Are poorer countries more exposed to multinational tax avoidance?

Method and evidence from micro-data

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Abstract: We use a global dataset with information on 210,000 corporations in 176 countries to investigate whether cross-border profit shifting by multinational firms is more prevalent in low- and middle-income countries than in high-income countries. We develop a novel technique to study aggressive profit shifting and improve the credibility of existing techniques. Our results consistently show that the sensitivity of reported profits to profit shifting incentives is considerably larger in countries with lower income levels. This implies that poorer countries are more exposed to multinational tax avoidance and may explain why many of them opt for low corporate tax rates in spite of urgent revenue needs and severe constraints on the use of other tax bases.

Keywords: profit shifting, multinational firms, tax avoidance, tax evasion, developing countries, fiscal capacity

JEL codes: H25, H26, H87, O23

1. Introduction

There is solid empirical evidence that multinational firms reduce their tax bills considerably by shifting profits from countries with high corporate taxes to countries with low corporate taxes and the various profit shifting techniques are fairly well understood.[1] The global loss of government revenue caused by profit shifting is most likely counted in hundreds of billions of dollars and has been increasing over time.[2]

While almost all of the empirical evidence on profit shifting concerns developed countries, the problem may be even more acute in developing countries. First, given the limitations on tax design imposed by a large informal sector (Gordon and Li, 2009), many developing countries depend heavily on tax payments from large corporations in the formal sector (UNCTAD, 2015). Second, a recent line of research shows that sophisticated anti-avoidance rules targeted multinational firms successfully limit profit shifting[3], however, such rules rarely exist in developing countries (OECD, 2014) where the regulatory and bureaucratic capacity is limited. The lack of regulatory tools may be reinforced by higher levels of corruption and weaker institutions, which potentially allow multinational firms to circumvent the anti-avoidance practices that are in place.

This paper studies profit shifting in developing countries and investigates whether the intensity of profit shifting differs systematically between countries with different income levels. While this would have been impossible a few years ago because suitable data were only available in high-income countries, we exploit that the leading global firm database, Orbis, has recently increased its coverage considerably in low- and middle-income countries. The database includes financial information at the level of individual corporations as well as ownership information serving to link corporations that belong to the same multinational group.

[1] There are two main profit shifting techniques. First, transfers between affiliates are systematically mispriced: goods (Cristea and Nguyen, forthcoming) and services (Hebous and Johannesen, 2015) are overpriced when flowing from low-tax to high-tax affiliates and underpriced when flowing in the opposite direction. Second, balance sheet items are allocated strategically: income-generating assets such as patents (Karkinsky and Riedel, 2012) and financial assets (Ruf and Weichenrieder, 2012) are allocated to low-tax affiliates whereas cost-generating liabilities such as external debt (Desai, Foley and Hines, 2004) and internal debt (Buettner and Wamser, 2013) are allocated to high-tax affiliates.

[2] With a variety of methods, the annual revenue loss due to profit shifting has recently been estimated at $130 billion for U.S. multinational firms (Zucman, 2014); $100-240 billion globally (OECD, 2015), $90 billion and $100 billion for developing and developed countries respectively (UNCTAD, 2015).

[3] Ruf and Weichenrieder (2012) show that c*ontrolled foreign corporation rules,* which subjects the income of foreign subsidiaries to domestic taxation when the foreign tax rate is below a threshold, discourages the allocation of financial assets to low-tax affiliates; Lohse and Riedel (2014) show that *transfer pricing rules*, which require firms to document that transfer prices are in line with observed prices in comparable arms-length transactions, reduce the responsiveness of firm profits to tax differentials; and Buettner et al. (2012) show that *thin capitalization rules*, which disallow the tax deductibility of interest payments on internal debt exceeding a threshold, discourage the allocation of liabilities to high-tax affiliates.

Much of our analysis focuses on 39 European countries where data availability has improved the most and where the significant income differences between the rich West and the poor East create a useful laboratory for our analysis. Per capita incomes are on average more than four times higher in the West than in the East and range from less than $3,000 in Georgia and Ukraine to around $80,000 in Norway and Switzerland. However, we also conduct regressions that use all the available information in Orbis including financial information of around 25,000 corporations in 108 low- and middle-income countries.

Our empirical strategy departs from the most widely used method for detecting profit shifting, which relates the reported profits of each corporation to its inputs of labor and capital and a variable capturing its tax incentive to engage in profit shifting with foreign affiliates (e.g. Hines and Rice, 1994; Huizinga and Laeven, 2008).[4] To the extent that corporations facing high tax rates relative to their affiliates systematically report lower profits than corporations facing low tax rates relative to their affiliates conditional on production inputs, this is taken as evidence of profit shifting.

We develop this methodology along several dimensions; often with the aim of addressing the specific issues arising in a sample that includes low-income countries where data quality is lower and the heterogeneity across countries is more pronounced.

First, contrary to the norm in the existing literature, we are careful not to identify profit shifting from variation in the domestic tax rate facing corporations. A high domestic tax rate creates an incentive to shift profits to foreign affiliates, but also to adapt domestic strategies to reduce the tax bill, such as financing with external debt as implied by trade-off models of capital structure (Myers, 1984); for managers owning shares to exert less effort as implied by standard models of labor supply (Feldstein, 1999); and to keep part of the business operations in the informal sector as might be a relevant margin of response in developing countries (Gordon and Li, 2009). Hence, if high domestic tax rates are associated with low reported profits conditional on production inputs, this may be, but need not be, due to profit shifting.

We improve the identification of profit shifting by relying exclusively on variation in the tax rates facing foreign affiliates. Exploiting the cross-sectional variation, we thus ask whether corporations whose foreign affiliates face relatively low tax rates systematically report less profits than corporations in the same country and with the same production inputs whose foreign affiliates face relatively high tax rates. Turning to the time variation, we ask whether corporations whose foreign affiliates experience a reduction

[4] One notable methodological exception is Dharmapala and Riedel (2013) who use shocks to profits rather than to taxes to identify profit shifting.

in the tax rate reduce reported profits relative to corporations in the same country whose foreign affiliates experience a constant tax rate. All regressions control fully and non-parametrically for cross-country productivity differences.

