

# International Profit Shifting within Multinationals: A Multi-Country Perspective

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**Key words:** corporate taxation, international profit shifting

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# International Profit Shifting within Multinationals: A Multi-Country Perspective

**Abstract:** We model the opportunities and incentives generated by international tax differences for international profit shifting by multinationals. The model considers not only profit shifting arising from international tax differences between affiliates and parent companies, but also from tax differences between affiliates in different host countries. Our model yields the prediction that a multinational's profit shifting in a country depends on a weighted average of international tax rate differences between all countries where the multinational is active. Using a unique dataset containing detailed firm-level information on the parent companies and subsidiaries of European multinationals and information about the international tax system, we test our model and empirically examine the extent of intra-European profit shifting by European multinationals. On average, we find a semi-elasticity of reported profits with respect to the top statutory tax rate of 1.31, while shifting costs are estimated to be 0.6 percent of the tax base. International profit shifting leads to a substantial redistribution of national corporate tax revenues. Many European nations appear to gain revenues from profit shifting by multinationals largely at the expense of Germany.

## 1. Introduction

Corporate income taxation continues to be a national affair in Europe despite economic integration brought on by free trade and the single currency. Corporate income in Europe is taxed at different rates in different countries. As a result, multinationals face incentives to re-allocate accounting profits internationally so as to reduce their worldwide corporate tax liability. The scope for international profit shifting for tax purposes is considerable in Europe, as large European multinational firms typically operate in many European countries.

A multinational can shift profits from high-tax countries to low-tax countries through a variety of techniques. First, a multinational can manipulate its transfer prices for international, intra-firm transactions. Specifically, the multinational can reduce accounting profits in a high-tax country by overstating the prices of imports into this country and conversely by understating the prices of exports. Several studies, mainly based on U.S. data and surveyed by Hines (1999) and Newlon (2000), find evidence of profit shifting through the manipulation of transfer prices. Clausing (2003), for instance, reports some direct evidence that intra-firm trade prices deviate from outside, “arm’s length” prices in ways that are consistent with international tax minimization. Second, a multinational can affect the international allocation of accounting profits through its financial structure. Particularly, by assigning (high-interest) debt to high-tax locales the multinational firm can reduce its worldwide tax bill.<sup>1</sup> Thirdly, the multinational can aim to re-assign common expenses, such as R&D expenses or headquarter services, to high-tax countries, thereby reducing accounting profits in these countries. International profit shifting, by any technique, imposes potentially significant accounting and other costs on the firm.

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<sup>1</sup> Hines and Hubbard (1990), Collins and Shackelford (1992), Froot and Hines (1992) and Grubert (1998) provide evidence that multinational financial structure and the pattern of intra-firm interest and other income flows are consistent with tax minimization objectives.

International profit shifting efforts, if effective, should reduce multinational company profits reported in high-tax countries. For the case of U.S. outward foreign direct investment, Grubert and Mutti (1991) indeed find a negative relationship between the reported profitability and tax burdens in foreign countries. Hines and Rice (1994) similarly investigate the relationship between the profitability of U.S. foreign direct investment abroad and foreign tax burdens after controlling for labor and capital inputs in these countries. Profits reported abroad by U.S. multinationals are found to be sensitive to national tax burdens, not least because U.S. multinationals operate in a variety of tax havens with presumably rather lax enforcement, if any, of anti-profit shifting statutes. Haufler and Schjelderup (2000) examine international tax competition in a model where countries can use the tax rate and the definition of the tax base as strategic variables. International profit shifting can explain a relatively low tax rate and a relatively broad definition of the tax base as Nash equilibrium outcomes. Mintz and Smart (2004) present evidence consistent with profit shifting within Canada to reduce provincial taxation. Demirgüç-Kunt and Huizinga (2001) find that the profitability reported by foreign-owned banks across 80 countries is negatively related to national top statutory tax rates, while similarly Bartelsman and Beetsman (2003) find that value added reported at the sectoral level in OECD countries is negatively related to statutory tax rates.

In this paper, we present a model of the opportunities and incentives generated by international tax differences for international profit shifting by multinationals. The model considers not only profit shifting arising from international tax differences between affiliates and parent companies, but also profit shifting arising from tax differences between affiliates in different host countries. Mintz and Smart (2004) have previously considered debt shifting in a model of a multinational with multiple subsidiaries. Our model yields the prediction that a multinational's profit shifting in a country depends on both national tax rates and differences

between national and foreign tax rates in all countries in which the multinational operates. In particular, we show that profit shifting into a country by a multinational is negatively related to a weighted average of international tax rate differences between this country and all other countries where the multinational is active.

To implement this framework, we use a unique dataset containing detailed firm-level information on the parent companies and subsidiaries of European multinationals from the Amadeus database. This database allows us to link each multinational's parent company to its foreign subsidiaries. We complement this dataset with information about international tax rates. We focus on Europe because of the availability of detailed data on the structure of European multinationals, including financial statements of not only parent companies but also subsidiaries, and because international tax policy and its impact on international profit shifting is a hotly debated topic in Europe, with the European Commission (2001) favoring the introduction of a common tax base for multinationals operating in Europe, in part to combat international profit shifting in Europe. Nevertheless, our framework can be applied to all countries.

Using this unique dataset, we test our model and empirically examine the extent of intra-European profit shifting by European multinationals. We find that international profit shifting by European multinationals is significant, and compare our estimates with those obtained by others in the literature. The estimation implies that European firms incur significant costs in shifting profits internationally. On average, these costs are estimated to be 0.6 percent of the tax base of multinational firms in Europe.

We aggregate our firm-level estimates of profit shifting to arrive at national measures of international profit shifting. On average, we find a semi-elasticity of reported profits with respect to the top statutory tax rate of 1.31. This elasticity is large enough for international profit shifting to be a serious issue for European tax authorities. This is confirmed by estimates of the corporate

tax revenue losses (or gains) that European governments currently experience on account of international profit shifting. We find that Germany has been a large tax revenue loser. Most other European countries in fact appear to have experienced net corporate tax revenue gains, at Germany's expense.

The remainder of the paper is organized as follows. Section 2 discusses the international tax system facing European multinationals. Section 3 outlines our model of international tax shifting by a multinational firm operating in multiple countries. Section 4 discusses the company-level data used in this study. Section 5 provides the empirical estimates of the impact of the tax regime on international profit shifting based on our micro data. Section 6 discusses the macro implications of these empirical estimates. First, we present estimates of macro elasticities of reported profits with respect to national tax rates and, second, we discuss estimates of the national tax revenue implications of international profit shifting by European multinationals. Section 7 concludes.

## **2. The international tax data**

A multinational firm is domiciled for tax purposes in its parent country and has subsidiaries in at least one foreign country. Profit shifting can occur between the parent country and one foreign country or between two foreign countries. Such shifts affect the reported pre-tax profitability and the taxes due in the two or more affected locales. The reduction in the firm's worldwide tax liability is given by the amount shifted times the difference in the two countries' tax rates in the absence of any international double taxation. Countries with residence-based taxation of their multinationals in principle tax the foreign source income of these firms but in practice often provide temporary or indefinite deferral of this taxation. Hence, even firms in countries with residence-based tax systems often obtain exemption from international double taxation. To

reflect this, we will assume that the incentive for a multinational firm to shift income internationally is represented fully by international tax rate differences.<sup>2</sup>

Table 1 provides information on top statutory rates in 1999 for the 32 European countries in our study taken from several sources: Taxation of Companies in Europe from the International Bureau of Fiscal Documentation, Corporate Taxes 1999-2000 Worldwide Summaries from PriceWaterhouseCoopers, and the Worldwide Corporate Tax Guide from Ernst and Young. In some countries such as Germany, corporate income is taxed at the national as well as the sub-national level. In these instances, the top statutory tax rate is calculated to reflect the various levels of taxation. The notes to Table 1 provide more details on the calculation of the marginal tax rates.

### **3. The model**

The model considers a multinational firm that generally operates establishments in  $n$  countries. In one of these countries, denoted  $p$ , the parent firm is located. The variable  $B_i$  represents the profits actually generated by the multinational firm in country  $i$ . The multinational can manipulate its transfer prices for international intra-firm transactions to shift profits  $S_i$  into country  $i$ . Manipulating transfer prices is assumed to be costly, as the multinational needs to modify its books, and possibly its real trade and investment pattern, to be able to justify the distorted transfer prices with the tax authorities.<sup>3</sup> Following Hines and Rice (1994), we assume that the marginal cost of shifting profits rises in proportion to the ratio of shifted profits to true profits given by  $S_i/B$  with  $\gamma$  being this factor of proportionality. This reflects that a company's

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<sup>2</sup> We obtain qualitatively similar results on profit shifting if instead we adjust the statutory tax rates by taking into account the rules used by the parent country to alleviate the potential double taxation of foreign-source income; see the working paper version of this paper, or Huizinga and Laeven (2007).

