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## **Are less developed 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 102 countries to investigate whether cross-border profit shifting by multinational firms is more prevalent in less developed countries. We propose 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 negatively related to the level of economic and institutional development. This may explain why many developing countries opt for low corporate tax rates in spite of urgent revenue needs and severe constraints on the use of other tax bases.

**Keywords:** developing countries, international taxation, multinational firms, profit shifting, tax avoidance, tax evasion

**JEL classification:** H25, H26, H87, O23

**Tables and Figures:** at the end of the paper.

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## 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.<sup>1</sup> 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.<sup>2</sup>

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 on multinational firms successfully limit profit shifting;<sup>3</sup> however, such rules rarely exist in developing countries (OECD 2014), where the regulatory and bureaucratic capacity is limited. Third, there is a broader concern that weak governance in developing countries, reflected in high levels of corruption, weak law enforcement, and a lack of political accountability, may foster an environment with low tax compliance.

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

Our empirical strategy to detect profit shifting departs from the most widely used method, which relates the reported profits of each corporation to its inputs of labour and capital and its tax incentive to engage in profit shifting with foreign affiliates (e.g. Hines and Rice 1994; Huizinga and Laeven 2008).<sup>4</sup> To the extent that corporations facing high tax rates relative to their affiliates

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<sup>1</sup> 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 et al. 2004) and internal debt (Buettner and Wamser 2013) are allocated to high-tax affiliates.

<sup>2</sup> With a variety of methods, the annual revenue loss due to profit shifting has recently been estimated at US\$130 billion for US multinational firms (Zucman 2014); US\$100–240 billion globally (OECD 2015), US\$90 billion and US\$100 billion for developing and developed countries respectively (UNCTAD 2015).

<sup>3</sup> Ruf and Weichenrieder (2012) show that *controlled foreign corporation rules*, which subject 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 (2013) show that *transfer pricing rules*, which require firms to document that transfer prices are in line with observed prices in comparable arm's-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.

<sup>4</sup> One notable methodological exception is Dharmapala and Riedel (2013), who use shocks to profits rather than to taxes to identify profit shifting.

systematically report lower profits 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 developing 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 labour 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 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. This theoretical benchmark of extreme tax aggressiveness 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.

This approach is attractive because it focuses directly on the most salient manifestation of profit shifting: multinational groups that consistently report zero profits in their high-tax affiliates despite being profitable at the global level. Moreover, 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 observed in the raw distributions of profits.

Equipped with these methods for detecting profit shifting, we investigate whether there are systematic differences across countries at different development levels.

Part of our analysis focuses on 39 countries in Europe where data coverage is most satisfactory and where a striking development gap between the West and the East creates a useful laboratory for analysis. Income levels in Europe are on average more than four times higher in the West than in the East and range from less than US\$3,000 in Georgia and Ukraine to around US\$80,000 in Norway and Switzerland. Likewise, the quality of governance is consistently higher in the West than in the East. Europe includes countries in the East like Russia and Bosnia, which

score well below the global average on all dimensions of governance, as well as countries in the West like Sweden and Finland, which are among the best governed in the world. These stark differences between otherwise similar regions have deep historical roots; notably, all countries in Eastern Europe share a legacy of autocratic socialist regimes and centrally planned economies.<sup>5</sup>

A simple comparison of profit shifting in Eastern and Western Europe thus provides our first test of how the tax avoidance of multinational firms is shaped by the development level of the host country. However, we also estimate models that use all the available information in Orbis, including financial information of around 25,000 corporations in 59 developing countries, and fully exploit the cross-country variation in economic and institutional development.

Our results provide robust evidence that firms' profit-shifting responses to tax incentives are stronger in less developed countries.<sup>6</sup>

We show that the tax rates facing the foreign affiliates of a corporation have a significant positive effect on the propensity to report zero profits and that this effect is decreasing in development: 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 points in Western Europe. This difference is clearly visible when we plot the raw profitability distributions for Eastern and Western Europe separately. In the global sample, our regressions indicate that increasing either income per capita or the quality of governance by one standard deviation reduces the effect of a 10 percentage point decrease in foreign affiliates' tax rates on the propensity to report zero profits by roughly 1 percentage point.

Moreover, we consistently find that the tax incentives for profit shifting matter for the level of profits reported by corporations in Eastern Europe: a 10 percentage point decrease in foreign affiliates' tax rates is found to decrease reported profits by 10–20 per cent. In Western Europe, the estimated effects are always smaller and often statistically insignificant.<sup>7</sup> In the global sample, our regressions indicate that increasing either income per capita or the quality of governance by one standard deviation reduces the effect of a 10 percentage point decrease in foreign affiliates' tax rates on reported profits by at least 5 percentage points.

Our finding that less developed countries are highly exposed to cross-border profit shifting may help explain why, often in spite of desperate revenue needs, they do not raise rates of corporate taxes. When firms respond strongly to profit-shifting incentives, increases in tax rates generate little or no increase 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 finding that fiscal capacity tends to be low in developing countries (Besley and Persson 2013).