Second, we propose to identify profit shifting with a "zero profit" dummy variable that indicates whether profits fall within a narrow range around zero. Our argument departs from the observation that the global tax bill of a multinational group is minimized when all profits are shifted to the corporation facing the lowest tax rate and zero profits are reported in all other corporations. While this theoretical benchmark of extreme tax aggressiveness is not directly relevant empirically, presumably because profit shifting is always to some extent constrained by tax rules, it suggests that corporations reporting almost precisely zero profits should be observed more frequently when profits are shifted more aggressively. Drawing on this insight, we estimate how the propensity to report zero profits correlates with the tax incentives to shift profits and test whether this correlation varies systematically across countries with different income levels.

This approach is attractive because it focuses directly on the most salient manifestation of profit shifting: multinational groups that consistently report zero profits in its high-tax affiliates despite being profitable at the global level. It is also appealing that it does not require precise measurement of factor inputs, which is likely to be particularly problematic in developing countries, and makes no parametric assumptions about the technology that transforms factor inputs into profits. Finally, it enhances the transparency of the analysis that the empirical patterns detected in the regressions can be traced to the raw distributions of profits.

Our results provide robust evidence that firms' profit shifting responses to tax incentives are stronger in countries with lower income levels.[5]

We first show that the tax rates facing the foreign affiliates of a corporation have a statistically and economically significant positive effect on the propensity to report zero profits and that this effect is decreasing in the income level: a 10 percentage point decrease in foreign affiliates' tax rates increases the likelihood that the corporation reports zero profits by 4 percentage points in Eastern Europe, but only by 1.5 percentage point in Western Europe. This difference is clearly visible when we plot the raw profitability distributions for East and West separately. In the global sample, our regressions indicate that a $10,000 increase in GNI per capita reduces the effect of a 10

[5] This result is consistent with the broader literature on corporate tax evasion in developing countries, which tends to find that evasion among small and medium-sized domestic firms is pervasive (e.g. Best et al, 2014; Johnson et al., 2000).

percentage point decrease in foreign affiliates' tax rates on the propensity to report zero profits by around 0.5 percentage points.

Turning to our improved version of the standard framework, we consistently find that the tax incentives for profit shifting matter for profits reported by corporations in Eastern Europe: a 10 percentage point reduction in foreign affiliates' tax rates is found to decrease reported profits by 10-15% depending on the specification. In Western Europe, the effects are smaller and often statistically insignificant.[6] In the global sample, we find that a $10,000 increase in GNI per capita reduces the effect of a 10 percentage point decrease in foreign affiliates' tax rates on reported profits by at least 3 percentage points.

Our finding that developing countries are highly exposed to cross-border profit shifting may help explain why they, often in spite of desperate revenue needs, do not raise corporate taxes rates. When firms respond strongly to profit shifting incentives, increases in tax rates generate little or no increases in government revenue. The inability to contain profit shifting therefore constitutes an effective constraint on tax policy and low rates may be the best feasible policy given this constraint. This illustrates the broader view that fiscal capacity tends to be low in developing countries (Besley and Persson 2013).

The paper contributes to a small existing literature that addresses profit shifting in developing countries. Fuest, Hebous and Riedel (2011, 2013) use detailed micro-data on the capital structure of German multinational firms to show that the use of internal debt in foreign affiliates is more sensitive to tax incentives in developing countries than in developed countries. Taking a macro perspective, Crivelli, de Mooij and Keen (2015) demonstrate that corporate tax externalities, encompassing both real investment and profit shifting responses to corporate taxation, are larger in developing countries than in developed countries. Also relying on macro data, UNCTAD (2015) shows that the average rate of return on foreign direct investment in developing countries decreases rapidly with the share of investment deriving from offshore financial centers, which is suggestive of profit shifting. To the best of our knowledge, no existing paper studies the responsiveness of reported profits to tax incentives using micro-data from low- and middle income countries.

[6] Previous studies of profit shifting in high-income countries typically report that a 10 percentage point reduction in the tax differential between a corporation and its foreign subsidiaries increases reported profits by around 8% (Heckemeyer and Overesch, 2013). Our results suggest that these estimates are not robust to a more demanding identification strategy where variation in the tax differential only derives from foreign tax variation.

The paper also makes a number of methodological contributions that, while generally applicable to any study of profit shifting, are particularly designed to ensure credible identification of tax avoidance by multinational firms in the context of developing countries and thus pave the way for future work in this field.

The paper proceeds in the following way. Section 2 describes the data; Section 3 develops and applies a novel framework to study aggressive profit shifting; Section 4 improves and applies the standard framework to studying profit shifting; and Section 5 concludes.

2. Data

Firm data are drawn from the full version of the proprietary database Orbis maintained by Bureau Van Dijk. The database includes basic information from the balance sheet and the profit and loss accounts for each individual corporation. The information derives from financial statements, but is adapted by Bureau Van Dijk to be comparable across countries. The database also identifies the ultimate owner of each corporation, which we use to construct corporate groups comprising all corporations with the same ultimate owner.[7]

Corporations enter our gross sample if they satisfy two requirements. First, they must have at least one foreign affiliate; we do not consider purely national firms for the simple reason that these firms cannot engage in international profit shifting. Second, there must be basic financial information about the corporation in Orbis; even the least demanding regression framework requires that total assets, profits and the industry classification is observed. Both requirements imply that our gross sample is far smaller than the total number of corporations in Orbis. The vast majority of corporations have no foreign affiliates and for the majority of those that do, no financial information is available.

Table 1 shows summary statistics for the largest estimating sample of corporations used in the cross-sectional regressions.[8] The information is for the financial years

[7] Our dataset was drawn from the database in October 2013 and the corporate groups reflect ownership information at that time. To the extent that corporate groups have changed between the time when financial information is reported and the time when the ownership information is observed, the incentives for profit shifting may be mismeasured. This measurement problem is prevalent in almost all empirical studies of profit shifting.