<sup>3</sup> Even if firms comply with transfer pricing regulations, they may face considerable costs in dealing with, for instance, documentation requirements. The European Commission (2004a, Table 3-5) reports qualitative survey results that indicate that the majority of European multinationals consider these requirements a difficulty.

accounts have to be distorted relatively little to accommodate profit shifting  $S_i$  if true profits  $B_i$  are relatively large. Total shifting expenses,  $E_i$ , incurred by the multinational in country  $i$  are

calculated as  $\frac{\gamma}{2} \frac{(S_i)^2}{B_i}$ .<sup>4</sup>

Total profits shifted by a multinational into its  $n$  countries of operation are non-positive so that  $\sum_{i=1}^n S_i \leq 0$ . The firm chooses the profit shifting level  $S_i$  to maximize worldwide after-tax profits given by

$$L = \sum_{i=1}^n (1 - \tau_i) \left( B_i + S_i - \frac{\gamma}{2} \frac{(S_i)^2}{B_i} \right) - \lambda \sum_{i=1}^n S_i \quad (1)$$

where  $\lambda$  is a Lagrange multiplier and  $\tau_i$  is the tax rate. In equation (1), shifting expenses are taken to be tax-deductible. The first order condition with respect to  $S_i$  is given by

$$(1 - \tau_i) \left( 1 - \gamma \frac{S_i}{B_i} \right) - \lambda = 0 \quad \text{for all } i = 1, \dots, n \quad (2)$$

Note that the term  $(1 - \tau_i) \left( 1 - \gamma \frac{S_i}{B_i} \right)$  in equation (2) is the after-tax, after-marginal-shifting-cost value of additional profits reported in country  $i$ . Equation (2) simply says that this marginal value of reported profits should be equalized across all countries where the multinational firm operates. Hines and Rice (1994) use equation (2) to derive an estimating equation relating aggregate profits reported by US multinationals in a set of countries to a measure of these countries' corporate tax rate. In the present paper, we use micro-level data on the operations of Europe-based multinational firms in many European countries. In this setting, it

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<sup>4</sup> Note that these quadratic shifting costs apply equally to inward and outward profit shifting. As a result there generally is profit shifting into and out of several countries, and optimal profit shifting in equation (3) is essentially a weighted average of a country's tax rate vis-à-vis other countries' tax rates. Mintz and Smart (2004) instead assume quadratic costs associated with internal borrowing but not internal lending. As a result, all subsidiaries are borrowers

is necessary to know how a multinational's incentive to shift profits into any one country depends on the tax rates of all the countries where it operates. For this purpose, we proceed to solve equation (2) for the optimal profit shifting  $S_i$  into country  $i$  to yield

$$S_i = \left( \frac{B_i}{\gamma(1-\tau_i)} \right) \frac{\sum_{k \neq i}^n \left( \frac{B_k}{1-\tau_k} \right) (\tau_k - \tau_i)}{\sum_{k=1}^n \left( \frac{B_k}{1-\tau_k} \right)} \quad (3)$$

where it should be noted that the sum of the  $S_i$  internationally equals zero.

Equation (3) indicates that the optimal inward profit shifting  $S_i$  is proportional to i) the true tax base  $B_i$ , ii) the inverse of  $\gamma(1-\tau_i)$ , and iii) a weighted average of the effective tax rate

differences  $\tau_k - \tau_i$  with weights  $\frac{\frac{B_k}{1-\tau_k}}{\sum_{k=1}^n \left( \frac{B_k}{1-\tau_k} \right)}$ . The effective tax rates  $\tau_i$  and  $\tau_k$  in the

term  $\gamma(1-\tau_i)$  and in the weights  $\frac{\frac{B_k}{1-\tau_k}}{\sum_{k=1}^n \left( \frac{B_k}{1-\tau_k} \right)}$  reflect that shifting costs are taken to be tax

deductible in the country where they are incurred, with the tax rate  $\tau_i$  in country  $i$  being relatively important in the determination of  $S_i$ . At the same time, a higher scaling variable  $B_k$  in country  $k$  is seen to increase the weight on  $\tau_k - \tau_i$  in the overall expression of  $S_i$ , which reflects that a larger scale of operation in country  $k$  makes it less costly for the multinational to shift profits into or out of this country. Other things equal, optimal profit shifting  $S_i$  into country  $i$

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apart from the one facing the lowest tax rate which becomes the lender. In this scenario, a subsidiary's optimal borrowing is related to the tax rate difference vis-à-vis the tax rate facing the lending subsidiary.

sensibly increases in the tax rate differences  $\tau_k - \tau_i$  and decreases with the shifting cost parameter  $\gamma$ .

Reported profits, denoted  $B_i^r$ , are equal to the sum of  $B_i$  and  $S_i$  as follows

$$B_i^r = B_i \left[ 1 - \frac{1}{\gamma(1-\tau_i)} \frac{\sum_{k \neq i}^n \left( \frac{B_k}{1-\tau_k} \right) (\tau_i - \tau_k)}{\sum_{k=1}^n \left( \frac{B_k}{1-\tau_k} \right)} \right] \quad (4)$$

After taking logs, we can approximate equation (4) to get

$$b_i^r = b_i - \frac{1}{\gamma} C_i \quad (5)$$

where  $b_i^r = \log(B_i^r)$ ,  $b_i = \log(B_i)$ , and  $C_i = \frac{1}{(1-\tau_i)} \frac{\sum_{k \neq i}^n \left( \frac{B_k}{1-\tau_k} \right) (\tau_i - \tau_k)}{\sum_{k=1}^n \left( \frac{B_k}{1-\tau_k} \right)}$ . The variable  $C_i$  is a

composite tax variable that summarizes all information about profit shifting incentives (or the tax rates  $\tau$  in all countries) and about profit shifting opportunities (or the scale of the firm's operations  $B$  in all countries). A positive value of  $C_i$  implies that the multinational firm optimally shifts profits out of county  $i$ . The variable  $C_i$  is seen to be the product of two terms:  $\frac{1}{(1-\tau_i)}$  and

a weighted average of the tax rate differences  $\tau_i - \tau_k$  with weights  $\frac{\frac{B_k}{1-\tau_k}}{\sum_{k=1}^n \left( \frac{B_k}{1-\tau_k} \right)}$ .<sup>5</sup>

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<sup>5</sup> In the absence of the tax deductibility of profit shifting costs,  $C_i$  would collapse to  $\frac{\sum_{k \neq i}^n B_k (\tau_i - \tau_k)}{\sum_{k=1}^n B_k}$ . We obtain

qualitatively similar results when using this alternative expression for  $C_i$  (not reported).

The true profit variables  $B_i$  are not directly observable. Following Hines and Rice (1994), we assume that true profits are the return to capital in a scenario where capital,  $K_i$ , and labor,  $L_i$ , are jointly employed by the firm to produce output  $Q_i$ . More specifically, we will assume a Cobb-Douglas production function given by  $Q_i = cA_i^\varepsilon L_i^\alpha K_i^\varphi e^{u_i}$ . The variable  $A_i$  is a productivity parameter that may reflect cross-country differences in technology or factor qualities, while  $u_i$  is a random term. True profits,  $B_i$ , are equal to output  $Q_i$  minus the wage bill, which gives  $B_i = Q_i - w_i L_i$ . The wage  $w_i$  is taken to be equal to the marginal product of labor given by  $c\alpha A_i^\varepsilon L_i^{1-\alpha} K_i^\varphi e^{u_i}$ . This implies that true profits  $B_i$  equal  $c(1-\alpha)A_i^\varepsilon L_i^\alpha K_i^\varphi e^{u_i}$ . Taking logs of this expression for  $B_i$ , we get

$$b_i = \log(c) + \log(1-\alpha) + \varepsilon a_i + \alpha l_i + \varphi k_i + u_i \quad (6)$$

where  $a_i = \log A_i$ ,  $l_i = \log L_i$ , and  $k_i = \log(K_i)$ . Substituting for  $b_i$  from (6) into (5), we get the following estimating equation

$$b_i^r = \beta_1 + \beta_2 a_i + \beta_3 l_i + \beta_4 k_i - \hat{\gamma} C_i + u_i \quad (7)$$

where  $\beta_1 = \log(c) + \log(1-\alpha)$ ,  $\beta_2 = \varepsilon$ ,  $\beta_3 = \alpha$ ,  $\beta_4 = \varphi$ ,  $\hat{\gamma} = \frac{1}{\gamma}$ . Equation (7) indicates that the logarithm of reported profits  $b_i^r$  responds negatively to the composite tax factor  $C_i$ . In fact, equation (7) suggests that we can interpret  $\hat{\gamma}$  as the semi-elasticity of reported profits  $B_i^r$  with respect to the composite tax variable  $C_i$ , as  $-\frac{1}{B_i^r} \frac{dB_i^r}{dC_i} = \hat{\gamma}$ .

As indicated,  $C_i$  reflects both a multinational's international structure and international tax rates. Tax authorities can affect  $C_i$  and hence reported profits  $B_i^r$  through changes in tax rates  $\tau_i$ . Straightforwardly, the elasticity of  $B_i^r$  with respect to  $\tau_i$  is given by

$$-\frac{1}{B_i^r} \frac{dB_i^r}{d\tau_i} = \hat{\gamma} \frac{dC_i}{d\tau_i} > 0, \text{ while at the same time we have } -\frac{1}{B_i^r} \frac{dB_i^r}{d\tau_k} = \hat{\gamma} \frac{dC_i}{d\tau_k} < 0 \text{ for tax rate}$$

changes in countries  $k$  different from  $i$ . Quite some information on the firm's international operations and on international tax rates is necessary to assess  $dC_i/d\tau_i$ . Assessments of the implications of tax rate changes on international profit shifting are therefore best addressed through computer simulation. This is done in section 6. Simulations of this kind require an estimated value for the elasticity parameter  $\hat{\gamma}$  as provided in section 5.