While we find a robust relation between a country's level of development and the tax aggressiveness of the multinational firms it is hosting, the precise causal mechanism is elusive.

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<sup>5</sup> It is well documented in the literature that economic institutions are highly persistent (e.g. Dell 2010)

<sup>6</sup> 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. 2015; Johnson et al. 2000).

<sup>7</sup> 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 per cent (Heckemeyer and Overesch 2013). We obtain similar results when we identify from all variation in taxes, but these estimates are not robust to a more demanding identification strategy where the variation only derives from foreign taxes.

Because of the strong correlation between the various dimensions of economic and institutional development – income, control of corruption, rule of law, political accountability, regulatory quality, government effectiveness, and political stability – disentangling their effect on profit shifting is highly challenging.

The paper contributes to a small existing literature that addresses profit shifting in developing countries. Fuest et al. (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 et al. (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 centres, 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.

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.<sup>8</sup>

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.

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<sup>8</sup> 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 applies to almost all empirical studies of profit shifting.

Table 1 shows summary statistics for the largest estimating sample of corporations used in the cross-sectional regressions.<sup>9</sup> The information is for the financial year ending in 2010, which is the year with the highest data coverage in developing countries.<sup>10</sup> 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 A1).<sup>11</sup>

The income and institutional variables in panels A and B motivate the comparison of profit shifting in Eastern and Western Europe as a starting point for analysing how development shapes tax avoidance. The average corporation in Eastern Europe operates in a country where GNI (gross national income) per capita is around US\$11,800 while the corresponding figure for corporations in Western Europe is almost four times higher at US\$45,500.

To make our results comparable across development measures with different scales, our regressions employ a standardized measure of GNI where, by construction, the (global) mean is zero and one unit represents one standard deviation in the (global) distribution. We note that incomes in Eastern Europe are very close to the global mean, but almost two standard deviations higher in Western Europe.

The lower income levels in Eastern Europe are mirrored by lower quality of governance as indicated by standardized measures of corruption, government effectiveness, political stability, regulatory capacity, rule of law, and political accountability (World Governance Indicators 2015). In all six dimensions, the governance outcome facing an average corporation in Eastern Europe is considerably worse than that facing an average corporation in Western Europe; and in five cases the difference is larger than one standard deviation.

Since the six variables capturing different dimensions of governance are highly correlated, as shown in Table 2, it is tedious to disentangle their effects on tax avoidance. In the main analysis, we therefore use the first principal component of the governance variables as an index of the quality of governance. The correlation coefficient between the first principal component and the individual governance variables ranges from 0.79 (political stability) to 0.99 (rule of law) and thus captures most of the variation in the quality of governance. The Online Appendix provides regression results where each of the governance variables is entered separately.

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<sup>9</sup> Our estimating sample is always smaller than the gross sample for three reasons. First, we exclude observations with a return on assets above 96 per cent (the 99<sup>th</sup> percentile in the gross sample) to avoid corporations with implausibly high profits, for instance due to measurement error, driving our results. 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 should 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 per cent and 0.5 per cent. Finally, we exclude the smallest corporations with assets below US\$1 million.

<sup>10</sup> 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.

<sup>11</sup> The Online Appendix is available at: <http://www.nielsjohannesen.net/papers>.

Panel C in Table 1 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 labour-intensive 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 on assets falls within a narrow range around zero (between -0.5 per cent and 0.5 per cent).

Panel D 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.<sup>12</sup> Absent special tax regimes and tax holidays, 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 through 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 foreign parent.<sup>13</sup> Both measures vary across corporations in the same country and are therefore useful for credible identification of profit shifting. Table 1 shows that tax rates are considerably lower in Eastern Europe than in Western Europe: the domestic tax rate facing an average corporation in the East is around 19 per cent compared to around 28 per cent for an average corporation in the West; also the tax rates of parents and foreign affiliates tend to be lower in the East than in the West.

Throughout the paper, we complement the comparison of Eastern and Western Europe with an analysis of the full global sample. It should be noted, however, that this only increases the estimating sample moderately: while there are around 190,000 corporations in Europe, including the rest of the world adds around 20,000 corporations to that figure.

### 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

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<sup>12</sup> To be precise, the foreign tax rates reported in Table 1 and used in the regressions also account for affiliated corporations about which Orbis includes information on the ultimate owner, but no financial information.

<sup>13</sup> Parent companies have been shown to play a prominent role in the profit-shifting strategies of multinational firms (Dischinger et al. 2013).



firm's optimum, because the tax bill in H is then zero and cannot be reduced any further by shifting profits to L.<sup>14</sup> 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.<sup>15</sup> 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  $\pi^H$  denote true profits in H, full shifting is optimal when  $\pi^H(t^H - t^L) > C$ , while no shifting is optimal when  $\pi^H(t^H - t^L) < C$ . The profit allocation is not affected by small tax changes except in the special case where  $\pi^H(t^H - t^L) = C$ .