[8] Our estimating sample is always smaller than the gross sample for three reasons. First, we exclude observations with a return on assets above 96% (the 99th percentile in the gross sample) to avoid that corporations with implausibly high profits, for instance due to measurement error, drive our results.

ending in 2010, which the is the year with the highest data coverage in developing countries.[9] Columns (1)-(3) and Columns (4)-(6) describe the Eastern European and Western Europe subsamples respectively whereas Columns (7)-(9) describe the World sample. Our definition of Eastern Europe comprises 23 countries in the former socialist bloc whereas Western Europe comprises 16 countries. A full list of these countries is included in the Online Appendix.

- Table 1 around here -

The separate analysis of Eastern and Western Europe is motivated in Panel A, which provide background information on the economic environment. The average corporation in Eastern Europe operates in a country where GDP per capita is around $8,650 while the corresponding figure for corporations in Western Europe is almost five times higher at $38,250. The income difference is only slightly less pronounced when expressed in terms of GNI per capita (computed with the Atlas method).[10]

The reason for focusing part of analysis on Europe is also immediately apparent from the table. While there are around 190,000 corporations in Eastern and Western Europe combined, including the rest of the world only adds around 20,000 corporations to that figure; almost 90% of the corporations in Orbis with basic financial information, such as profits and total assets, are located in Europe.

Panel B provides summary statistics of the financial information in Orbis. Corporations in Eastern Europe are smaller than those in Western Europe in terms of assets, but larger in terms of the number of employees, which is consistent with more labor-intensive

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Second, some observations with negative returns are dropped. In the standard empirical framework, the logarithmic transformation of profits implies that only observations with strictly positive profits enter the estimating sample. Our novel "zero-profit" framework, in principle, allows observations with negative profits by relying on a dummy transformation of profits rather than a logarithmic transformation. However, this would be problematic since losses change the marginal tax incentives in highly complex ways. In a simple static analysis, corporate groups always have a tax incentive to shift profits to loss-making corporations *regardless* of the tax rates. Taking into account dynamic aspects, incentives depend on tax rates as well as rules for loss-carry forward and expected future profits. We sidestep these intricacies and include only observations with strictly positive profits and profits sufficiently close to zero to switch on the "zero-profit" dummy, that is returns on assets between -0.5% and 0.5%. Finally, we exclude the smallest corporations with assets below $1 million.

[9] Notably in developing countries, there is often a considerable time lag from the ending of the financial year until accounts are closed, financial information is published and this information is adapted by Bureau van Dijk and entered into Orbis.

[10] This is the income measure used by the World Bank to construct country-level income groups.

production in low-income countries. Average reported profits are lower in Eastern Europe than in Western Europe when measured in absolute terms, but the profitability is very similar across the two regions whether measured as the return on assets or the probability that the return to assets falls within a narrow range around zero (between -0.5% and 0.5%).

Panel C provides summary statistics of the tax variables, which is based on information on statutory corporate tax rates from KPMG and information on the full corporate group structures from Orbis.[11] Absent special tax regimes and tax holidays, which are often negotiated at the firm-level and about which we do not have information, the statutory tax rate is precisely the effective tax rate applying to the marginal dollar of reported profits and thus captures the incentive to manipulate the tax base with profit shifting or otherwise (Devereux and Maffini, 2007).

Besides the domestic corporate rate, we report summary statistics for our two measures of foreign tax rates: the average tax rate facing foreign corporations belonging to the same group and the tax rate facing the parent.[12] Both measures vary across corporations in the same country and are therefore useful for credible identification of profit shifting.

The table shows that tax rates are generally considerably lower in Eastern Europe than in Western Europe: the domestic tax rate facing an average corporation in the East is around 19% compared to around 28% for an average corporation in the West; also the tax rates of parents and foreign affiliates are lower in the East than in the West.

3. A new approach to studying aggressive profit shifting

This section first argues that aggressive profit shifting, the shifting of all profits to low-tax affiliates, requires a new empirical framework where the key outcome is the reporting of zero profits. It then investigates empirically, with graphical analysis and in a regression model, whether the prevalence of zero profits correlates with the tax incentive to shift profits in line with the theoretical prediction and whether this correlation varies systematically across countries with different income levels.

[11] To be precise, the foreign tax rates reported in the table and used in the regressions also account for affiliated corporations about which Orbis includes information on the ultimate owner, but no financial information.

[12] Parent companies have been shown to play a prominent role in the profit shifting strategies of multinational firms (Dischinger, Knoll and Riedel, 2013).

3.1 Theoretical motivation

The standard framework for studying profit shifting can be illustrated with the following simple example. A multinational firm consists of two profitable corporations: one in country H with a high tax rate t^H and one in a country L with a low tax rate t^L. Shifting a dollar of profits from the former to the latter yields a tax saving of $t^H - t^L$, but also creates a cost in the form of concealment efforts, expected tax penalties, or similar. Assuming that shifting costs, C, are a convex function of the amount of profits shifted, S, the firm will optimally shift profits from H to L until $t^H - t^L = C'(S)$. This implies that a small increase in t^H or decrease in t^L induce a small increase in profit shifting; less profits are reported in H and more are reported in L for a given amount of production inputs in the two countries. The empirical profit shifting literature is largely devoted to testing this theoretical prediction.

This framework relies on the implicit assumption that shifting costs are large enough to sustain an optimum with positive reported profits in both countries. If shifting costs are sufficiently small, however, the firm optimally chooses to report all its profits in L and zero profits in H. More precisely, if $t^H - t^L > C'(S)$ at the allocation where all profits in H are shifted to L, this is the firm's optimum, because the tax bill in H is then zero and cannot be reduced any further by shifting profits to L.[13] Clearly, this profit allocation is insensitive to small changes in tax rates; the key theoretical prediction of the standard framework no longer holds.

Moreover, it is also assumed that shifting costs are variable, whereas in reality they may have an important fixed component.[14] If shifting costs are fixed at C, the firm optimally chooses either to report all profits in L or to report profits truthfully in both countries. Letting p^H denote true profits in H, full shifting is optimal when $p^H(t^H - t^L) > C$ while no shifting is optimal when $p^H(t^H - t^L) < C$. The profit allocation is not affected by small tax changes except in the special case where $p^H(t^H - t^L) = C$.