#### 4. The company data

The data on multinational firms are taken from the Amadeus database compiled by Bureau Van Dijk.<sup>6</sup> This database provides accounting data on private and publicly owned European firms as well as on their ownership relationships. These ownership data allow us to match European firms with their domestic subsidiaries and subsidiaries located in other European firms. A firm is defined to be a subsidiary, if at least 50 percent of the shares are owned by another single firm. As we are interested in international profit shifting, we restrict our sample to multinational firms that have at least one foreign subsidiary. Multinational firms tend to provide consolidated and unconsolidated accounting statements. Consolidated statements reflect the activities within the parent companies themselves and of all domestic and foreign subsidiaries. Separate, non-consolidated statements in contrast reflect the activities directly within the parent firm and in each of its subsidiaries. Using non-consolidated statements, we can define the sales of domestic multinationals in a country as the sum of the sales of the country's parent companies and their domestic subsidiaries, if any. The sales of foreign multinationals in a country in turn are the sales of foreign subsidiaries located domestically. Using this breakdown, Table 2 shows that sales by

foreign multinationals represent about 23 percent of all sales by multinationals in Europe for 1999. The table also reports sales data for a smaller sample of multinational firms for which we have some basic accounting data beyond sales data. For this smaller sample, the total foreign share in sales by multinationals is 22 percent.

The accounting data in Amadeus are needed to construct the variables used in the subsequent empirical analysis. We require reporting firms to have some basic accounting information in their accounts over the years, i.e., data on total assets, sales, profit before tax, taxes paid, labor compensation, and employment. For multinationals with more than one establishment in a country, variables are aggregated at the country level. Aggregation of this type does not affect the relationships between actual profits, reported profits and taxes in equation (5). This follows from the fact that the optimal inward or outward profit shifting by a multinational at the national level only depends on true profits at the national level and not on the dispersion of these true profits among the multinational's establishments within countries (as is shown in Appendix 1).<sup>7</sup> Our main dependent variable will be the log of earnings before interest and taxes (for definitions of variables and data sources, see Appendix 2). Alternatively, we consider the log of pre-tax profits defined as earnings net of interest expense but before taxes. As our measure of capital we will use the log of fixed assets on the assumption that fixed assets are more easily valued than intangible assets. To represent labor input, we use the labor variable, defined as the log of total labor compensation and, alternatively, employment defined as the log of the number of employees. Financial leverage is defined as total debt over total assets. On account of the tax deductibility of interest expenses, pre-tax profits are expected to be negatively related to financial leverage. Earnings before interest and taxes may be affected by leverage as well, if

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<sup>6</sup> The database is created by collecting standardized data received from 50 vendors across Europe. The local source for this data is generally the office of the Registrar of Companies.

<sup>7</sup> With constant returns to scale, production functions can be exactly aggregated.

leverage affects investment choices and other non-financial aspects of firm performance. We use period average exchange rates from the International Monetary Fund's International Financial Statistics to convert all accounting data into U.S. dollars.

Table 3 provides summary statistics for the firm-level variables, including the composite tax variable  $C$  in Panels A through D. As seen in equation (5), we need the tax rates of all the countries where the multinational operates to construct  $C$ . Sales are used as a proxy for profits  $B$  in the construction of  $C$ . Panel A provides these statistics for all firms regardless of whether they are domestic or foreign and for all sectors, while Panel B only considers foreign subsidiaries. Panels C and D represent all manufacturing firms and foreign subsidiaries in the manufacturing sectors only. Comparing Panels A and B, it is interesting to see that on average foreign subsidiaries are relatively small in terms of both the income measures and the input measures. The same pattern is seen in Panels C and D for manufacturing firms only. As the composite tax variable  $C$  is a weighted average of bilateral tax differences, it is not surprising that the median value of  $C$  is zero in all four panels. The mean value of  $C$ , however, is negative at -0.01 in Panel A and -0.02 in Panels B through D. Given that  $C$  is an average of bilateral tax differences weighted by sales as a proxy for the variable  $B_i$ , this suggests that – for any multinational firm – establishments in low-tax countries register relatively low sales. This is to be expected as low-tax countries tend to be small countries with small market sizes.

Next, Panel E of Table 3 provides a correlation matrix for some of the main firm-level variables and also per capita income. These correlations are for all establishments, both within and across multinational firms. The earnings variable is, not surprisingly, positively related to the input measures compensation, employees and capital. All of these are also positively related to per capita income, suggesting that firms are larger in richer countries. Finally, the composite tax variable  $C$  is negatively related to the income and input variables. This suggests that

multinationals economize on inputs as well as on reported income in high-tax countries.<sup>8</sup> The variable  $C$ , finally, is positively related to per capita income. This may reflect that wealthy countries tend to have higher corporate income tax rates.

## 5. Empirical results

### 5.1 Basic results

The dependent variable in our basic regressions is the log of earnings before interest and taxes. The benchmark sample is restricted to observations for foreign subsidiaries and thus excludes parent companies. We also restrict the base sample to manufacturing firms for which the production function approach of equation (6) may describe output better than for, say, service industries. We further limit the sample to include only multinational firms for which we have at least 20 percent of all (European) subsidiaries in the sample. As robustness checks, we later will (i) expand the sample to include parent companies, alternatively (ii) expand the sample to include non-manufacturing firms, or (iii) limit the sample to include only firms for which we have at least 50 percent of all subsidiaries in our sample.

In Table 4, regression 1, we see that the composite tax variable  $C$  enters with an estimated coefficient  $\hat{\gamma}$  of 1.017 that is significant at the 1 percent level, consistent with tax-induced profit shifting. The sum of the coefficients on the labor and capital variables is 0.876. This suggests that overall the technology displays decreasing returns to scale. The per capita income variable as a proxy for overall economic development enters with a negative coefficient that is significant at the 1 percent level. This coefficient reflects the sum effect of several

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<sup>8</sup> The simple correlation between aggregate profitability, measured as aggregate pre-tax profits at the country-level divided by aggregate total assets at the country-level, and the source country corporate income tax rate, weighted by the number of observations in the country, is -0.33, consistent with our prior that tax rates are negatively correlated with reported pre-tax profits. In section 5 we use regression analysis to control for a host of other factors that determine profitability.

possibly opposite channels by which economic development potentially affects profitability. Higher profitability could materialize in richer countries on account of more advanced technologies. To the contrary, profitability could on average be negatively impacted by the state of development, if firms require higher expected returns in poorer countries characterized by less effective property rights and regulations. Our finding of a negative coefficient for the per capita income variable suggests that effects of the second kind dominate.

Regression 2 adds industry fixed effects to the regression to yield an estimated  $\hat{\gamma}$  of 0.850. As indicated in the table, an F-test of no significance of these industry fixed effects is rejected.

Next, regression 3 includes a dummy variable that equals one for firms in Eastern Europe and zero for firms in Western Europe, along with an interaction term of this variable with the composite tax variable  $C$ . The purpose of including these two additional variables is to see whether the implied estimated relationship between reported profitability and profit shifting incentives, as represented by  $C$ , is different in Eastern Europe. This does not seem to be the case, as both the Eastern European dummy variable and its interaction term with  $C$ , while negative, are not statistically significant. The coefficient for the non-interacted  $C$  variable, in contrast, is estimated at 0.843 and significant at 1 percent.

In regression 4 we split  $C$  into two variables for each observation: one variable is the part representing the tax difference of a subsidiary vis-à-vis its parent firm and the other is the (weighted) sum of the tax difference vis-à-vis subsidiaries in other (foreign) countries. The first part – relating to parent firms – obtains a coefficient of 0.975 that is significant at the 1 percent level, but the second part – while negative – obtains a coefficient that is not statistically significant.

Next, in regression 5 we restrict the sample to subsidiaries of multinationals for which we have data on at least 50 percent of the subsidiaries to obtain a larger estimate of  $\hat{\gamma}$  of 1.749. For this restricted sample, regression 6 again splits the  $C$  variable into the parts relating to the parent firm and subsidiaries in other countries. Both parts of  $C$  now obtain significant coefficients, with the part of  $C$  relating to other subsidiaries obtaining a large  $\hat{\gamma}$  of 3.711. Hence, there is evidence of profit shifting between subsidiaries and their parent firms as well as among the subsidiaries themselves.

## 5.2 Robustness checks

We next report several alternative regressions as additional robustness checks taking regression 2 in Table 4 as a starting point. First, we compute the composite tax variable  $C$  on the assumption that the multinational's ability to shift profits into or out of a country is unrelated to the scale of activities in each country. This is achieved by calculating  $C$  after setting all the  $B$ 's to a constant. In regression 1 of Table 5, we see that this gives rise to an estimated coefficient  $\hat{\gamma}$  of 0.857 that is significant at 1 percent.