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, that is, firms for which  $t^H - t^L$  is large.

### 3.2 Graphical evidence

Figures 1a–1b provide 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 (red line) and corporations whose parent is facing a lower tax rate than themselves (blue line).

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

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.

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<sup>14</sup> 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.

<sup>15</sup> 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.

In Eastern Europe, the fraction reporting a return between 0 per cent and 0.1 per cent is around 5 per cent for corporations with low-tax parents, but only 2 per cent 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 per cent and 0.1 per cent is around 2 per cent 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 less developed East are not present in the developed West. This represents our first suggestive evidence that the exposure to profit shifting is larger in less developed countries.

Figures 1c–1d compare the distribution of returns across corporations whose profit-shifting incentives differ by a wider margin: corporations facing a tax rate at least 5 percentage points lower (red line) and higher (blue line) than their parent respectively. In the East, the contrast is now even more striking with almost 6 per cent of the former but only around 1.5 per cent of the latter reporting a return between 0 per cent and 0.1 per cent. In the West, the pattern remains roughly unchanged.

In the Online Appendix, we show the same type of figures for the global sample while grouping countries according to explicit measures of development. We find that countries with low incomes and poor governance generally exhibit patterns very similar to Eastern Europe, whereas countries with high incomes and good governance resemble Western Europe (Figures A1–A2). This is not surprising given that the majority of the firms in our sample are located in Europe and that the East–West split almost perfectly captures cross-country differences in income and governance. We obtain very similar figures when the tax incentive for profit shifting is measured with reference to the average tax rate facing foreign affiliates rather than the tax rate facing the parent (Figures A3–A5).

### 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 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 per cent and 0.5 per cent. 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 Figures 1 and 2, but given that the choice is somewhat arbitrary, the Online Appendix includes robustness tests where the dummy is defined for narrower intervals.

The main explanatory variable is the tax rates facing foreign affiliates,  $tax^{for}$ . Given that the equation includes country fixed effects,  $a_i$ , 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 novel empirical framework for detecting profit shifting 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 3. 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 around 1.5 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).

While the large difference between East and West supports the notion that less developed countries are more exposed to aggressive profit shifting, we exploit all the underlying variation in development levels by estimating an augmented version of the model where the tax variable is interacted with our two measures of development: income per capita and the quality of governance. These regressions effectively include corporations in 93 countries.<sup>16</sup>

The results suggest that increasing GNI per capita by one standard deviation reduces the effect of a 10 percentage point decrease in the parent tax rate on the propensity to report zero profits by around 0.9 percentage points (column 5) and reduces the effect of a 10 percentage point decrease in the average foreign tax rate by around the same magnitude (column 6). Likewise, increasing the quality of governance by one standard deviation reduces the effect of a 10 percentage point decrease in the parent tax rate on the propensity to report zero profits by around 1.3 percentage points (column 7) and reduces the effect of a 10 percentage point decrease in the average foreign tax rate by around 1.1 percentage points (column 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 per cent and 2 per cent and thus effectively compare profits that are close to zero to profits that are clearly non-zero (Table A1). 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: similar results are produced by windows both between -0.25 per cent and 0.25 per cent and between -0.1 per cent

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<sup>16</sup> This figure disregards countries where all outcomes are perfectly predicted by country fixed effects because all corporations or no corporations have zero profits. Such observations do not contribute to the identification of the variables of interest.

and 0.1 per cent although interactions with development variables are not always statistically significant (Table A2).

Finally, we re-estimate the model while replacing the governance index with the underlying governance measures (Table A3). For all combinations of the two tax measures and the six governance measures, we find point estimates on their interaction term between 0.08 and 0.16. Given the strong correlation between the governance measures, however, these results should be interpreted with great caution. While they corroborate our finding that aggressive tax avoidance is more prevalent in less developed countries, it is not clear which particular aspects of development are driving this correlation.

## 4 Improving identification in the standard framework

In this section, we improve the standard framework for detection of profit shifting with the aim of making identification more credible. We then use this 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:

$$\log(\text{profits}_i) = \alpha + \beta_1 \log(\text{capital}_i) + \beta_2 \log(\text{labor}_i) + \beta_3 (\text{tax}_i^{\text{dom}} - \text{tax}_i^{\text{for}}) + \gamma X_i + \varepsilon_i$$

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 describe 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 in the introduction, the domestic tax rate is likely to affect both profit shifting and other behavioural 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 behavioural responses to domestic taxation. These behavioural 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 domestic and foreign tax rates and augment the model with country fixed effects, which gives us the following estimating equation:

$$\log(\text{profits}_i) = \alpha_c + \beta_1 \log(\text{capital}_i) + \beta_2 \log(\text{labor}_i) + \beta_3 \text{tax}_i^{\text{for}} + \gamma X_i + \varepsilon_i$$