While this simple example illustrates the limitations of the standard framework as a guide to empirical analysis, it also suggests an alternative approach that focuses on the prevalence of zero profits. Whether full shifting occurs because variable shifting costs are low or shifting costs are fixed altogether, we should expect a more frequent reporting of zero profits among firms with a large saving from profit shifting, i.e. firms for which $t^H - t^L$ is large.

[13] Technically, an optimum where negative profits are reported in H would require that $-t^L = S'(P)$, which is impossible given that marginal shifting costs are positive and there is some taxation of profits in L.

[14] Shifting cost components such as consultant fees, costs of operating shell corporations and risk of negative publicity are presumably largely independent of the scale of the profit shifting and could reasonably be considered fixed.

3.2 Graphical evidence

Figure 1 provides a graphical analysis of the prevalence of zero profits by showing raw histograms of the return to assets in Eastern and Western Europe respectively. The histograms are shown separately for corporations with different tax incentives to shift profits as measured by the parent tax rate: corporations whose parent is facing a higher tax rate than themselves ("diff to parent<0" - the red line) and corporations whose parent is facing a lower tax rate than themselves ("diff to parent>0" - the blue line).

- Figure 1 around here -

The figure offers clear evidence of bunching at zero profits regardless of the profit shifting incentives. In all four groups, more than 2% of corporations report a return to assets between 0% and 0.1%, whereas less than 1% report a return to assets in the similar-sized windows between -1% and -0.9% and between 1% and 1.1%.

While bunching at zero profits among corporations with high-tax parents cannot be explained with profit shifting, it can be rationalized with other tax- and non-tax incentives. The marginal incentive to reduce the tax base through other channels than profit shifting, whether legitimate (e.g. external leverage) or illegitimate (e.g. non-reporting of income), changes fundamentally at zero profits where there are no taxes to pay. Hence, corporations with no incentives to shift profits abroad may bunch at zero profits for domestic tax reasons. In the accounting literature, bunching at zero profits has been discussed and interpreted as evidence that firm managers have discretion to shift profits across financial years and choose to report slightly positive profits in years where true profits are slightly negative to maintain a record of "consistent profitability" (Burgstahler and Dichev, 1997).

From a profit shifting perspective, the interesting feature is therefore not bunching at zero profits *per se*, but that the magnitude of the bunching varies systematically with the incentives to shift profits.

In Eastern Europe, the fraction reporting a return between 0% and 0.1% is around 5% for corporations with low-tax parents, but only 2% for corporations with high-tax parents. Similarly, there is more mass immediately to the left and to the right of this interval for corporations with low-tax parents than for those with high-tax parents. Assuming that true returns are distributed similarly for the two groups, the striking difference in reported returns close to zero is suggestive of aggressive profit shifting

whereby all profits are shifted to foreign affiliates with lower tax rates and no taxes are paid domestically.

In Western Europe, by contrast, the fraction of corporations reporting a return between 0% and 0.1% is around 2% regardless of the tax difference to the parent. More generally, the distributions of reported returns are very similar for corporations with low-tax and high-tax parents. Hence, the clear signs of aggressive profit shifting that we observed in the poor East are not present in the rich West. This represents our first suggestive evidence that the exposure to profit shifting is larger in countries with lower income levels.

3.3 Regression framework

The graphical analysis has several limitations. First, the simple comparison of corporations with low-tax and high-tax parents only uses part of the variation in the tax incentive to shift profits; it ignores that the tax saving from profit shifting is not the same for all corporations with low-tax parents, but proportional to the tax differential. Second, we are effectively making comparisons across corporations operating in different countries, comparing, for instance, a corporation in Poland with a low-tax parent to a corporation in Georgia with a high-tax parent. This is problematic if there are cross-country differences in the propensity to report zero profits for other reasons than profit shifting.

We address these both of these limitations in the following simple regression framework:

$$zero_i = \alpha_c + \beta_3 tax_i^{for} + \varepsilon_i$$

The dependent variable is a dummy variable indicating whether the reported return to assets falls between -0.5% and 0.5%. In the spirit of the bunching literature (e.g. Saez, 2010), we are effectively assuming that firms cannot fully control their true income and expenses such that profits realized after profit shifting may be slightly positive or negative even when firms aim for exactly zero profits. The specific range chosen corresponds roughly to the range in which there is excess mass in the raw profit distributions shown in Figure 1, but given that the choice is somewhat arbitrary, we include robustness tests where the dummy is defined for narrower intervals in the Online Appendix.

The main explanatory variable is the tax rates facing foreign affiliates, tax^{for}. Given that the equation includes country fixed effects, α_c, we are effectively comparing the probability of reporting zero profits of corporations in the same country whose incentive

to shift all profits to foreign affiliates differs because these affiliates are facing different tax rates. The domestic tax rate is not identified in the model due to the country fixed effects.

The parsimony of this model is appealing; it requires very little financial information and makes no parametric assumptions about the technology that transforms production inputs into profits. It is therefore especially useful in the context of developing countries where financial information is often incomplete and measurement error in the financial variables is always a serious concern.

3.4 Regression results

The results are presented in Table 2. Estimating the model separately for Eastern and Western Europe suggests that a 10 percentage point decrease in the parent tax rate increases the likelihood that a corporation reports zero profits by around 4 percentage points in the East (Column 1), but only by 1.6 percentage point in the West (Column 2). The estimated effects of a change in the average foreign tax rate are almost identical (Columns 3-4).

- Tabel 2 around here -

While the large difference between East and West supports the notion that poorer countries are more exposed to aggressive profit shifting, we exploit all the underlying variation in income levels by estimating an augmented version of the model where the tax variable is interacted with income per capita. We rebase the income variable at $8.000, roughly the average income level in our sample of developing countries, so that the main effect of the tax variable can be interpreted as the marginal effect at this income-level.

Estimating this model on the full European sample suggests that a $10,000 increase in GNI per capita reduces the effect of a 10 percentage point decrease in the parent tax rate on the propensity to report zero profits by around 0.5 percentage points (Column 5) and, analogously, reduces the effect of a 10 percentage point decrease in the average foreign tax rate by around 0.7 percentage points (Column 6). The effects are slightly smaller when we make the same estimations on the full global sample (Columns 7-8).