Next, in regression 2 we use assets rather than sales to represent the  $B$ 's in the construction of  $C$ . This would be appropriate, if sales data are too distorted by profit shifting to proxy for a multinational's scale of activities in different locales. This results in an estimated  $\hat{\gamma}$  of 0.806, which is very similar to the benchmark estimate of 0.850 in regression 2 of Table 4.

In regression 3, we in turn use the log of the number of employees rather than of employee compensation to represent labor input. By its very nature, the employment variable fails to reflect international differences in labor quality as reflected in international wage differences. The estimated value of  $\hat{\gamma}$  is now slightly lower at 0.595.

So far, our sample has contained only observations on foreign subsidiaries to the exclusion of parent companies. This ensures that not all the establishments of any particular multinational enter our sample as separate observations. This way we sidestep the potential problem that deviations from optimal profit shifting for the various establishments of a given multinational as given by equation (3), at least theoretically, add up to zero.<sup>9</sup> The inclusion of parent firms in regression 4 expands the sample with 652 observations to a total of 1,870, and yields an estimated  $\hat{\gamma}$  of 0.824 very similar to the benchmark estimate of 0.850.

Regression 5 includes foreign subsidiaries in all sectors (not only manufacturing) to yield 2,713 observations and an estimated  $\hat{\gamma}$  of 0.708.

Regression 6 again restricts the sample to manufacturing, but now takes the log of pre-tax profits rather than of earnings before interest and taxes as the dependent variable. This results in a somewhat smaller estimated  $\hat{\gamma}$  of 0.901.

In regression 7, we include leverage as an additional explanatory variable. Leverage enters the regression with a negative coefficient that is statistically significant at the 1 percent level. Hence, leverage appears to reduce reported earnings before interest and taxes, perhaps because it makes profitable investments more difficult to finance, while  $\hat{\gamma}$  is estimated at 0.753.

Regression 8 also includes the leverage variable and, as regression 6, has the log of pre-tax earnings after interest but before taxes as the dependent variable. Leverage has a more negative impact on pre-tax profits than on pre-tax earnings, no doubt on account of the tax deductibility of interest expenses. Relative to equation (6), the inclusion of the leverage variable increases the estimated  $\hat{\gamma}$  to 1.192.

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<sup>9</sup> The random term  $u_i$  in regression equation (7) in practice, of course, also reflects establishment-specific productivity shocks or perhaps demand shocks that would not add up to zero for the overall multinational firm.

Regression 9 adds the Corruption variable constructed by ICRG (with higher values denoting less corruption) to see whether less corruption would lead to higher reported earnings. Indeed the Corruption variable enters the regression with a positive coefficient, but it is not statistically significant.

Regression 10 restricts the sample to subsidiary observations in Western Europe on the assumption that reported profitability in Western Europe may be depressed relatively little by tax or other fraud not related to transfer prices. This reduces the sample to 1080 observations to yield an estimated  $\hat{\gamma}$  to 0.851 close to the benchmark estimate of 0.850.

Regression 11 replaces  $C$  by the top statutory tax rate facing the subsidiary yielding a more negative estimated coefficient of  $-2.117$ . Unlike the regressions that include  $C$ , this regression suffers from an omitted variable bias as it excludes the parent country tax rate. To maximize profit shifting opportunities, one expects parent firms in high tax countries to choose subsidiaries in low tax countries, and vice versa. Hence, subsidiary and parent country tax rates are expected to be negatively correlated. The exclusion of the parent country tax rate in regression 11 then yields an downwardly biased estimated coefficient for the subsidiary country tax rate.

Regression 12 uses our firm level data to construct national aggregate data to run a regression analogous to those in Table II of Hines and Rice (1994). Each variable is aggregated by country pair, i.e., we aggregate over all subsidiaries in a given subsidiary country with parents in a given parent country. The sample reduces to 207 parent-subsidiary country pairs. For the source country average tax rate variable, computed as the ratio of aggregate taxes paid to aggregate pre-tax profits at the country pair level, we obtain an estimated coefficient of  $-1.083$ . This is less negative than the estimate of  $-2.83$  obtained by Hines and Rice (1994) in their regression 1 in Table II. This difference could reflect that the study by Hines and Rice (1994)

includes many non-European tax havens with presumably lax enforcement policies regarding international profit shifting.

In regression 13 we take interest expense to be the dependent variable. We expect interest expense to be positively related to country's tax rate differences vis-à-vis other countries and indeed the  $C$  variable obtains a positive coefficient of 1.047 that is significant at 1 percent.

So far, we have considered how taxation affects international profit shifting conditional on the allocations of capital and labor. As noted by Hines and Rice (1994), however, these factor allocation themselves are also affected by taxation. Specifically, higher taxes should depress capital and labor employment, augmenting the negative relationship between tax rates and reported profitability. To check this and analogous to Hines and Rice (1994), we regress reported pretax earnings on the variable  $C$  and on national GDP. The results are presented in regression 14 of Table 5. The estimated coefficient for the  $C$  variable of  $-1.819$  is larger in absolute value than our previous benchmark estimate of  $\hat{\gamma}$  of 0.850 from regression 2 in Table 4. This suggests that higher tax rates indeed reduce factor allocations. Regression 15 instead takes pretax net income including financial income as the dependent variable. The estimated coefficient on the  $C$  variable is slightly more negative at  $-2.005$  to reflect that net financial income is subject to shifting as well.<sup>10</sup>

### **5.3 Endogeneity of tax policy**

So far we have assumed that tax policy is exogenous to reported pre-tax profits. In practice, however, tax policy may to some extent be endogenous. To see this, note that firms and also countries may differ in whether they can generate rents through the exploitation of natural resources or perhaps better access to consumer markets. Rents would register as higher reported pre-tax profits and, at the same time, warrant higher levels of taxation if these rents are

internationally immobile. Hence, higher pre-tax profits could give rise to higher tax levels. Similarly, reported pre-tax profits may be relatively high in countries that provide relatively plentiful public inputs to production in the form of, say, high-quality infrastructure. To finance extensive public inputs, countries may need to levy relatively high corporate income taxes. Again, higher pre-tax profits would endogenously be associated with higher corporate tax burdens. Such endogeneity is expected to lead to a downward bias of the OLS estimate of  $\hat{\gamma}$ .

To correct for this and following Hines and Rice (1994), this section presents instrumental variables estimates of  $\hat{\gamma}$ , where we take the size of the country, as proxied by its population, as an instrument for the corporate tax burden. This reflects the notion that on account of international tax competition smaller countries tend to levy lower corporate income taxes.<sup>11</sup> To implement this, we first regress the top statutory tax rate on the log of total population to obtain a predicted value of the top statutory tax rate. We next use these predicted values rather than the actual ones to construct the composite tax variable  $C$ . The result is an estimated  $\hat{\gamma}$  of 1.263 in regression 1 of Table 6. This estimate is higher than our benchmark estimate of 0.850 in Table 4, regression 2, which suggests that the OLS estimate of  $\hat{\gamma}$  is indeed biased downward.

Next, in regression 2 we use the difference of the logs of the populations of the subsidiary and parent countries to instrument for the overall variable  $C$ . This approach implies that the overall tax variable  $C$  is taken to be endogenous.<sup>12</sup> Now we find an estimated  $\hat{\gamma}$  of 1.766 in regression 2.

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<sup>10</sup> We obtain slightly more negative estimated coefficients on the  $C$  variable if we instrument for the tax rate using the instruments introduced in Table 6.

<sup>11</sup> Huizinga (1987) finds that corporate tax rates are positively correlated with country populations.

<sup>12</sup> Bond and Samuelson (1989) and Mintz and Tulkens (1996) theoretically consider the endogenous choice of tax systems.

In regression 3, we exclude subsidiaries of multinational firms for which we have incomplete data for more than half of European subsidiaries from the sample of regression 2 yielding an estimate of  $\hat{\gamma}$  of 1.874.

In regression 4 we go back to the full sample of subsidiaries, but we use the log of the population of the country with the highest tax rate among affiliates of the firm as an additional instrument (in addition the instrument used in regressions 2 and 3) resulting in a  $\hat{\gamma}$  of 1.734. The Sargan test of overidentifying restrictions, as reported in the table, supports the choice of instruments.

Finally, in regression 5 we add country dummies to the previous regression (obviously dropping the log per capita income variable) yielding a significant estimate of  $\hat{\gamma}$  of 1.537. In the remainder of this paper, we take the estimated  $\hat{\gamma}$  of 1.766 in regression 2 of Table 6 as our preferred estimate, as the results of this section suggest that endogeneity of tax policy is a relevant issue.

## **6. Interpretation of results**

Our estimates of the semi-elasticity of pre-tax profits with respect to the composite tax variable  $C$  by themselves suggest that reported pre-tax profits in Europe reflect tax rates. The variable  $C$ , however, is not a direct tax policy variable. Therefore it is useful to see what our regression estimates imply about the elasticities of reported pre-tax profits with respect to actual tax rates as considered in subsection 6.1. Next, subsection 6.2 provides estimates of how national tax revenues are affected by the implied degree of international profit shifting.