The country fixed effects absorb the domestic tax rate and profit shifting is thus identified exclusively from *within-country variation* in the tax rates faced by foreign 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:

$$\log(\text{profits}_{it}) = \alpha_i + \beta_1 \log(\text{capital}_{it}) + \beta_2 \log(\text{labor}_{it}) + \beta_3 \text{tax}_{it}^{\text{dom}} + \beta_4 \text{tax}_{it}^{\text{for}} + \gamma X_{it} + \mu_t + \varepsilon_{it}$$

where  $\alpha_i$  represents corporation fixed effects and  $\mu_t$  is a set of time dummies. Since all cross-sectional variation in profits is 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 industry and with the same production inputs whose foreign affiliates experience a constant tax rate. The identifying assumption is that, within 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 the domestic tax rate is also 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 differences in the ability to transform production factors into profits. Since the expansion of the firm database in developing countries occurred recently, however, most corporations in these countries are observed in relatively few time periods (3.5 years for the average corporation). 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 behaviour.

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 is accounted for in the regressions, but before taxes. Capital is measured as fixed assets, which is in line with most of the literature, whereas labour is measured as the number of employees, which is more commonly available in developing countries than the total wage bill.

## 4.2 Regression results

The results from the cross-sectional model are presented in Table 4. 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 per cent in the East (column 1), but only by 10 per cent in the West (column 2). When the profit-shifting incentive is measured with the average foreign affiliate tax rate, the effect is 14 per cent in the East and a statistically insignificant 1 per cent in the West (columns 3–4).

Estimating the model on the global sample while introducing an interaction term between the foreign tax rate and the income level, we find that increasing GNI per capita by one standard deviation reduces the effect of a 10 percentage point reduction in foreign tax rates on reported profits by 5–7 percentage points (columns 5–6). The effect of increasing the quality of governance by one standard deviation is strikingly similar (columns 7–8).

Broadly the same patterns emerge from the panel model, which we estimate for the sample period 2003–12. The results presented in Table 5 estimates suggest that a 10 percentage point reduction in the parent tax rate decreases reported profits by around 10 per cent in Eastern Europe (columns 1 and 3) while there is no such effect in Western Europe (columns 2 and 4). In the global sample, both higher income and better governance are associated with a large and strongly significant decrease in the effect of foreign taxes on reported profits (columns 5–8).<sup>17</sup>

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 behavioural 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.

The cross-sectional and panel regressions include corporations in 71 and 57 countries respectively, as compared to 93 countries in the zero-profit regressions reported in the previous section. The loss of observations occurs because financial reporting in developing countries is often incomplete and erratic, which leads to missing information about production inputs and short panels.<sup>18</sup> This highlights that the zero-profit framework proposed in this paper is less vulnerable to the data limitations often present in the context of developing countries than existing methods.

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 per cent. By comparison, our estimates that rely only on variation in foreign tax rates tend to imply a larger tax sensitivity than this benchmark in Eastern Europe and a smaller tax sensitivity (close to zero) in Western Europe.

We conduct a number of additional tests, which are reported in the Online Appendix. First, we show that the negative correlation between the level of development and the tax responsiveness of reported profits is even more pronounced in the standard framework where the tax incentive for profit shifting is captured by the difference between the domestic and foreign tax rates (Table A4). These results suggest that a 10 percentage point reduction in the foreign tax rates decrease reported profits by more than 20 per cent in Eastern Europe, whereas the effects remain close to zero in Western Europe. Hence, our main finding holds, irrespective of the methodological advances we are proposing. Second, we show that when the standard framework is applied to all corporations in the European Union, a typical sample in the studies covered by Heckemayer and Overesch (2013), we find that a 10 percentage point reduction in the tax differential between a corporation and its foreign subsidiaries increases reported profits by an average of around 4 per cent (Table A5). This is close to the estimates reported by most recent studies (e.g. Dischinger et

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<sup>17</sup> In the panel model, both income and governance are measured as the average over the sample period.

<sup>18</sup> Not uncommonly, we only observe corporations once, in which case profits are perfectly predicted by the corporation fixed effects in the panel specification.

al. 2013; Lohse and Riedel 2013), which reassures us that our results are not driven by peculiarities of our data source or the sample period.

Finally, we re-estimate the model while replacing the governance index with the underlying governance measures (Table A6). Their interactions with the parent tax rate have point estimates between -0.7 and -1.5, whereas their interactions with the average foreign affiliate tax rate have point estimates between -1.7 and -2.7. We reiterate that these results should be interpreted with caution and cannot be taken as direct evidence on which particular aspects of development are the main drivers of tax avoidance.

## **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 developing countries, we show that the sensitivity of firms' reported profits to incentives for cross-border profit shifting varies systematically with economic and institutional development: less developed 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 development 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. All our indicators of development, whether related to income or governance, correlate with tax aggressiveness; however, the high correlation between the indicators themselves makes it difficult to disentangle their effects. Credible identification of the mechanisms that lead to low tax compliance in developing countries is an important goal for future research.

