones from the other four studies.

The Authors ask the main research question: *which countries' tax revenues are affected most by the tax avoidance and how much?* They assume after the UNCTAD that *the negative relationship between the share of FDI from tax havens and the rate of return on the FDI is due to profit shifting*. However, unlike UNCTAD they provide country-level estimates of profit shifting for as many countries as possible.

The main variables in the core regression are the same as in UNCTAD research:

- the dependent variable is the rate of return on FDI (named by the Authors *FDI_ROR*, calculated according to Table 2 from the Method I description - as the total ROR and the equity and debt component)
- the main explanatory variable is the offshore indicator equal to the Share of FDI from tax havens in a country *i* (named *share_havens*).

Other variables are: inward FDI stock (USD billion); GDP (USD billion); Nominal corporate tax rate (%); Total corporate tax revenue (% of GDP) and Total tax revenue (% of GDP).

There are two models that Janský and Palanský (2019) consider in their analysis on the relationship between the rate of return on FDI and the share of FDI from tax havens. The first one is the baseline model that follows the UNCTAD (2015a, 2015b) methodology, but it is used for the extended time frame (2009-2016). The model is as follows:

$$FDI\_ROR_{it} = \beta * share\_havens_{it} + \sum_{s=2009}^{2016} \delta_s z_{s,i} + \sum_{k=1}^{7} \phi_k d_{k,i} + \varepsilon_{it}$$

where FDI_ROR_{it} is the rate of return on FDI in country *i* in year *t*, $share\_havens_{it}$ is the share of FDI from tax havens in a country *i* in a year *t*, $z_{s,i}$ are year fixed effects, and $d_{k,i}$ are regional fixed effects based on the World Bank's classifications.

As in UNCTAD research the Authors consider all three types of rate of return on FDI—the overall rate of return and its equity component in case of which they hypothesize a negative

relationship as well as the debt component in case of which they expect a positive parameter estimate.

The second model is the extended model of UNCTAD (2015a, 2015b):

$$FDI\_ROR_{it} = \beta * share\_havens_{it} + \sum_{m=1}^{5} \beta_m * share\_havens_{it} * inc_{m.i}$$

$$+ \sum_{k=1}^{7} \gamma_k * share\_havens_{it} * d_{k.i} + \sum_{m=1}^{5} \delta_m \, inc_{m.i} + \sum_{k=1}^{7} \phi_k d_{k,i} + \sum_{s=2009}^{2016} \delta_s z_{s,i} + \varepsilon_{it}$$

where $inc_{m,i}$ are dummy variables for income groups (as per the classification by the World Bank), with the remaining notation the same as in the baseline model.

The Authors make two innovations in the extended model:

1. They classify countries according to the World Bank's classification of countries by income per capita and add controls for income groups in the model, using dummy variables in the full-sample regression (and not splitting the sample for developing and developed countries like it is in the UNCTAD research).
2. The model tracks the interaction terms for income and regional groups with the share of FDI from tax havens.

The Authors use three data sources as in UNCTAD (2015a, 2015b), though with the update until 2016 and additional data sources. These are: IMF's Balance of Payments Statistics to calculate the rate of return on FDI, IMF Coordinated Direct Investment Survey (CDIS) to calculate the offshore indicator as well as the UNCTAD FDI data base to to retrieve inward FDI stock values.

The analysis is conducted for 79 countries in 2009-2016. The list of countries defined as tax havens was built like in UNCTAD. It consists of 37 *tax havens* compiled by UNCTAD plus a group of 14 so-called self-declared special-purpose entity (SPE) countries from the OECD database plus a group of 4 tax havens are 'other SPE countries', which do not declare themselves to be SPE-enabling countries, but seem to behave as such (quartile methodology).

Baseline model: For both the rate of return and its equity component, the statistically significant negative relationship between the share of inward FDI originating from tax havens and the rate of return on FDI was found.

Extended model: A statistically significant, negative relationship between the share of FDI from tax havens and the rate of return on FDI as well as its equity component was observed. However, none of the interaction terms is significant at the 5% level of significance, which

suggests that that there might not be large differences between countries from different income and regional groups.