### **6.1 Implied elasticities of aggregate reported profits with respect to tax rates**

Aggregate international profit shifting experienced by a country is the simple sum of the profit shifting by all the multinationals operating within its territory. To arrive at an estimate of

aggregate profit shifting in response to a change in the top statutory tax rate, we thus first need to estimate how profit shifting by each and every multinational is affected by the tax policy change. Profit shifting by any multinational depends, as seen in section 3, on its own particular structure as well as on the tax incentives it faces. More specifically, estimated changes in reported profits per firm in country  $i$  in response to a change in the tax rate in country  $i$  are given by the

expressions  $dB_i^r = -\hat{\gamma}B_i^r \frac{dC_i}{d\tau_i} d\tau_i$ . To proceed, we take the estimated  $\hat{\gamma}$  of 1.766 from regression

2 in Table 6. Next, to evaluate the derivative  $\frac{dC_i}{d\tau_i}$ , we examine by raw calculation how much  $C_i$

is impacted by an increase of 0.01 in  $\tau_i$ . In either case, the change in nationally reported pre-tax profits, denoted  $d\bar{B}_i^r$ , is calculated as the sum of the changes  $dB_i^r$  by all multinationals operating

within the country. Subsequently, we can calculate the national semi-elasticity and elasticity of

the reported tax base with respect to the tax rate, i.e.  $-\frac{1}{\bar{B}_i^r} \frac{d\bar{B}_i^r}{d\tau_i}$  and  $-\frac{\tau_i}{\bar{B}_i^r} \frac{d\bar{B}_i^r}{d\tau_i}$ .

Table 7 reports our simulated semi-elasticities and elasticities of reported pre-tax profits with respect to tax rates. On average, we find a semi-elasticity of pre-tax profits with respect to tax rates of 1.31 and an elasticity of 0.45. In column 2, we see that Germany is estimated to have the lowest elasticity of pre-tax profits with respect to the tax rate of 0.15. Other large European countries, and in particular France, Italy, the United Kingdom and Spain, similarly obtain relatively low elasticities with respect to tax rates (all below the average of 0.45 for all European countries).<sup>13</sup> Smaller countries such as Belgium, the Netherlands and Portugal instead all have simulated elasticities above 1.00.

## 6.2 Implications of current profit shifting for national tax revenues

In this subsection, we provide estimates of current levels of profit shifting in Europe and their tax revenue implications for European treasuries. To do so, we compare the outcome with profit shifting to the hypothetical outcome without profit shifting that materializes if profit shifting expenses are prohibitively high, say on account of perfect tax enforcement. Within our model, the latter case obtains if we let the shifting cost parameter  $\gamma$  go to infinity.<sup>14</sup> The composite tax variable,  $C_i$ , the profit shifting variable,  $S_i$ , and profit shifting expenses,  $E_i$ , then all collapse to zero. Estimates of  $S_i$  and  $E_i$  in case of profit shifting along with information on tax rates internationally can be used to estimate how national tax revenues are affected by international profit shifting.

To proceed, first note that equation (5) can be written as  $B_i^r = B_i - \hat{\gamma}B_iC_i$  from which we can solve for true profits  $B_i$  as  $\frac{B_i^r}{1 - \hat{\gamma}C_i}$  for each multinational in each country. Noting that

$$B_i^r = B_i + S_i, \text{ we now see that inward profit shifting, } S_i, \text{ can be calculated as } -\frac{\hat{\gamma}B_i^rC_i}{1 - \hat{\gamma}C_i}.$$

Expenses incurred by shifting profits into country  $i$  by a firm can be estimated by

$E_i = (1/2\hat{\gamma})(S_i)^2 / B_i$ . Individual firm estimates of  $S_i$  can next be used to construct aggregate measures of international profit shifting by all multinationals. To wit, let  $\bar{S}_{ij}$  be the aggregate profit shifting into country  $i$  by multinationals domiciled in country  $j$ . Aggregating this over countries  $j$ , we subsequently get  $\bar{S}_i$ , or the total profit shifting into country  $i$  by multinationals domiciled anywhere. Adding aggregate inward profit shifting  $\bar{S}_i$  to the aggregate reported pre-

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<sup>13</sup> Intuitively, these profit shifting elasticities should be relatively small for firms in large countries if these firms themselves are also relatively large as then it will be difficult to shift a large share of their profits. Consistent with this, the variable  $C$  is relatively insensitive to a change in the subsidiary's own tax rate for large firms.

<sup>14</sup> Alternatively, profit shifting would be eliminated following tax rate harmonization, in which case tax revenues also change on account of tax rate changes.

tax profits,  $\bar{B}_i^r$ , we arrive at an estimate of the true aggregate pre-tax profits  $\bar{B}_i$ . Similarly,  $\bar{E}_{ij}$  is defined as the total profit shifting expense incurred in country  $i$  by multinationals domiciled in country  $j$ , while  $\bar{E}_i$  is the total profit shifting expense in country  $i$  incurred by multinationals domiciled anywhere.

Table 8 gives estimates of profit shifting at the national level. The country with the highest statutory tax rate in the sample, Germany, can only experience outward profit shifting, and indeed the ratio of inward profit shifting to the true tax base,  $\bar{S}_i / \bar{B}_i$ , is estimated to be  $-0.136$  for Germany. At the other extreme, the country with the lowest statutory tax rate, Hungary, is expected to experience inward profit shifting, and indeed the same ratio is  $0.224$  for Hungary. All other countries may simultaneously experience significant outward and inward profit shifting. For these countries, actual aggregate profit shifting depends as much on the actual pattern of European multinational investment as on the size of the national statutory tax rate vis-à-vis other countries. In the table, we see that most countries on net experience inward profit shifting (with a positive  $\bar{S}_i$ ). Only Germany, as already mentioned, and Italy, Portugal and the Slovak Republic experience net outward profit shifting. The predominance of inward profit shifting across Europe no doubt reflects the dominant position of Germany as the country with the highest statutory tax rate and the largest multinational activity (as measured, for instance, by sales in Table 2). Thus even a country such as France with a relatively high statutory tax rate of 40 percent on net receives inward profit shifting (albeit small in relative terms, with  $\bar{S}_i / \bar{B}_i = 0.004$ ), as Europe's main economy, i.e. Germany, has an even higher tax rate of almost 54 percent.

As seen in Table 8, countries that experience significant outward or inward profit shifting relative to the tax base  $\bar{S}_i / \bar{B}_i$  also incur high relative profit shifting expenses  $\bar{E}_i / \bar{B}_i$ . On

average, profit shifting expenses are estimated to be 0.6 percent of the tax base of multinational firms in Europe. Finally, the estimated tax revenue implications in the table reflect the revealed pattern of international profit shifting as well as profit shifting expenses. All European countries in fact are estimated to gain tax revenues on account of international profit shifting, apart from Germany, Italy, Portugal and the Slovak Republic. Note that the tax revenue losses by these four countries together are estimated to exceed the tax revenue gains by all the other countries. This is to be expected as countries engage in international profit shifting with a view to reducing their worldwide tax liabilities.<sup>15</sup>

## **7. Conclusions**

Europe's firms are increasingly multinational following the creation of a single market in the EU and the introduction of the euro. At the same time, multinational firms continue to report taxable profits separately in each European country where they have a permanent establishment.

European multinationals, typically active in several countries, have many opportunities to re-allocate profits internationally, while significant international tax rate differences provide powerful incentives to actually do this. Our theoretical framework suggests that the international profit shifting by an individual multinational firm depends on its international structure and on the tax regime it faces in each of the countries it operates. Using a unique dataset of European multinational firms and on tax rates, we find evidence in support of significant profit shifting.

Using our estimates, we compute aggregate semi-elasticities of reported profits with respect to tax rates. The average semi-elasticity of reported profits with respect to the top statutory tax rate

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<sup>15</sup> At the same time, the profits shifted out of Germany, Italy, Portugal and the Slovak Republic are estimated to exceed the profits shifted into all the other countries. Taken at face value, this finding contradicts the model of section 3, which suggests that worldwide shifts in profits should add up to zero. However, the profit shifting estimates are calculated on the basis of a sample that does not include all parent companies and subsidiaries because data are lacking for firms that do not report independent unconsolidated statements and for subsidiaries located

is estimated to be 1.31, which is substantial. The costs of international profit shifting appear to be considerable, and profit shifting leads to a significant redistribution of national corporate tax revenues in Europe. Germany, with the highest tax rate in 1999 and the largest economy, appears to have lost considerable tax revenues on account of international profit shifting. Most other countries may on net have gained some corporate tax revenues, at Germany's expense.

The proclivity of multinationals to shift profits so as to reduce their worldwide tax bill provides countries with the incentive to reduce their top statutory tax rate – to reduce outward profit shifting and perhaps to attract some inward profit shifting. Many European countries have indeed started to lower their top statutory tax rates in recent years. For the EU-15, the average top statutory tax rate declined from 38.0 percent in 1995 to 31.4 percent in 2004 (as documented by European Commission, 2004b). Notably, Germany lowered its federal tax rate in 2001 to 25 percent. This tax rate slashing has been accompanied by base-broadening reforms so as to leave the effective marginal tax rate on investment fairly stable (Devereux et al., 2002).