We conduct a number of robustness tests, which are reported in the Online Appendix. First, addressing the fuzziness of the threshold between zero and non-zero profits, we exclude returns between 0.5% and 2% and thus effectively compare profits that are close to zero to profits that are clearly non-zero. This increases both point estimates and significance levels of the tax terms. Second, we show that the results remain qualitatively unchanged when the zero profits dummy is defined over narrower windows of profitability: windows between -0.25% and 0.25% and between -0.1% and 0.1% both produce similar results although income interactions are not always statistically significant. Finally, all results are robust to using a probit model instead of the linear probability model that is our baseline.

In sum, this section offers very robust evidence that aggressive profit shifting, the shifting of all profits to foreign low-tax affiliates, is more prevalent in low- and middle income countries than in high-income countries.

4. Improving identification in the standard framework

In this section, we develop the standard framework for detection of profit shifting with the aim of making identification more credible. We then use this improved framework to investigate whether the sensitivity of reported profits with respect to tax incentives for profit shifting varies systematically across countries with different income levels.

4.1 Regression framework

Our regression framework departs from the following standard specification for detecting profit shifting:

$$\log(profits_i) = \alpha + \beta_1 \log(capital_i) + \beta_2 \log(labor_i) + \beta_3\left(tax_i^{dom} - tax_i^{for}\right) + \gamma X_i + \varepsilon_i$$

The two tax variables express the domestic tax rate facing corporation i and the foreign tax rates facing its affiliates respectively and X is a vector of controls including, for instance, income per capita and industry dummies to capture total factor productivity. Conceptually, the non-tax terms on the right-hand side of the equation describes true profits under the assumption that the production technology is Cobb-Douglas (Huizinga and Laeven, 2008), while the tax term measures the incentive to engage in profit shifting with foreign affiliates.

This specification raises several concerns about identification. First, as argued above, the domestic tax rate is likely to affect both profit shifting and other behavioral margins: it shapes the incentives to finance the firm with external debt, to move transactions to

the informal sector and to exert effort for all employees and managers with a stake in after-tax profits. Since the tax term in the standard framework varies one-to-one with the domestic tax rate, it is likely to effectively confound profit shifting and a number of entirely unrelated behavioral responses to domestic taxation. These behavioral responses are likely to be especially pronounced in developing countries (Besley and Persson, 2013). Second, total factor productivity presumably has a strong country-specific component, which is only imperfectly absorbed by the country-level controls in X; to the extent that the error correlates with the tax term, the estimated tax effects will be biased.

To address these concerns, we separate the domestic and the foreign tax rates and augment the model with country fixed effects, which gives us the following estimating equation:

$$\log(profits_i) = \alpha_c + \beta_1 \log(capital_i) + \beta_2 \log(labor_i) + \beta_3 tax_i^{for} + \gamma X_i + \varepsilon_i$$

The domestic tax rate drops out of the equation due to the country fixed effects. Profit shifting is thus identified exclusively from *within-country variation* in the foreign tax rates faced by affiliates: we are effectively asking whether corporations whose foreign affiliates face relatively low tax rates report systematically different levels of profits than corporations in the same country and industry and with the same production inputs whose foreign affiliates face relatively high tax rates. The identifying assumption is that within countries and industries, the ability of a corporation to transform production factors into profits is uncorrelated with the tax rates faced by its foreign affiliates.

We also estimate the following panel analogue of this equation:

$$\log(profits_{it}) = \alpha_i + \beta_1 \log(capital_{it}) + \beta_2 \log(labor_{it}) + \beta_3 tax_{it}^{dom} + \beta_4 tax_{it}^{for} + \gamma X_{it} + \mu_t + \varepsilon_{it}$$

where α_i represents corporation fixed effects and μ_t is a set of time dummies. Since all cross-sectional variation in profits are absorbed by the fixed effects, profit shifting is identified exclusively from *time variation* in the foreign tax rates faced by affiliates: we are effectively asking whether corporations whose foreign affiliates experience a change in the tax rate systematically change the level of reported profits relative to corporations in the same country and industry and with the same production inputs whose foreign affiliates experience a constant tax rate. The identifying assumption is that within countries and industries, changes in the ability of a corporation to transform production factors into profits is uncorrelated with changes in the tax rates faced by its foreign affiliates.

The panel equation resembles the equation that is estimated by most of the recent papers in the literature (Heckemayer and Overesch, 2013) except that these papers all lump together domestic and foreign tax rates in a single tax differential and thus identify profit shifting from time variation in both tax variables. While also the domestic tax rate is statistically identified in our panel model, we are reluctant to give a precise interpretation to the estimated coefficients because the domestic tax rate is likely to affect reported profits through a number of other channels than profit shifting as discussed above.

It is not clear *a priori* whether the cross-sectional model or the panel model provides the best identification of profit shifting. The main advantage of the panel model is that it controls fully for fixed factors in the ability to transform production factors into profits. Since the expansion of the firm database in low- and middle income countries occurred recently, however, most corporations in these countries are observed in relatively few time periods; hence, to the extent that profit shifting adjusts to changes in tax incentives with a lag, the panel model is likely to underestimate the long-run effects on profit shifting behavior.

Finally, before estimating the models, we need to take a stand on the precise definitions of the variables. Profits are measured after financial income and expenses, which implies that profit shifting in the form of interest payments on intra-firm loans are accounted for in the regressions, but before taxes. Capital is measured as fixed assets, which is in line with most of the literature, whereas labor is measured as the number of employees, which is more commonly available in low- and middle-income countries than the total wage bill.[15]

4.2 Regression results

The results from the cross-sectional model are presented in Table 3. Estimating the model separately for Eastern and Western Europe, we find that a 10 percentage point reduction in the parent tax rate decreases reported profits by around 18% in the East (Column 1), but only by 10% in the West (Column 2). When the profit shifting incentive is measured with the average foreign tax rate, the effect is 14% in the East and a statistically insignificant 1% in the West (Columns 3-4).