In order to estimate how much profit is shifted and what the associated tax revenue losses are the Authors follow the procedure[2] of UNCTAD (2015a, 2015b) in the baseline model. For the extended model, they do the same procedure but they use country-specific values for the variables whenever available; e.g. they calculate the country-level estimates using specific corporate tax rates for each country rather than one estimate for all countries. This, together with the region- and income-group fixed effects, makes the extended model more reliable than the basic model at the country level. The final results shows that the total profits of multinational enterprises that were shifted out of analyzed 79 countries in 2016 amounted to $420 billion, resulting in these countries incurring tax revenue losses of $125 billion.

4. Results

4.1.Profit shifting estimation based on Method I and II

Our methodology for estimation of profit shifting is based on the hypothesis of the negative relationship at the country level between the share on inward investment stock from offshore hubs (hereafter "offshore Indicator") and the rate of return on the total inward FDI stock. The economic rationality over the hypothesis relates to the impact of investments through offshore investment hubs on a country's FDI rate of return. Hence, a high offshore indicator can artificially deflate a country's return. In the first step of our research, we empirically verify this hypothesis with the methodology presented by UNCTAD (UNCTAD, 2015a, 2015b).

UNCTAD (UNCTAD, 2015a, 2015b) proposed a profit-shifting estimation methodology in 2015. They present the correctness of assumptions based on four years horizon from 2009 to 2012. Our research extends this period by three times, covering 12 years from 2009 to 2022. We introduce two corrections to the existing methodology to cover a much longer horizon. First, we estimate the share of FDI outflow from offshore hubs through their Special Purpose Entities (SPEs) to total FDI outflow (Beta) in each year separately. UNCTAD (UNCTAD, 2015a, 2015b) estimated it once in the last year of their sample period. **We observe noticeable beta**

[2] The procedure is as follows. The Authors multiply the responsiveness of the reported rate of return to the share of FDI from tax havens—a parameter estimated by the regression above—by the actual value of FDI from tax havens. Then, to arrive at an estimate of the associated tax loss, they transform the estimates of shifted profits to pre-tax values, an adjustment which is necessary because the original FDI data are after-tax. Finally, they multiply these estimates of pre-tax shifted profits by the relevant statutory tax rate (which implies that all the shifted profits would, had they not been shifted, have been liable to corporate income taxation).

changes over the analysed 12 years; therefore, the constant beta level from the last year of observations does not represent the actual outflow from SPEs in the reporting period.[3] Second, we change the approach to outliers detection. UNCTAD (UNCTAD, 2015a, 2015b) uses the expert method to select outliers, and they detect nine outliers by observation of four charts representing each of the analysed years. Each chart demonstrates the relationship between offshore indicators and the rate of returns. Our twelve-year timespan makes this approach to be inappropriate**. Countries report meaningful changes in FDI data year to the year leading to variable estimations of offshore indicators and rate of returns.** Although we still start with the list of nine countries selected as outliers by UNCTAD, we add additional countries to this group (Barbados, Madagascar, Eswatini (former Swaziland), and Benin) and also eliminate all observations with negative FDI rate of returns and offshore indicators. Besides the above changes, we closely follow the methodology presented by UNCTAD.

Our global macroeconomic analysis is based on the country-level data on FDI. We use two data sources from IMF to estimate the rate of returns. First, we use yearly FDI incomes per country reported as total income and its equity and debt income component. We get this data from IMF Balance of Payment Standard Presentation by Indicator: Current Account, Primary Income, Direct Investment with 1) Investment Income (total income), 2) Income on Equity (equity income), and 3) Interest (debt income) from the Debit side reported in US dollars. Second, we get bilateral data on FDI stocks from the IMF's Coordinated Direct Investment Survey (CDIS), which covers up to 127 countries from 2009-2020. For each year we download data from CDIS Table 6: Inward Direct Investment Positions by All Reporting Economies Cross-classified by Counterpart Economies reported in US Dollars.