The root cause of international profit shifting in Europe is the system of separate, national bookkeeping and tax bases. The introduction of a common tax base for multinational firms in Europe would eliminate all potential for international profit shifting – at least within Europe. However, until such a system has been put in place, the evidence of this paper suggests that international profit shifting in Europe will continue to generate massive redistributions of national tax revenues.

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outside of Europe. For the subset of European firms included in our analysis, estimated aggregate profit shifting is therefore unlikely to exactly add up to zero.

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Table 1. Corporate tax rates on domestic income in 1999

This table reports top statutory tax rates as of end 1999 (taking into account subnational corporate income taxes). Sources: Taxation of Companies in Europe, International Bureau of Fiscal Documentation; Corporate Taxes 1999-2000 Worldwide Summaries, PriceWaterhouseCoopers; and Worldwide Corporate Tax Guide, Ernst & Young.

Country	Corporate tax rate
Austria	34
Belgium	40.17 (a)
Bulgaria	34.30 (b)
Croatia	35
Czech Republic	35
Denmark	32
Estonia	26
Finland	28
France	40 (c)
Germany	53.76 (d)
Greece	40
Hungary	18
Iceland	30
Ireland	28 (e)
Italy	41.25 (f)
Latvia	25
Lithuania	29
Luxembourg	37.45 (g)
Netherlands	35
Norway	28
Poland	34
Portugal	37.4 (h)
Romania	38
Slovak Republic	40
Slovenia	25
Spain	35
Sweden	28
Switzerland	33.19 (i)
United Kingdom	30
Average	34.44

(a) The corporate tax rate in Belgium is 39%. This rate is increased by a 3% crisis tax, resulting in a total tax rate of 40.17%.

(b) In addition to the basic corporate tax of 27%, there is a municipal tax of 10% of the taxable profit. The municipal tax is a deductible expense for profit tax purposes. The total tax rate is therefore 34.3%.

(c) The total corporate tax rate of 40% includes a base rate of 33.33%, plus two surtaxes equal to 10% each of the base corporate tax rate.

(d) German business profits are subject to two taxes: corporation tax and municipal trade tax. Corporation tax is levied under a split-rate imputation system at the following rates: 30% on profits distributed to stockholders and 40% on undistributed profits. The total amount of corporation tax due is subject to a surcharge of 5.5% (the "solidarity levy"). The municipal trade tax varies by location from 12% to 20.5%. This tax is deductible as an expense for corporation tax. The total income tax rate, including corporation tax and municipal trade tax, is 53.76%. In this calculation, we assume a trade tax of 20% (the average for large cities) and zero distributed profits.

(e) For manufacturing firms a 10% rate is applicable.

(f) This includes a local (regional) tax on productive activities (IRAP) on Italian-source income.

(g) The base corporate income tax rate is 30%. A solidarity tax of 4% of the above tax is levied. In addition, a municipal tax on income is levied at a rate of between rate of 7.46% and 12.31%, depending on the commune in which the firm is located (the municipal tax is 10% in Luxembourg City). The municipal tax is deductible as an expense from its own and the corporate income tax basis. The total income tax rate, including income tax and municipal business tax, is between 36.29% and 39.65% (37.45% for Luxembourg City). We use the rate for Luxembourg City.

(h) The base corporate tax rate in Portugal is 34%, which increases to 37.4% in almost all cases by a municipal surcharge of 10%.

(i) The Swiss Federation levies direct federal income tax at a flat rate of 8.5% on profits after tax. In addition, each canton has its own tax law and levies cantonal and communal income taxes at different rates. The approximate range of the maximum total income tax rate on profit for federal, cantonal, and communal taxes is between 14.42% and 44.98%, depending on the company's profitability and place of residence. Taxes are treated as tax-deductible expenses, so that the maximum total tax rate varies between 12.6% and 31.02%. For Geneva, the Federal tax is 8.5% and the Cantonal tax is 23.39%, thus the total is 31.89%. In Zurich, the Federal tax rate is 8.5% and the cantonal tax rate is 24.69% for the model firm (in the example provided in PriceWaterhouseCoopers, 2000), hence the total is 33.19%. We take the rate for Zurich.

Table 2. Sample of multinational firms in Amadeus

Sales are in billions of US dollars. Foreign to total sales is the ratio of sales to foreign subsidiaries and total sales. Firms with basic accounting data are firms with data on total assets, fixed assets, sales, labor compensation, pre-tax profits, taxes and the number of employees. Data are from Amadeus.

Country	Firms with at least one foreign subsidiary					Firms with at least one foreign subsidiary and basic accounting information				
	<u>Parent companies and domestic subsidiaries</u>		<u>Foreign subsidiaries</u>		Foreign to total sales	<u>Parent companies and domestic subsidiaries</u>		<u>Foreign subsidiaries</u>		Foreign to total sales
	Sales	Number of firms	Sales	Number of firms		Sales	Number of firms	Sales	Number of firms	
Austria	18.40	223	11.50	223	0.38	8.56	61	4.04	109	0.32
Belgium	58.30	1053	39.00	618	0.40	53.70	830	24.40	426	0.31
Bulgaria	0.07	6	0.00	2	0.07	0.07	6	0.00	2	0.07
Croatia	0	0	0.07	1	1.00	0	0	0	0	
Czech Republic	2.05	38	0.05	5	0.02	2.05	38	0.01	2	0.00
Denmark	27.20	354	15.10	468	0.36	27.00	288	12.80	333	0.32
Estonia	0.01	2	0.00	1	0.13	0.01	2	0.00	1	0.13
Finland	64.70	593	24.10	488	0.27	57.60	436	22.20	359	0.28
France	395.00	4247	95.00	1695	0.19	349.00	3419	77.50	1151	0.18
Germany	510.00	1453	78.50	992	0.13	402.00	339	65.00	768	0.14
Greece	5.18	198	0.06	33	0.01	0	0	0.06	29	1.00
Hungary	1.23	32	0.11	17	0.08	0.27	11	0.07	13	0.20
Ireland	0.91	19	3.20	84	0.78	0	0	2.87	65	1.00
Italy	92.60	414	16.80	194	0.15	92.30	387	13.30	139	0.13
Luxembourg	3.20	23	2.48	65	0.44	1.83	18	2.29	40	0.56
Netherlands	1.74	56	50.30	704	0.97	1.38	12	40.70	493	0.97
Norway	27.40	786	9.50	312	0.26	20.40	579	8.33	228	0.29
Poland	7.71	108	0.41	9	0.05	2.80	47	0.41	8	0.13
Portugal	0.13	11	6.99	15	0.98	0.03	3	6.96	12	1.00
Slovenia	2.73	27	0.12	8	0.04	0	0	0.04	4	1.00
Slovak Republic	1.46	2	0.02	3	0.01	0.07	1	0.01	2	0.14
Spain	177.00	751	10.30	172	0.05	175.00	649	6.20	120	0.03
Sweden	126.00	2846	44.00	984	0.26	121.00	2139	39.10	713	0.24
Switzerland	16.10	156	40.60	711	0.72	1.09	5	36.00	450	0.97
United Kingdom	293.00	2552	86.90	1365	0.23	247.00	1753	76.40	922	0.24
Total	1830.00	15955	535.00	9171	0.23	1560.00	11023	439.00	6390	0.22

Table 3. Summary statistics

Pre-tax earnings is the logarithm of earnings before interest and taxes. Pre-tax profit is the log of earnings before taxes. Capital is the log of the amount of fixed assets. Labor is the log of total labor compensation. Employees is the log of the number of employees. Our sample consists of the parent company and all foreign subsidiaries for all firms that have at least one subsidiary in a European country other than the country where the parent company is located and for which basic accounting data are available (earnings, sales, capital, and labor). For each firm, we aggregate all establishments located in one country (i.e., all subsidiaries and the parent company, if applicable) to one observation. Hence, each observation represents the total business operation of a particular multinational firm in a given country. In panel B we restrict the sample to foreign subsidiaries only. In panels C and D and the remainder of the tables, we restrict the sample to manufacturing companies only (NACE industry codes 15 to 40). Data are from Amadeus.