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## Tables and Figures

Table 1: Descriptive statistics

	Eastern Europe			Western Europe			World		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
<b>Panel A: Income</b>									
GNI per capita (US\$)	35,327	11,795	4,851	156,424	45,522	12,382	210,566	38,264	17,685
GNI per capita (standardized)	35,327	-0.05	0.26	156,424	1.77	0.67	210,566	1.38	0.95
<b>Panel B: Governance</b>									
Control over corruption (standardized)	35,327	-0.22	0.67	156,424	1.41	0.70	211,277	1.07	0.95
Government Effectiveness (standardized)	35,327	0.18	0.60	156,424	1.40	0.51	211,277	1.15	0.71
Political stability (standardized)	35,327	0.21	0.78	156,424	0.65	0.41	211,291	0.54	0.57
Regulatory quality (standardized)	35,327	0.45	0.70	156,424	1.41	0.32	211,277	1.19	0.58
Rule of Law (standardized)	35,327	0.08	0.72	156,424	1.45	0.50	211,291	1.16	0.78
Voice and Accountability (standardized)	35,327	0.27	0.79	156,424	1.29	0.20	211,291	1.05	0.58
First principal component (standardized)	35,327	0.17	0.77	156,424	1.43	0.46	210,566	1.16	0.74

	Eastern Europe			Western Europe			World		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
<b>Panel C: Financial information</b>									
Total Assets (mill. US\$)	35,327	123	2,083	156,424	558	13,900	211,325	707	17,200
Fixed Assets (mill. US\$)	34,829	44	819	154,136	116	1,757	205,715	110	1,615
Turnover (mill. US\$)	35,047	67	787	137,988	94	867	192,323	125	1,139
Profits (mill. US\$)	35,327	7	84	156,424	14	198	211,325	17	220
Employees (number)	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 (dummy)	35,327	0.159	0.366	156,424	0.149	0.356	211,325	0.146	0.353
<b>Panel D: Tax</b>									
Domestic tax rate	35,323	0.185	0.025	156,424	0.282	0.046	211,153	0.269	0.060
Foreign parent tax rate	33,209	0.229	0.078	147,148	0.290	0.065	198,943	0.282	0.074
Average foreign affiliate tax rate	35,327	0.221	0.060	156,424	0.258	0.050	211,325	0.252	0.054

Notes: The table shows descriptive statistics for our gross sample of corporations in 2010. Starting from the full sample of corporations in Orbis we have excluded: (i) corporations with no foreign affiliates; (ii) corporations with assets below US\$1 million; (iii) corporations with a return to assets in excess of 96 per cent (the 99<sup>th</sup> percentile). Variables: *GNI per capita* is the gross national income per person measured with the World Bank's Atlas Method; *Control over corruption* captures perceptions of the extent to which public power is exercised for private gain; *Government effectiveness* captures perceptions of the quality of public services and civil service and the degree of its independence from political pressures; *Political stability* measures perceptions of the likelihood of political stability and politically motivated violence; *Regulatory quality* captures perceptions of the government's ability to formulate and implement sound policies and regulation; *Rule of law* captures perceptions of the extent to which agents have confidence in and abide by the rules of society; *Voice and Accountability* captures perceptions of the extent to which a country's citizens are able to participate in selecting their government as well as freedom of expression; *First principal component* is the first principal component of the six governance variables. *Total assets* is the book value of the total assets; *Fixed assets* is the book value of fixed assets; *Turnover* is total sales of a corporation; *Profits* is net income after financial income and expenses but before taxation; *Employees* is the number of employees; *Return on assets* is the ratio of profits to total assets; *Zero profits* is a dummy variable coded one when the return on assets is between -0.5 and 0.5 per cent and zero otherwise; *Domestic tax rate* is the corporate tax rate faced by the corporation; *Parent tax rate* is the corporate tax rate faced by the parent company of the corporation. *Average foreign affiliate tax rate* is the simple average of the corporate tax rates faced by the foreign affiliates of the corporation. When variables are standardized, we have subtracted the global mean and divided by the global standard deviation. *Eastern Europe* comprises: Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Macedonia, Hungary, Kazakhstan, Latvia, Lithuania, Montenegro, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Ukraine. *Western Europe* comprises: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

Source: authors based on Governance variables are from World Governance Indicators (2016); income per capita is from World Development Indicators (2016); financial information is from Orbis; Tax rates are from KPMG (2015).