The second key input into the baseline regression model is the offshore indicator for each country and year. It is represented by the relation of FDI inflows to a country coming from offshores and FDI inflows. Along with UNCTAD methodology, we divide offshore countries into three categories: tax havens, self-declared offshore countries, and other countries defined as offshores empirically. We use the list of 37 tax havens defined by OECD (see Appendix A) and four self-declared offshores (Austria, Hungary, Luxembourg, Netherlands (the)). The empirical approach is based on two criteria. We define a country as the offshore when: 1) its FDI total is greater than GDP, and 2) its FDI total is greater than the 75 percentile of all countries in a year. This approach extends the offshore list to additional four countries (Ireland, Singapore, Switzerland, and Belgium) and Hong Kong (China). Next, we estimate the portion

[3] Please see changes of β in Table 5.

of FDI inflow from each offshore country that should be treated as offshore. For tax havens, we assume that all inflow should be considered offshore. For the additional nine countries, we use data from OECD's Foreign Direct Investment Statistics that distinguish the FDI inflow data related to SPEs and non-SPEs. Unfortunately, three countries do not report the slit in the OECD report (Hong Kong, Ireland, and Singapore). For these records, we estimate the share of FDI outflow using the regression approach where we first do the regression of each country FDI inflow on GDP, and then we estimate the theoretical FDI for each country. The difference between observed and estimated FDI presents the excess FDI from SPEs investments.

To estimate the regression of FDI return on offshore indicator we take only non-offshore countries. In other words, we remove all countries defined as tax havens, self-declared offshores, and empirically estimated offshores. Additionally, we remove outliers as specified in the previous section. Finally, we have **96 countries in our sample**, represented by 939 yearly observations. The first set of regressions uses the same variables as UNCTAD. It also includes two fixed effects: 1) time, 2) six geographical regions as classified by the United Nations (5 major regions with an additional split of Americas). The second set of regressions is based on variables defined by Janský and Palanský (2019). It extends regression model defined by UNCTAD with one additional dummy that describes income of a country along with the World Bank classification (low, low-mid, up-mid and high income countries). Additionally, it includes two types of interactions: 1) between income of a country and offshore indicator, and 2) between countries region and offshore indicator.

Table 4 demonstrates descriptive statistics of data used in Method I and II. Offshore indicators for each country in all our data sample are demonstrated in Table 5. For majority of offshore countries it reaches 100% but there are some countries with large economies where exposition of the total economy to offshore activity is much lower, e.g.: Austria, Belgium, or Switzerland.

We base our research on the Blundell and Bond (1998) Generalised Method of Moments (GMM). We use this method because we have a longer research sample than the earlier studies. UNCTAD (2015) prepared its model with the estimations for 4 years (2009-2012) and Janský and Palanský (2019) for 8 years (2009-2016). Our data cover 12 years in the period of 2009-2020. To properly calibrate the regression model to a panel consisting of more time periods we use the dynamic panel data model instead of the static one used in UNCTAD (2015) and Janský and Palanský (2019). We switch to GMM Blundell and Bond (1998) that is appropriate for series that are highly autoregressive which is the case for both ROR and offshore indicator.

The results of GMM Blundell and Bond (1998) regressions are demonstrated in Table 6. As may be seen for all/developing/developed countries the beta ratios of the offshore indicator are negative in case of the total and the equity ROR. This confirms the hypotheses about the negative relation between rate of returns from foreign direct investments and the exposition of a country to flows from the offshore hubs. As Poland is officially classified as developed economy we concentrate on the group of developed countries. Coefficients estimated from countries within this group are deeper negative suggesting stronger negative relation. Method II confirms results from Method I, presenting event stronger negative relation between returns and expositions. In contrast the majority of estimations for debt returns does not show any statistical significance for offshore indicators' betas. We therefore do not include debt RoRs in any further profit shifting estimations.

Finally Tables 7 and 8 visualize results of profit shifting estimations. More negative beta coefficients for offshore indicators for Method II translate into 15% higher values of profit shifting but overall both methods deliver very comparable approximations.