Panel A: All firms

	Mean	Median	St. dev.	Minimum	Maximum	Number
Pre-tax earnings	7.70	7.66	2.43	-3.88	15.77	4321
Pre-tax profit	7.46	7.43	2.49	-4.12	15.53	3962
Capital	8.67	8.82	3.06	-1.84	17.81	4321
Labor	8.54	8.58	2.18	-0.44	16.24	4321
Employees	4.94	4.97	2.10	0.00	12.11	4321
Financial leverage	0.62	0.65	0.37	-9.15	4.77	4321
C	-0.01	0.00	0.09	-0.43	0.53	4321

Panel B: Foreign subsidiaries only

	Mean	Median	St. dev.	Minimum	Maximum	Number
Pre-tax earnings	6.98	6.96	2.19	-3.88	15.74	2713
Pre-tax profit	6.76	6.78	2.26	-4.12	15.53	2483
Capital	7.68	7.76	2.77	-1.84	16.04	2713
Labor	7.90	7.89	1.96	-0.44	15.74	2713
Employees	4.33	4.33	1.89	0.00	11.80	2713
Financial leverage	0.64	0.68	0.43	-9.15	4.77	2713
C	-0.02	0.00	0.12	-0.43	0.53	2713

Panel C: Manufacturing firms

	Mean	Median	St. dev.	Minimum	Maximum	Number
Pre-tax earnings	7.64	7.66	2.34	-3.88	15.77	1870
Pre-tax profit	7.42	7.42	2.41	-4.12	15.24	1716
Capital	8.54	8.76	2.94	-0.32	17.66	1870
Labor	8.51	8.51	2.09	1.36	16.24	1870
Employees	4.94	4.98	2.02	0.00	12.07	1870
Financial leverage	0.62	0.64	0.27	-2.11	3.07	1870
C	-0.02	0.00	0.10	-0.43	0.53	1870

Panel D: Manufacturing firms, foreign subsidiaries only

	Mean	Median	St. dev.	Minimum	Maximum	Number
Pre-tax earnings	6.93	6.92	2.16	-3.88	12.96	1218
Pre-tax profit	6.72	6.76	2.25	-4.12	12.80	1115
Capital	7.53	7.66	2.69	-0.32	15.36	1218
Labor	7.83	7.80	1.87	1.36	13.02	1218
Employees	4.27	4.28	1.84	0.00	9.63	1218
Financial leverage	0.63	0.66	0.29	-2.11	1.62	1218
C	-0.03	0.00	0.13	-0.43	0.53	1218

Panel E: Correlation matrix of main variables. Sample includes manufacturing firms and foreign subsidiaries only. P-values are between round brackets. Number of observations is reported between square brackets.

	Pre-tax earnings	Capital	Labor	Employees	Financial leverage	Per capita income
Capital	0.77*** (0.00) [1218]					
Labor	0.79*** (0.00) [1218]	0.84*** (0.00) [1218]				
Employees	0.76*** (0.00) [1218]	0.85*** (0.00) [1218]	0.91*** (0.00) [1218]			
Financial leverage	-0.17*** (0.00) [1218]	-0.14*** (0.00) [1218]	-0.06** (0.05) [1218]	-0.10*** (0.01) [1218]		
Per capita income	0.09*** (0.00) [1218]	0.04 (0.14) [1218]	0.25*** (0.00) [1218]	-0.09*** (0.00) [1218]	0.10*** (0.00) [1218]	
C	-0.10*** (0.00) [1218]	-0.07** (0.02) [1218]	-0.02 (0.43) [1218]	-0.10*** (0.00) [1218]	0.09*** (0.01) [1218]	0.13*** (0.00) [1218]

Table 4. Estimation of the profit shifting equation

This table reports OLS estimates of the profit shifting equation:  $b_i^r = \beta_1 + \beta_2 a_i + \beta_3 l_i + \beta_4 k_i - \gamma C_i + u_i$ . The dependent variable is the logarithm of earnings before interest and taxes. Labor (l) is the log of the total labor compensation. Capital (k) is the log of the amount of fixed assets. Per capita income (proxying for a) is the log of GDP per capita. C is the composite tax variable in the model, calculated using country-level statutory tax rates and the firm's total sales as a proxy for the tax base  $B$ . Regressions 2-6 include industry dummies at the 2-digit NACE industry code level (not reported). Regression 3 includes a dummy variable indicating Eastern European firms and an interaction variable of the Eastern Europe dummy and the C variable. Regression 4 splits up the C variable into parts that represent profit shifting incentives vis-à-vis the parent and subsidiaries in other countries. In regression 5, we exclude firms if we have incomplete data on more than 50 percent of the subsidiaries of the firm (of all subsidiaries located in Europe). In regression 6, we exclude firms if we have incomplete data on more than 50 percent of the subsidiaries of the firm and split up the C variable into parts that represent profit shifting incentives vis-à-vis the parent and subsidiaries in other countries. We report White's (1980) heteroskedasticity-consistent standard errors in parentheses. The standard errors are corrected for clustering at the multinational firm level. \*, \*\*, and \*\*\* denote significance at 10%, 5% and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Labor	0.620*** (0.052)	0.629*** (0.052)	0.625*** (0.052)	0.628*** (0.053)	0.466*** (0.072)	0.477*** (0.071)
Capital	0.256*** (0.035)	0.241*** (0.035)	0.243*** (0.035)	0.241*** (0.036)	0.305*** (0.048)	0.302*** (0.047)
Per capita income	-0.158*** (0.055)	-0.144*** (0.053)	-0.274** (0.113)	-0.143*** (0.057)	-0.035 (0.081)	-0.050 (0.076)
C	-1.017*** (0.312)	-0.850*** (0.297)	-0.843*** (0.309)		-1.749*** (0.590)	
Eastern Europe*C			-0.354 (0.927)			
Eastern Europe			-0.368 (0.294)			
C vis-à-vis parent				-0.975*** (0.346)		-1.309** (0.654)
C vis-à-vis other subsidiaries				-0.493 (0.800)		-3.711*** (1.325)
Industry dummies	No	Yes	Yes	Yes	Yes	Yes
F-test of no significance of industry dummies (p-value)		0.00	0.00	0.00	0.00	0.00
Observations	1218	1218	1218	1218	428	428
R-squared	0.67	0.69	0.69	0.69	0.66	0.66

Table 5. Robustness of the estimated profit shifting equation

This table reports OLS estimates of the profit shifting equation. The dependent variable is the logarithm of earnings before interest and taxes. Labor is the log of the total labor compensation. Employment is the log of the number of employees. Capital is the log of the amount of fixed assets. Per capita income is the log of GDP per capita.  $C$  is the composite tax variable in the model, calculated using country-level statutory tax rates and a proxy for the firm's tax base  $B$ . Financial leverage is total debt over total assets. Corruption is the ICRG corruption index, with higher values denoting less corruption. Tax rate is the top statutory tax rate. Sums of labor and capital are logarithms of sums at the national level. Average tax rate is the ratio of taxes paid to pre-tax earnings at the national level. In regression 1,  $C$  is calculated under the assumption that  $B$  equals 1 throughout so that the costs of profit shifting are taken to be unrelated to the scale of activities at the multinational's establishments. In regression 2,  $C$  is calculated using total assets as a proxy for  $B$  to reflect that assets may be less misrepresented by transfer pricing than sales. In regressions 3 to 13,  $C$  is calculated using sales as a proxy for  $B$ . In regression 3, we use the log of the number of employees as a proxy for the labor input rather than the log of total labor compensation. In regression 4, we include observations on parent companies. In regression 5, we include all industries (not only manufacturing). In regressions 6 and 8, the dependent variable is the logarithm of pre-tax profits. Regressions 7 and 8 control for leverage. Regression 9 controls for corruption at the country level. The sample in regression 10 excludes subsidiaries located in Eastern Europe. In regression 11 we replace the composite tax variable  $C$  by the top statutory tax rate facing the subsidiary. In regression 12 the dependent variable is the logarithm of earnings before interest and taxes aggregated over all firms by country pair. Aggregate labor is the log of total labor compensation aggregated over all firms by country pair. Aggregate capital is the log of fixed assets aggregated over all firms by country pair. Average tax rate is the ratio of taxes paid aggregated over all firms by country pair and pre-tax profits aggregated over all firms by country pair. In regression 13 the dependent variable is the logarithm of interest expense. The dependent variable in regression 14 is the logarithm of earnings before interest and taxes. GDP is the log of GDP. The dependent variable in regression 15 is pretax net income including financial income. All regressions, except regression 12, include a constant and industry dummies at the 2-digit NACE industry code level (not reported). We report White's (1980) heteroskedasticity-consistent standard errors in parentheses. The standard errors are corrected for clustering at the multinational firm level. \*, \*\*, and \*\*\* denote significance at 10%, 5% and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Labor	0.637*** (0.052)	0.629*** (0.052)		0.603*** (0.041)	0.565*** (0.029)	0.650*** (0.058)	0.644*** (0.050)	0.688*** (0.055)
Employment			0.516*** (0.051)					
Capital	0.242*** (0.035)	0.241*** (0.035)	0.301*** (0.035)	0.289*** (0.029)	0.287*** (0.020)	0.221*** (0.040)	0.223*** (0.034)	0.181*** (0.037)
Per capita income	-0.155*** (0.053)	-0.146*** (0.053)	0.345*** (0.054)	-0.126*** (0.048)	-0.146*** (0.034)	0.019 (0.076)	-0.128** (0.055)	0.041 (0.075)
$C$	-0.857** (0.399)	-0.806*** (0.275)	-0.595* (0.315)	-0.824*** (0.285)	-0.708*** (0.209)	-0.901** (0.382)	-0.753** (0.291)	-0.727* (0.371)
Financial leverage							-0.651*** (0.185)	-1.192*** (0.228)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1218	1218	1218	1870	2713	1115	1218	1115
R-squared	0.69	0.69	0.66	0.77	0.71	0.65	0.69	0.67

(Table 5, continued)