Table 2: Correlation between quality of governance and per capita income (standardized variables)

	Control over Corruption	Regulatory Quality	Rule of Law	Voice and Accountability	Government effectiveness	Political Stability	First Principal Component of Governance Indicators	Gross National Income pr. capita
Control over Corruption	1.00							
Regulatory Quality	0.92	1.00						
Rule of Law	0.97	0.96	1.00					
Voice and Accountability	0.86	0.91	0.89	1.00				
Government effectiveness	0.97	0.92	0.97	0.85	1.00			
Political Stability	0.71	0.73	0.70	0.79	0.70	1.00		
Principal Component	0.98	0.97	0.99	0.93	0.97	0.79	1.00	
GNI pr. capita	0.85	0.78	0.83	0.79	0.85	0.68	0.85	1.00

Notes: The table shows the correlation matrix for the following eight variables: six measures of quality of governance (control over corruption, regulatory quality, rule of law, voice and accountability, government effectiveness and political stability), the first principal component of these six variables and gross national income per capita. The sample is the 102 countries that enter into one or more of the estimations and where the year is 2010. All income and governance variables are standardized by subtracting the mean and dividing by the empirical standard deviation.

Source: authors.

Table 3: Zero reported profits

	Dependent variable: Zero profits							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Eastern Europe	Western Europe	Eastern Europe	Western Europe	World	World	World	World
Parent tax rate	-0.404*** (0.0531)	-0.157** (0.0626)			-0.313*** (0.0568)		-0.354*** (0.0369)	
Average foreign affiliate tax rate			-0.436*** (0.0679)	-0.156*** (0.0350)		-0.306*** (0.0757)		-0.302*** (0.0691)
Parent tax rate × GNI per capita (standardized)					0.0876** (0.0401)			
Average foreign affiliate tax rate × GNI per capita (standardized)						0.0892** (0.0428)		
Parent tax rate × Governance (standardized)							0.133*** (0.0404)	
Average foreign affiliate tax rate × Governance (standardized)								0.107** (0.0528)
Observations	25,779	65,077	35,327	156,424	98,065	210,566	98,053	210,551
R-squared	0.051	0.058	0.055	0.044	0.058	0.049	0.058	0.049
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table shows results from an OLS regression with observations at the corporation level for 2010. Variables: *zero profits* is a dummy variable coded one when the corporation's return to assets is between -0.5 and 0.5 per cent and zero otherwise; *parent tax rate* is the corporate tax rate in the country of the corporation's ultimate owner; *average foreign affiliate tax rate* is the unweighted average of the corporate tax rates in the countries of the corporation's foreign affiliates; *GNI per capita* is the standardized value of the gross national product (GNP) in the country of the corporation; *Governance* is the standardized value of the first principal component of the 6 indicators of quality of governance (control over corruption, regulatory quality, rule of law, voice and accountability, government effectiveness and political stability). The income and governance variables are standardized by subtracting the global mean and dividing by the standard deviation. Sample: in columns (1) and (3) the sample is 23 countries in Eastern Europe; in columns (2) and (4) the sample is 16 countries in Western Europe; in columns (5)-(8) the sample is 93 countries in the world. The sample is winsorized by excluding corporations with a return to assets exceeding 96 per cent (the 99<sup>th</sup> percentile in the gross sample). Standard errors: all reported standard errors are robust to heteroscedasticity and to clustering at the country-level. Statistical significance: \*, \*\* and \*\*\* Indicate significance at the 10, 5, and 1 per cent level, respectively.

Source: authors.

Table 4: Reported profits—cross-sectional model

	Dependent variable: Profits (in logs)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Eastern Europe	Western Europe	Eastern Europe	Western Europe	World	World	World	World
Parent tax rate	1.777*** (0.272)	0.971*** (0.202)			1.782*** (0.205)		1.780*** (0.173)	
Average foreign affiliate tax rate			1.423*** (0.476)	0.108 (0.481)		1.160*** (0.375)		0.970*** (0.270)
Parent tax rate × GNI per capita (standardized)					-0.503*** (0.161)			
Average foreign affiliate tax rate × GNI per capita (standardized)						-0.661** (0.327)		
Parent tax rate × Governance (standardized)							-0.503*** (0.161)	
Average foreign affiliate tax rate × Governance (standardized)								-0.572** (0.280)
Fixed assets (in logs)	0.253*** (0.0131)	0.326*** (0.0165)	0.281*** (0.0138)	0.337*** (0.0141)	0.309*** (0.0144)	0.332*** (0.0115)	0.309*** (0.0144)	0.332*** (0.0115)
Employees (in logs)	0.512*** (0.0510)	0.340*** (0.0288)	0.487*** (0.0528)	0.368*** (0.0246)	0.387*** (0.0358)	0.391*** (0.0257)	0.387*** (0.0358)	0.391*** (0.0256)
Observations	19,746	39,273	27,561	87,942	62,045	126,032	62,045	126,034
R-squared	0.382	0.415	0.374	0.406	0.446	0.434	0.446	0.434
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table shows results from an OLS regression with observations at the corporation level for 2010. Variables: *profits* is reported profits; *parent tax rate* is the corporate tax rate in the country of the corporation's ultimate owner; *average foreign affiliate tax rate* is the unweighted average of the corporate tax rates in the countries of the corporation's foreign affiliates; *GNI per capita* is the standardized value of the GNP in the country of the corporation; *Governance* is the standardized value of the first principal component of the 6 indicators of quality of governance (control over corruption, regulatory quality, rule of law, voice and accountability, government effectiveness and political stability); *fixed assets* is the value of the corporation's fixed assets; *employees* is the number of employees at the corporation. The income and governance variables are standardized by subtracting the global mean and dividing by the standard deviation. Sample: in columns (1) and (3) the sample is 23 countries in Eastern Europe; in columns (2) and (4) the sample is 16 countries in Western Europe; in columns (5)-(8) the sample is 71 countries in the world. The sample is winsorized by excluding corporations with a return to assets exceeding 96 per cent (the 99<sup>th</sup> percentile in the gross sample). Standard errors: all reported standard errors are robust to heteroscedasticity and to clustering at the country-level. Statistical significance: \*, \*\* and \*\*\* Indicate significance at the 10, 5, and 1 per cent level, respectively.