Table 4. Descriptive statistics of the variables used in Method I and II

	count	mean	std	min	25%	50%	75%	max
Rate of return on FDI (%)	925	7,73	4,70	0,13	4,58	6,95	9,80	33,47
Rate of return on FDI—equity component (%)	919	7,15	4,76	-0,80	3,96	6,37	9,24	31,91
Rate of return on FDI—debt component (%)	842	0,66	0,70	-0,07	0,10	0,43	1,00	4,45
Share of FDI from tax havens	925	22,37	11,39	0,00	13,81	21,67	31,01	56,72
GDP (USD billion)	918	696 554	2 196 829	241	19 839	68 861	381 287	21 372 600
Inward FDI stock (USD billion)	925	170 069	440 687	132	7 284	24 207	143 971	4 626 452
FDI income total (USD billion)	925	10 150	24 404	1	454	1 847	10 142	235 306
FDI income – equiy component (USD billion)	919	8 488	19 604	-555	390	1 695	8 612	185 042
FDI income – debt component (USD billion)	842	1 763	5 572	-3	15	103	718	50 264

Table 5. Offshore countries and their share of offshore component over the total outward investment stock (β %)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Anguilla[1]	100	100	100	100	100	100	100	100	100	100	100	100
Antigua and Barbuda[1]	100	100	100	100	100	100	100	100	100	100	100	100
Aruba[1]	100	100	100	100	100	100	100	100	100	100	100	100
Austria[2]	42	33	33	34	32	31	28	19	23	12	0	1
Bahamas (the)[1]	100	100	100	100	100	100	100	100	100	100	100	100
Bahrain[1]	100	100	100	100	100	100	100	100	100	100	100	100
Belgium[3]				4	4	4	3	3	2	11	10	12
Belize[1]	100	100	100	100	100	100	100	100	100	100	100	100
Bermuda[1]	100	100	100	100	100	100	100	100	100	100	100	100
Cayman Islands (the)[1]	100	100	100	100	100	100	100	100	100	100	100	100
Cook Islands[1]	100	100	100	100	100	100	100	100	100	100	100	100
Cyprus[1]	100	100	100	100	100	100	100	100	100	100	100	100
Dominica[1]	100	100	100	100	100	100	100	100	100	100	100	100

Gibraltar[1]	100	100	100	100	100	100	100	100	100	100	100	100
Grenada[1]	100	100	100	100	100	100	100	100	100	100	100	100
Guernsey[1]	100	100	100	100	100	100	100	100	100	100	100	100
Hong Kong[3]	87	88	90	90	90	91	91	90	90	91	90	89
Hungary[2]	88	84	83	80	79	76	76	87	85	76	82	87
Ireland[3]	55	60	67	72	73	72	86	84	85	84	85	84
Isle of Man[1]	100	100	100	100	100	100	100	100	100	100	100	100
Jersey[1]	100	100	100	100	100	100	100	100	100	100	100	100
Liberia[1]	100	100	100	100	100	100	100	100	100	100	100	100
Liechtenstein[1]	100	100	100	100	100	100	100	100	100	100	100	100
Luxembourg[2]	95	95	95	95	94	96	95	96	95	95	94	71
Malta[1]	100	100	100	100	100	100	100	100	100	100	100	100
Marshall Islands (the) [1]	100	100	100	100	100	100	100	100	100	100	100	100
Mauritius[1]	100	100	100	100	100	100	100	100	100	100	100	100
Monaco[1]	100	100	100	100	100	100	100	100	100	100	100	100
Montserrat[1]	100	100	100	100	100	100	100	100	100	100	100	100
Nauru[1]	100	100	100	100	100	100	100	100	100	100	100	100
Netherlands (the) [2]	76	76	77	79	79	70	61	59	61	62	57	39
Niue[1]	100	100	100	100	100	100	100	100	100	100	100	100
Panama[1]	100	100	100	100	100	100	100	100	100	100	100	100
Saint Kitts and Nevis[1]	100	100	100	100	100	100	100	100	100	100	100	100
Saint Lucia[1]	100	100	100	100	100	100	100	100	100	100	100	100
Saint Vincent and the Grenad.[1]	100	100	100	100	100	100	100	100	100	100	100	100
Samoa[1]	100	100	100	100	100	100	100	100	100	100	100	100
San Marino[1]	100	100	100	100	100	100	100	100	100	100	100	100
Seychelles[1]	100	100	100	100	100	100	100	100	100	100	100	100
Singapore[3]	75	78	82	83	84	86	86	86	87	88	89	88
Sint Maarten (Dutch part) [1]	100	100	100	100	100	100	100	100	100	100	100	100
Switzerland[3]		9		9	9	9	9	12	12	11	9	9
Turks and Caicos Islands (the) [1]	100	100	100	100	100	100	100	100	100	100	100	100
Vanuatu[1]	100	100	100	100	100	100	100	100	100	100	100	100
Virgin Islands (British) [1]	100	100	100	100	100	100	100	100	100	100	100	100
Virgin Islands (U.S.) [1]	100	100	100	100	100	100	100	100	100	100	100	100