[15] The wage bill is a theoretically more satisfactory measure of labor inputs by accounting for the quality of labor. We include robustness tests with this measure in the Online Appendix.

- Tabel 3 around here -

Estimating the model on the full European sample while introducing an interaction term between the foreign tax rate and the income level, we find that a $10,000 increase in GNI per capita decreases the effect of a 10 percentage point reduction in the foreign tax rates on reported profits by around 3% (Columns 5-6). Repeating the estimation on the full global sample raises the income sensitivity of the tax effects slightly (Columns 7-8).

Broadly the same patterns emerge from the panel model, which we estimate for the sample period 2003-2012. The results presented in Table 4 estimates suggest that a 10 percentage point reduction in the parent tax rate decreases reported profits by around 10% in Eastern Europe (Columns 1 and 3) while there is no such effect in Western Europe (Columns 2 and 4). In the full European sample, we find that the effect of the parent tax rate decreases by around 7% and the effect of the average foreign tax rate by around 8.5% for each $10,000 increase in GNI per capita. In the full global sample, the income sensitivity is somewhat higher.[16]

- Tabel 4 around here –

The panel results also suggest that, notably in Eastern Europe, reported profits tend to be more sensitive to the domestic tax rate than to the foreign tax rates faced by affiliates. This is consistent with our conjecture that the domestic tax rate induces other behavioral responses than profit shifting. It also raises concerns that identification of profit shifting from variation in the domestic tax rate may cause estimates to be upward biased.

It is instructive to compare our estimates to the benchmark provided by a recent meta-study (Heckemayer and Overesch, 2013). Based on 25 papers using the standard empirical framework, most of them studying multinational groups in Europe, they estimate that a 10 percentage point reduction in the tax differential between a corporation and its foreign subsidiaries increases reported profits by around 8%. By comparison, our estimates tend to imply a larger tax sensitivity than this benchmark in Eastern Europe and a smaller tax sensitivity (often zero) in Western Europe.

[16] In the panel model, income levels are measured as the average over the sample period.

In sum, the results reported in this section provide further support for the finding that profit shifting responses to tax incentives are stronger in poorer countries. This is true both when we use the standard framework for detecting profit shifting and when we apply our improved framework that identifies profit shifting cleanly from cross-sectional and time variation in the foreign tax rates of affiliates.

5. Concluding remarks

This paper provides empirical evidence on the link between the tax aggressiveness of multinational firms and the economic development of their host countries. We develop new techniques to detect cross-border profit shifting while paying special attention to the methodological challenges that arise in the context of developing economies. Applying these techniques to a global firm dataset with a reasonable coverage in low- and middle income countries, we show that the sensitivity of firms' reported profits to incentives for cross-border profit shifting varies systematically with per capita income levels: poorer countries appear to be significantly more exposed to tax avoidance by multinational firms. This is consistent with the broader view that developing countries have lower fiscal capacity.

The negative relation between a country's income level and its exposure to multinational tax avoidance is very robust and emerges in a wide array of empirical specifications, however, it is less clear what causal mechanisms are at play. Credible identification of the mechanisms that lead to low tax compliance by multinational firms in developing countries is an important goal for future research.

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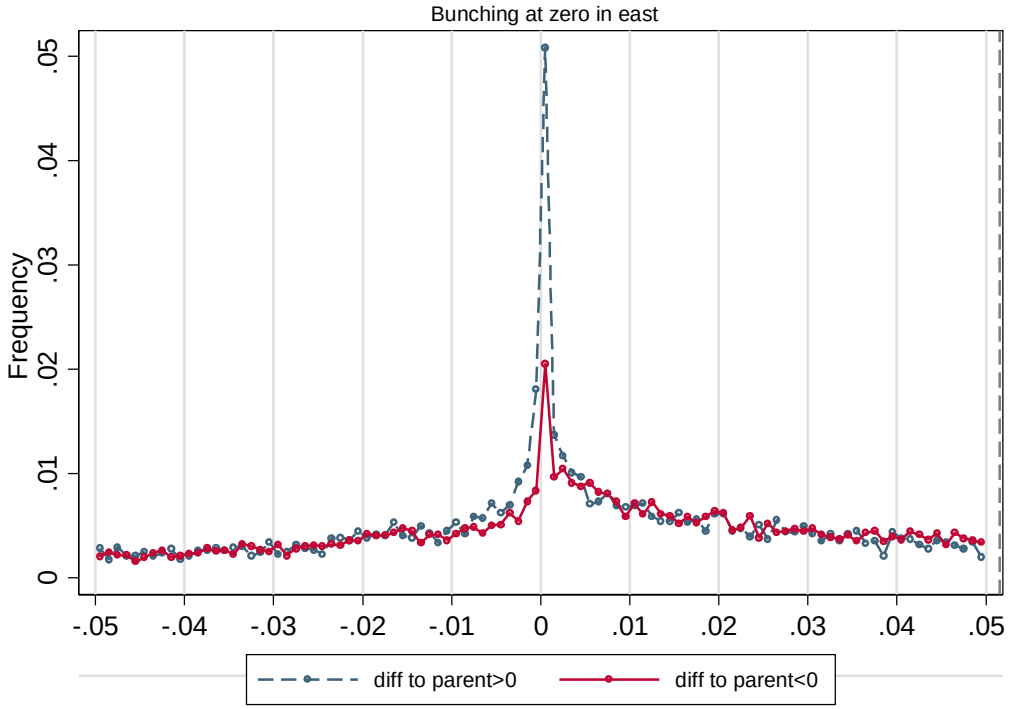
Table 1: Descriptive statistics