Source: authors.

Table 5: Reported profits—panel model

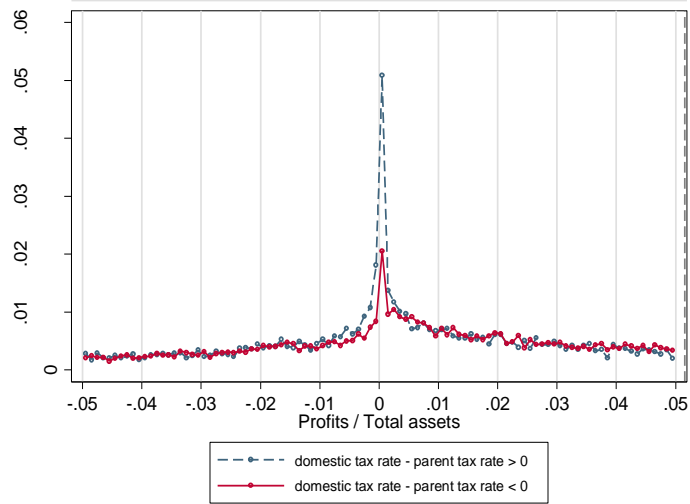
	Dependent variable: Profits (in logs)							
	(1) Eastern Europe	(2) Western Europe	(3) Eastern Europe	(4) Western Europe	(5) World	(6) World	(7) World	(8) World
Parent tax rate	1.009*** (0.243)	0.00383 (0.145)			1.659*** (0.190)		1.289*** (0.234)	
Average foreign affiliate tax rate			1.042*** (0.312)	-0.274 (0.177)		2.337*** (0.225)		1.817*** (0.249)
Parent tax rate × GNI per capita (standardized)					-1.612*** (0.144)			
Average foreign affiliate tax rate × GNI per capita (standardized)						-2.624*** (0.157)		
Parent tax rate × Governance (standardized)							-1.078*** (0.177)	
Average foreign affiliate tax rate × Governance (standardized)								-2.073*** (0.187)
Domestic tax rate	-4.888*** (0.329)	0.167 (0.159)	-3.908*** (0.255)	-0.301*** (0.108)	-2.562*** (0.247)	-1.611*** (0.185)	-3.548*** (0.256)	-2.643*** (0.181)
Domestic tax rate × GNI per capita (standardized)					1.394*** (0.185)	0.288** (0.135)		
Domestic tax rate × Governance (standardized)							2.142*** (0.180)	1.170*** (0.128)
GNI per capita (in logs)	1.222*** (0.118)	1.700*** (0.136)	1.796*** (0.0987)	2.085*** (0.0885)	0.917*** (0.0602)	1.313*** (0.0461)	0.861*** (0.0588)	1.208*** (0.0454)
Fixed assets (in logs)	0.136*** (0.00662)	0.0661*** (0.00379)	0.148*** (0.00563)	0.0704*** (0.00274)	0.0844*** (0.00324)	0.0893*** (0.00240)	0.0839*** (0.00324)	0.0888*** (0.00240)
Employees (in logs)	0.322*** (0.0109)	0.300*** (0.00812)	0.305*** (0.00962)	0.283*** (0.00522)	0.305*** (0.00636)	0.285*** (0.00445)	0.305*** (0.00636)	0.285*** (0.00445)
Observations	150,396	331,902	216,751	759,271	509,355	1,066,788	509,355	1,066,788
R-squared (within)	0.095	0.051	0.094	0.051	0.065	0.060	0.065	0.060
Number of corporations	36,824	73,608	50,590	166,609	118,744	238,942	118,744	238,942
Corporation fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year-income group fixed effects	-	-	-	-	Yes	Yes	Yes	Yes