Note: Offshore countries cover three groups of countries marked by indices: [1] tax havens, [2] self-declared offshore countries, [3] additional group of empirically estimated offshore countries (FDI total is greater than GDP and FDI total percentile is greater than the 75). β estimation depends on country groups and data availability where: 1) for tax havens it is 100%, 2) for non tax haven countries we take data from OECD's Foreign Direct Investment Statistics where β is equal to: $\frac{(FDI\ outflow\ with\ SPEs)-(FDI\ outflow\ without\ SPEs)}{FDI\ outflow\ with\ SPEs}$, 3) for Hong Kong, Ireland, and Singapore we estimate β by regressing FDI total on GDP, where β is represented with the relation $\frac{FDI\ excess}{FDI\ total}$ ($FDI\ excess$ is the difference between FDI total and FDI estimated by regressing FDI total on GDP). Data source is IMF.

Table 6. GMM Blundell and Bond (1998) regression– key statistics

	(1) Dependent variable: FDI Income rate of return (Rate of Return)			(2) Dependent variable: equity component of FDI Income rate of return (Rate of Return_Equity)			(3) Dependent variable: debt component of FDI Income rate of return (Rate of Return_Debt)		
	All	Developing	Developed	All	Developing	Developed	All	Developing	Developed
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(8)
Panel A: Method I - estimation based on variates used in UNCTAD									
L2.Offshore indicator	-0.067***	-0.077**	-0.069*	-0.035*	-0.079**	-0.098**	-0.002	-0.002	-0.022***
	(0.0171)	(0.0238)	(0.0293)	(0.0172)	(0.0247)	(0.0342)	(0.0024)	(0.0032)	(0.006)
Obs.	595	418	177	591	418	173	531	288	174
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: Method II - estimation based on variates used in Janský and Palanský (2019)									
L2.Offshore indicator	-0.049**	-0.067**	-0.077**	-0.021	-0.069**	-0.116***	-0.002	-0.002	-0.012
	(0.0182)	(0.0232)	(0.0293)	(0.0160)	(0.0230)	(0.0342)	(0.0030)	(0.0032)	(0.007)
Obs.	595	418		591	418	173	531	288	174
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Corrected standard errors in parentheses									

***p<0.01, **p<0.05, *p<0.1

Note: We use offshore indicators from columns marked as grey to estimate profit shifting

Table 7. Profit shifting estimation for Poland (in USDm) based on Method I

Country	Year	Inward position (1)	Offshore indicator (2)	L2.Offshore indicator coefficient (3)	Profitability gap (4)	profit_shifting after_tax (5=1*4)	profit_shifting pre_tax (5*tax rate=20%*)
Poland	2009	185,688.1	0.272	-0.09	0.0245	4,549.8	5,687.2
Poland	2010	215,512.8	0.302	-0.09	0.0272	5,865.2	7,331.5
Poland	2011	202,977.9	0.299	-0.09	0.0269	5,463.9	6,829.9
Poland	2012	235,113.0	0.295	-0.09	0.0265	6,241.2	7,801.4
Poland	2013	231,981.7	0.294	-0.09	0.0265	6,138.9	7,673.6
Poland	2014	213,253.4	0.305	-0.09	0.0274	5,845.2	7,306.5
Poland	2015	186,941.1	0.307	-0.09	0.0276	5,157.2	6,446.5
Poland	2016	189,752.2	0.298	-0.09	0.0268	5,084.4	6,355.5
Poland	2017	241,522.0	0.313	-0.09	0.0281	6,797.9	8,497.4
Poland	2018	229,819.6	0.341	-0.09	0.0307	7,051.1	8,813.9
Poland	2019	241,136.1	0.312	-0.09	0.0281	6,777.9	8,472.3
Poland	2020	250,301.0	0.256	-0.09	0.0231	5,769.5	7,211.8