	Eastern Europe			Western Europe			World		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Panel A: National economy									
GNI per capita	35,327	11,795	4,851	156,424	45,522	12,382	210,566	38,264	17,685
GDP per capita	35,327	8,651	4,106	156,424	38,241	9,856	210,560	32,004	14,951
GDP per capita growth rate	35,327	2.7	1.7	156,424	1.6	1.5	210,577	2.0	2.1
Population (mill.)	35,327	52	56	156,424	45	27	210,931	63	127
Panel B: Financial information									
Total Assets (mill. USD)	35,327	123	2,083	156,424	558	13,900	211,325	707	17,200
Fixed Assets (mill. USD)	34,829	44	819	154,136	116	1,757	205,715	110	1,615
Turnover (mill. USD)	35,047	67	787	137,988	94	867	192,323	125	1,139
Profits (mill. USD)	35,327	7	84	156,424	14	198	211,325	17	220
Employees	30,617	332	5,804	99,456	197	1,551	142,012	287	3,993
Return to Assets	35,327	0.100	0.128	156,424	0.100	0.130	211,325	0.099	0.128
Zero profits	35,327	0.159	0.366	156,424	0.149	0.356	211,325	0.146	0.353
Panel C: Tax									
Domestic tax	35,323	0.185	0.025	156,424	0.282	0.046	211,153	0.269	0.060
Parent tax	33,209	0.229	0.078	147,148	0.290	0.065	198,943	0.282	0.074
Average foreign affiliate tax	35,327	0.221	0.060	156,424	0.258	0.050	211,325	0.252	0.054

Notes: The observational unit is subsidiaries of MNEs in 2010 with at least one foreign affiliate and assets of at least 1 mill USD*GNI per capita* is the gross national income per person in USD, measured using the World Bank's Atlas Method. *GDP per capita* is the gross domestic product per capita, measured in USD. *GDP per capita growth* is the growth rate of *GDP per capita* in percent during 2010. *Population (mill.)* is the population of the country in millions. *Total assets (mill. USD)* are all reported assets of the corporation in million USD. *Fixed assets (mill. USD)* are all fixed assets of the corporation in million USD. *Turnover (mill. USD)* is total turnover of the corporation in million USD. *Profits (mill. USD)* are all pre-tax profits including financial income measured in million USD. *Employees* is the number of employees in the observed corporation. *Return on assets* is *Profits (mill. USD)* divided by *Total assets (mill. USD)*. *Zero profits* is a dummy variable defined as 1 when reported return to assets (ROA) is within 0.5 percentage points of 0, missing if above 96% or below -0.5%, otherwise 0 *Domestic tax* is the tax rate faced by the observed corporation. *Parent tax* is the tax rate faced by the parent company of the orbserved corporation. *Average foreign affiliate tax* is the average taxation of affiliates of the observed firm, located in other countries.

Figure 1: Histograms of return on assets conditional on difference to parent taxation and geography



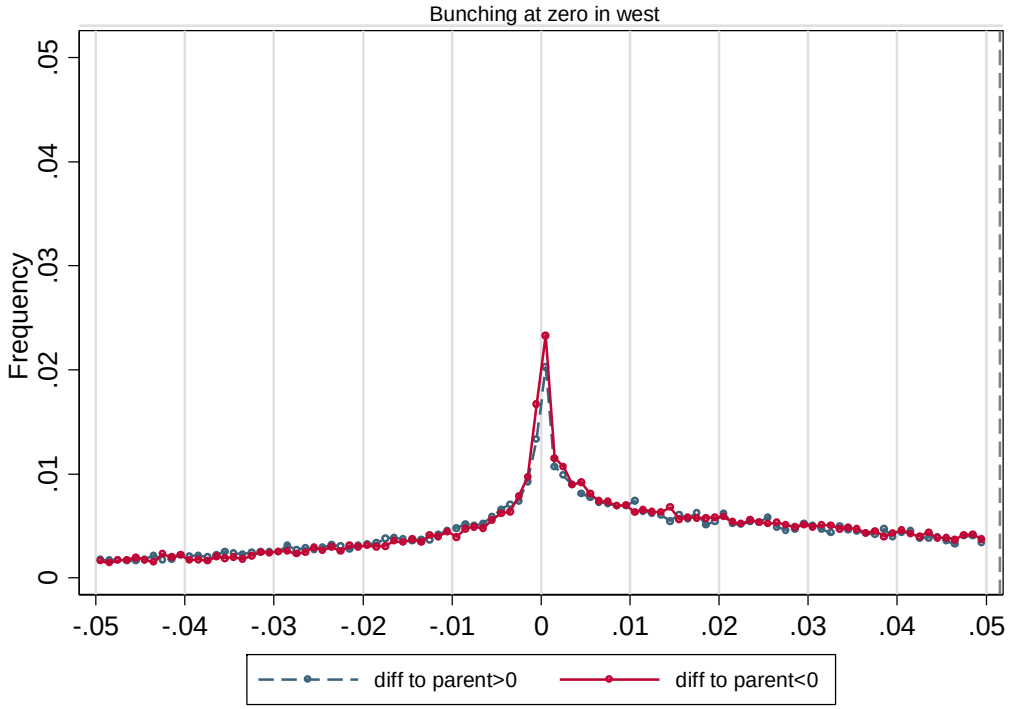


Table 2: Likelihood of reporting zero profits

	Dependent variable: Zero profit							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	East	West	East	West	West+East	West+East	World	World
Parent tax	-0.404***	-0.157**			-0.374***		-0.335***	
	(0.0531)	(0.0626)			(0.0657)		(0.0630)	
Parent tax × GNI per capita					0.00549**		0.00473**	
					(0.00221)		(0.00216)	
Average foreign affiliate tax			-0.436***	-0.156***		-0.413***		-0.328***
			(0.0679)	(0.0350)		(0.0679)		(0.0858)
Average foreign affiliate tax × GNI per capita						0.00686***		0.00481**
						(0.0018)		(0.00231)
Observations	25,779	65,077	35,327	156,424	90,856	191,751	98,065	210,566
R-squared	0.051	0.058	0.055	0.044	0.056	0.046	0.058	0.049

Notes: Heteroscedasticity robust standard errors, adjusted for country clusters are reported in parentheses. The observational unit is subsidiaries of MNEs in 2010 with at least one foreign affiliate and assets of at least 1 mill USD. The dependent variable is*Zero profits* , which is a dummy variable defined as 1 when reported return to assets is within 0.5 percentage points of 0, missing if above 96% or below -0.5%, otherwise 0. All regressions include industry- and country fixed effects. Industry fixed effects are computed using 1-digit NACE codes*Parent tax* is the tax rate faced by the parent company of the observed corporation.*GNI per capita* is the gross national income per person in 1,000 USD, measured using the World Bank's Atlas Method, rebased at USD 8,000. *Average foreign affiliate tax* is the average taxation of affiliates of the observed firm, located in other countries. *, ** and *** Indicate significance at the 10%, 5% and 1% level respectively.