Notes: The table shows results from an OLS regression with observations at the corporation level for the period 2003–12. Variables: *profits* is reported profits; *parent tax rate* is the corporate tax rate in the country of the corporation's ultimate owner; *average foreign affiliate tax rate* is the unweighted average of the corporate tax rates in the countries of the corporation's foreign affiliates; *domestic tax rate* is the corporate tax rate in the country of the corporation; *GNI per capita* is the standardized value of the GNP in the country of the corporation (average over the sample period); *Governance* is the standardized value of the first principal component of the 6 indicators of quality of governance: control over corruption, regulatory quality, rule of law, voice and accountability, government effectiveness and political stability (average over the sample period); *fixed assets* is the value of the corporation's fixed assets; *employees* is the number of employees at the corporation. The income and governance variables are standardized by subtracting the global mean and dividing by the standard deviation. Sample: in columns (1) and (3) sample is 15 countries in Eastern Europe; in columns (2) and (4) sample is 16 countries in Western Europe; in columns (5)–(8) sample is 56 countries in the world. The sample is winsorized by excluding corporations with a return to assets exceeding 96 per cent (the 99<sup>th</sup> percentile in the gross sample). Standard errors: all reported standard errors are robust to heteroscedasticity and to clustering at the corporation level. Statistical significance: \*, \*\* and \*\*\* indicate significance at the 10, 5, and 1 per cent level, respectively.

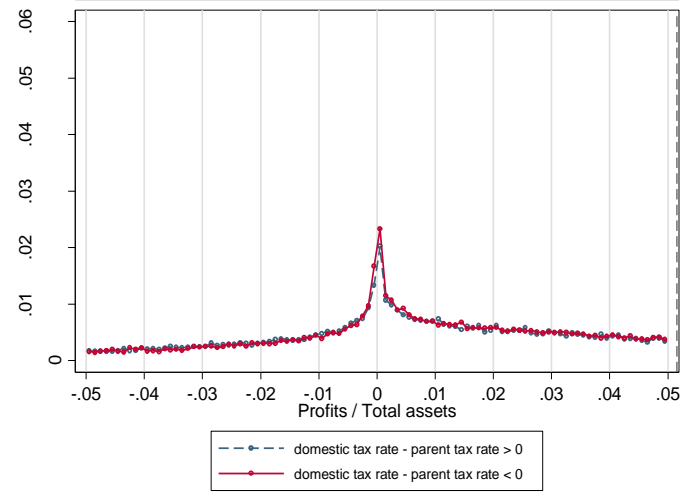
Source: authors.

Figure 1: Tax incentives for profit shifting and the return on assets

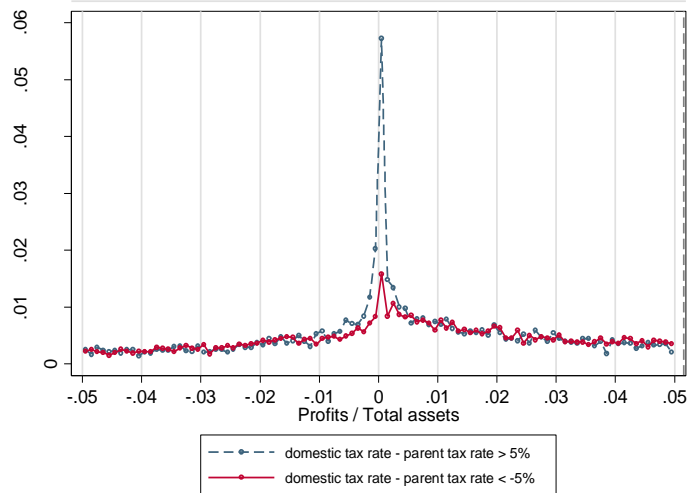
1a: Eastern Europe



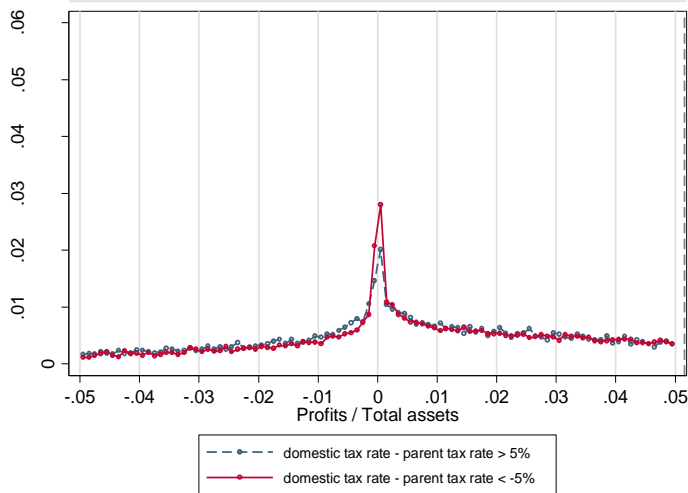
1b: Western Europe



1c: Eastern Europe



1d: Western Europe



Notes: The figure shows histograms of the return on assets in Eastern Europe and Western Europe respectively. The return on assets is the ratio of profits (after financial income and expenses but before taxation) to total assets.

Source: authors.