* Pre-tax profit shifting is obtained by assuming an average corporate effective tax rate at 20%, roughly in line with most common empirical evidence as in UNCTAD

Table 8. Profit shifting estimation for Poland (in USDm) based on average offshore indicator from Method II

Country	Year	Inward position (1)	Offshore indicator (2)	L2.Offshore indicator coefficient (3)	Profitability gap (4)	profit_shifting after_tax (5=1*4)	profit_shifting pre_tax (5*tax rate=20%*)
Poland	2009	185,688.1	0.272	-0.10	0.026	4,884.6	6,105.7
Poland	2010	215,512.8	0.302	-0.10	0.029	6,296.7	7,870.9
Poland	2011	202,977.9	0.299	-0.10	0.029	5,866.0	7,332.5
Poland	2012	235,113.0	0.295	-0.10	0.028	6,700.4	8,375.5
Poland	2013	231,981.7	0.294	-0.10	0.028	6,590.6	8,238.2
Poland	2014	213,253.4	0.305	-0.10	0.029	6,275.3	7,844.1
Poland	2015	186,941.1	0.307	-0.10	0.030	5,536.7	6,920.8
Poland	2016	189,752.2	0.298	-0.10	0.029	5,458.5	6,823.2
Poland	2017	241,522.0	0.313	-0.10	0.030	7,298.1	9,122.6
Poland	2018	229,819.6	0.341	-0.10	0.033	7,570.0	9,462.5
Poland	2019	241,136.1	0.312	-0.10	0.030	7,276.6	9,095.7
Poland	2020	250,301.0	0.256	-0.10	0.025	6,194.0	7,742.5

* Pre-tax profit shifting is obtained by assuming an average corporate effective tax rate at 20%, roughly in line with most common empirical evidence as in UNCTAD

5. **Conclusions**

In order to reach the goal of our study we present two methods of estimating the value of profit shifting based on the data from BoP. We also estimate the profit shifting in Poland using these models in order to see whether the updated results follow the ones reached in the earlier studies. We challenge especially the quality and sources of data used in empirical verification of proposed methods, such that finally we are able to give recommendations how valuable it is to estimate profit shifting in case of Poland.

The results of our analysis concerning Method I and II show that for all/developing/developed countries the beta ratios of the offshore indicator are negative in case

of the total and equity ROR and positive in case of debt ROR. This confirms the hypotheses of the UNCTAD research. However, in all three cases of ROR it is not statistically significant. Also, in all three cases of ROR for the samples of all countries and developing countries the R sq. is very low which means a weak match of the variables in the model. A closer look at the graphical results confirms lack of regression path in the data. Such results do not give argument to calculate the dollar value of the profit shifting in the analysed countries. We confirmed our suspicion that the reason for that is that **the Method I and II for estimating profit shifting are time sensitive**:

- it works for UNCTAD (2015a, 2015b) and Janský and Palanský (2019) with the data of 2009-2016, when the share of the offshore component over the total outward investment stock (β %) was constant or was not changing too much over time. In the following years in some important cases we observe big (positive or negative) changes in that value (see, for example, the Netherlands who changed the way of reporting this value in 2020 –they have aligned their definition of SPEs with the definition that is used by the IMF) – this may cause a different final result;
- an essential change in the share of offshore component as a % of beta influences the final results of the research, especially when a considered offshore country has a high share in the basket of FDI. For example, this is the case of the Netherlands.

Our research sample is longer than earlier studies (12 years versus 4 years of UNCTAD (2015) study and 8 years of Janský and Palanský (2019) study). To properly calibrate the regression model to a panel consisting of more time periods we use dynamic panel data model instead of static. We switch to Blundell and Bond (1998) Generalised Method of Moments that is appropriate for series that are highly autoregressive which is the case for both ROR and the offshore indicator. Finally we demonstrate the statically significant negative relation between the ROR and the offshore indicator.

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Appendix A. List of tax havens originally defined by OECD used by (UNCTAD, 2015a, 2015b)

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