Table 3: Cross sectional results

	Dependent variable: Profits (in logs)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	East	West	East	West	West+East	West+East	World	World
Parent tax	1.777***	0.971***			1.988***		1.909***	
	(0.272)	(0.202)			(0.272)		(0.235)	
Parent tax × GNI per capita					-0.0294***		-0.0272***	
					(0.00955)		(0.00871)	
Average foreign affiliate tax			1.423***	0.108		1.364***		1.327***
			(0.476)	(0.481)		(0.460)		(0.427)
Average foreign affiliate tax × GNI per capita						-0.0341*		-0.0357**
						(0.0187)		(0.0177)
Fixed assets (in logs)	0.253***	0.326***	0.281***	0.337***	0.306***	0.326***	0.309***	0.332***
	(0.0131)	(0.0165)	(0.0138)	(0.0141)	(0.0149)	(0.0119)	(0.0144)	(0.0115)
Employees (in logs)	0.512***	0.340***	0.487***	0.368***	0.394***	0.393***	0.387***	0.391***
	(0.0510)	(0.0288)	(0.0528)	(0.0246)	(0.0376)	(0.0275)	(0.0358)	(0.0257)
Observations	19,746	39,273	27,561	87,942	59,019	115,503	62,045	126,034
R-squared	0.382	0.415	0.374	0.406	0.431	0.411	0.446	0.434

Notes: Heteroscedasticity robust standard errors, adjusted for country clusters are reported in parentheses. The observational unit is subsidiaries of MNEs in 2010 with at least one foreign affiliate and assets of at least 1 mill USD. The dependent variable is*Profits (in logs)*, which is the logarithm of the pre-tax profits including financial income. All regressions include industry- and country fixed effects. Industry fixed effects are computed using 1-digit NACE codes.*Parent tax* is the tax rate faced by the parent company of the observed corporation.*GNI per capita* is the gross national income per person in 1,000 USD, measured using the World Bank's Atlas Method, rebased at $8,000.*Average foreign affiliate tax* is the average taxation of affiliates of the observed firm, located in other countries.*Fixed assets (in logs)* is the logarithm to all fixed assets of the corporation.*Employees (in logs)* is the logarithm to the number of employees in the observed corporation.*, ** and *** Indicate significance at the 10%, 5% and 1% level respectively.

Table 4: Panel results 2003-2012

	Dependent variable: Profits (in logs)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	East	West	East	West	West+East	West+East	World	World
Parent tax	1.009***	0.00383			1.922***		2.028***	
	(0.243)	(0.145)			(0.233)		(0.215)	
Parent tax × GNI per capita					-0.0719***		-0.0853***	
					(0.00821)		(0.00761)	
Average foreign affiliate tax			1.042***	-0.274		2.677***		2.930***
			(0.312)	(0.177)		(0.268)		(0.253)
Average foreign affiliate tax × GNI per capita						-0.114***		-0.139***
						(0.00892)		(0.0083)
Domestic tax	-4.888***	0.167	-3.908***	-0.301***	-3.869***	-2.786***	-2.874***	-1.696***
	(0.329)	(0.159)	(0.255)	(0.108)	(0.307)	(0.225)	(0.283)	(0.212)
Domestic tax × GNI per capita					0.114***	0.0665***	0.0736***	0.0159**
					(0.0104)	(0.00753)	(0.00979)	(0.00715)
GDP per capita (in logs)	1.222***	1.700***	1.796***	2.085***	1.435***	1.953***	0.918***	1.313***
	(0.118)	(0.136)	(0.0987)	(0.0885)	(0.0901)	(0.0670)	(0.0602)	(0.0461)
Fixed assets (in logs)	0.136***	0.0661***	0.148***	0.0704***	0.0840***	0.0862***	0.0844***	0.0893***
	(0.00662)	(0.00379)	(0.00563)	(0.00274)	(0.00329)	(0.00247)	(0.00324)	(0.00240)
Employees (in logs)	0.322***	0.300***	0.305***	0.283***	0.310***	0.289***	0.305***	0.285***
	(0.0109)	(0.00812)	(0.00962)	(0.00522)	(0.00654)	(0.00461)	(0.00636)	(0.00445)
Observations	150,396	331,902	216,751	759,271	482,298	976,022	509,360	1,066,802
R-squared within	0.095	0.051	0.094	0.051	0.066	0.061	0.065	0.060
No of firms	36,824	73,608	50,590	166,609	110,432	217,199	118,746	238,950
Industry#year effects fixed effects	✓	✓	✓	✓				
Industry#year#region fixed effects					✓	✓		
Industry#year#income group fixed effects							✓	✓

Notes: Heteroscedasticity robust standard errors, adjusted for entity clusters are reported in parentheses. The observational unit is yearly observations of subsidiaries of MNEs with at least one foreign affiliate and assets of at least 1 mill USD. The dependent variable is *Profits (in logs),* which is the logarithm of pre-tax profits including financial income. All regressions include entity fixed effects. *Parent tax* is the tax rate faced by the parent company of the observed corporation. *GNI per capita* is the gross national income per person in 1,000 USD, measured using the World Bank's Atlas Method, rebased at $8,000. *Average foreign affiliate tax* is the average taxation of affiliates of the observed firm, located in other countries. *Domestic tax* is the tax rate faced by the observed corporation. *GDP per capita (in logs)* is the gross domestic product per capita, measured as the logarithm of the USD amount. *Fixed assets (in logs)* is the logarithm to all fixed assets of the corporation. *Employees (in logs)* is the logarithm to the number of employees in the observed corporation. Industry fixed effects are computed using 1-digit NACE codes. The two regions are Eastern and Western Europe. The two income groups are high income (above $12,250 *GNI per capita*) and low income (below 12,250 *GNI per capita*). *, ** and *** Indicate significance at the 10%, 5% and 1% level respectively.