	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Labor	0.635*** (0.053)	0.624*** (0.057)	0.654*** (0.055)		0.476*** (0.055)		
Capital	0.241*** (0.035)	0.237*** (0.038)	0.235*** (0.037)		0.490*** (0.039)		
Per capita income	-0.130** (0.061)	-0.482*** (0.149)	-0.157*** (0.057)	-0.195*** (0.072)	-0.610*** (0.072)		
C	-0.823*** (0.307)	-0.851*** (0.311)			1.047*** (0.351)	-1.819*** (0.534)	-2.005*** (0.603)
GDP						0.232*** (0.051)	0.295*** (0.057)
Corruption	0.019 (0.058)						
Tax rate			-2.117*** (0.639)				
Aggregate labor				0.550*** (0.092)			
Aggregate capital				0.368*** (0.078)			
Average tax rate				-1.083** (0.496)			
Industry dummies	Yes	Yes	Yes	No	Yes	Yes	Yes
Observations	1206	1080	1218	207	1156	1221	1118
R-squared	0.69	0.69	0.69	0.89	0.67	0.10	0.10

Table 6. Endogeneity of tax variables

This table reports instrumental variables (IV) estimates of the profit shifting equation. The dependent variable is the logarithm of earnings before interest and taxes. Labor is the log of total labor compensation. Capital is the log of the amount of fixed assets. Per capita income is the log of GDP per capita of the country.  $C$  is the composite tax variable calculated using country-level statutory tax rates and the firm's total sales as a proxy for the tax base  $B$ . In regression 1, the log of the country's total population is used as an instrument for the top statutory tax rate used to calculate the  $C$  variable. In regression 2, the difference between the log population of countries  $i$  and  $p$  is used as an instrument for  $C$ . Regression 3 is as regression 2 (and uses the same instrument) but excludes firms for which we have incomplete data on more than half of the subsidiaries of the firm. Regression 4 is as regression 2 with the logarithm of the population of the country with the highest tax rate among affiliates of the firm as an additional instrument. Regression 5 includes country dummies and uses the same instruments as regression 4. All regressions include a constant and industry dummies (not reported). We report White's (1980) heteroskedasticity-consistent standard errors in parentheses. The standard errors are corrected for clustering at the multinational firm level. \*, \*\*, and \*\*\* denote significance at 10%, 5% and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
Labor	0.630*** (0.052)	0.640*** (0.053)	0.464*** (0.072)	0.639*** (0.053)	0.647*** (0.051)
Capital	0.240*** (0.035)	0.233*** (0.035)	0.306*** (0.048)	0.233*** (0.035)	0.216*** (0.034)
Per capita income	-0.136** (0.054)	-0.107** (0.054)	-0.032 (0.080)	-0.108** (0.053)	
$C$	-1.263* (0.657)	-1.766** (0.731)	-1.874* (0.982)	-1.734*** (0.658)	-1.537** (0.709)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	No	Yes
Partial R-squared of excluded instruments	0.23	0.19	0.30	0.23	0.29
F-Test of excluded instruments (p-value)	0.00	0.00	0.00	0.00	0.00
Sargan test of overidentifying restrictions (p-value)	--	--	--	0.91	0.92
Observations	1218	1205	428	1205	1205
R-squared	0.69	0.68	0.66	0.69	0.70

Table 7. Aggregate profit shifting elasticities

This table reports aggregate tax base shifting semi-elasticities and elasticities with respect to the top statutory rate of the country of location. Simulated aggregate statutory tax rate semi-elasticities are obtained as follows. For a given country, we increase the top statutory rate by 0.01. This leads to changes in the  $C$ 's for all firms doing business in this country whether or not they are foreign subsidiaries. The change in reported tax base is calculated from

$$dB_i^r = -\hat{\gamma}_i B_i^r \frac{dC_i}{d\tau_i} d\tau_i \text{ for any firm located in country } i. \text{ Aggregating the changes in } dB_i^r \text{ for all firms located in}$$

country  $i$  gives the aggregate change in reported profits  $d\bar{B}_i^r$  to be used to calculate the aggregate tax base shifting

$$\text{semi-elasticity } -\frac{1}{\bar{B}_i^r} \frac{d\bar{B}_i^r}{d\tau_i}. \text{ The corresponding elasticities are given by } -\frac{\tau_i}{\bar{B}_i^r} \frac{d\bar{B}_i^r}{d\tau_i}.$$

Country	Semi-elasticity as to top statutory tax rate (1)	Elasticity as to top statutory tax rate (2)
Austria	1.07	0.38
Belgium	2.75	1.13
Bulgaria	0.96	0.27
Czech Republic	0.69	0.25
Denmark	1.37	0.45
Estonia	2.09	0.56
Finland	0.58	0.17
France	0.52	0.21
Germany	0.28	0.15
Hungary	1.55	0.30
Italy	0.44	0.19
Luxembourg	0.68	0.26
Netherlands	2.92	1.05
Norway	0.51	0.15
Poland	2.21	0.77
Portugal	2.86	1.10
Romania	1.88	0.73
Slovak Republic	1.05	0.43
Spain	0.83	0.30
Sweden	1.30	0.38
United Kingdom	0.96	0.30
Average	1.31	0.45

Table 8. Estimates of international profit shifting and national tax revenue losses

This table reports the estimated changes in national tax revenues due to international profit shifting. For this purpose, we use the instrumental variables estimate of  $\hat{\gamma}$  from the model in Table 6, column 2. To estimate a multinational firm's true profits in country  $i$ , we use  $B_i = B_i^r / (1 - \hat{\gamma}C_i)$ . Profits shifted into country  $i$  by a firm are estimated as  $S_i = -\hat{\gamma}B_i^r C_i / (1 - \hat{\gamma}C_i)$ . Expenses incurred by shifting profits into country  $i$  by a firm are estimated by  $E_i = (1/2\hat{\gamma})(S_i)^2 / B_i$ . Firm-level data are aggregated to national true profits,  $\bar{B}_i$ , inward profit shifting  $\bar{S}_i$ , and aggregate profit shifting costs  $\bar{E}_i$  and their ratios  $\bar{S}_i / \bar{B}_i$  and  $\bar{E}_i / \bar{B}_i$ . The estimated national tax change,  $dT_i$ , in country  $i$  is calculated using tax system data and estimates of bilateral aggregated tax base shifting  $\bar{S}_{ij}$  and bilateral shifting expenses  $\bar{E}_{ij}$  in country  $i$  for a multinational domiciled in country  $j$ . Figures on  $\bar{B}_i$ ,  $\bar{S}_i$ ,  $\bar{E}_i$ , and  $dT_i$  are reported in millions of US dollars.

Country	$\bar{B}_i$	$\bar{S}_i$	$\bar{S}_i / \bar{B}_i$	$\bar{E}_i$	$\bar{E}_i / \bar{B}_i$	$dT_i$
Austria	122.32	16.15	0.132	2.30	0.019	4.71
Belgium	3084.39	32.90	0.011	11.05	0.004	8.78
Bulgaria	14.08	1.86	0.132	0.17	0.012	0.45
Czech Republic	459.29	120.65	0.263	14.55	0.032	37.14
Denmark	1609.56	54.59	0.034	1.86	0.001	16.87
Estonia	8.67	0.81	0.094	0.08	0.009	0.19
Finland	3961.81	268.20	0.068	9.25	0.002	72.51
France	13600.00	51.45	0.004	39.00	0.003	4.98
Germany	15500.00	-2104.03	-0.136	239.98	0.015	-1260.14
Hungary	25.18	5.65	0.224	0.70	0.028	0.89
Italy	10100.00	-113.79	-0.011	20.82	0.002	-55.53
Luxembourg	27.15	1.82	0.067	0.17	0.006	0.62
Netherlands	329.07	24.60	0.075	1.90	0.006	7.94
Norway	1785.06	43.42	0.024	2.49	0.001	11.46
Poland	199.74	15.80	0.079	1.62	0.008	4.82
Portugal	62.26	-2.97	-0.048	0.08	0.001	-1.14
Romania	25.25	1.76	0.070	0.28	0.011	0.56
Slovak Republic	6.46	-0.12	-0.018	0.01	0.001	-0.05
Spain	2832.08	103.95	0.037	9.30	0.003	33.13
Sweden	3849.94	300.28	0.078	23.13	0.006	77.60
United Kingdom	8224.46	448.83	0.055	25.02	0.003	127.14
Total	65826.77	-728.19	-0.011	403.76	0.006	-907.07

## Appendix 1. Aggregation of a multinational's establishment within a country

This appendix shows that the international pattern of profit shifting at the country level is unaffected by whether the multinational has true profits  $B_i^j$  at establishments  $j = 1, \dots, k$  in

country  $i$  or only true profits  $B_i = \sum_{j=1}^k B_i^j$  at a single establishment in country  $i$ . In the latter case,

let  $S_i$  be the optimal profit shifting into country  $i$ . This yields costs equal to  $\frac{\gamma_i (S_i)^2}{2 B_i}$ . In the

absence of aggregation, we can optimally allocate  $S_i^j$  to establishment  $j$  with  $S_i = \sum_{j=1}^k S_i^j$ . In the

disaggregated case, the firm allocates profits so as to minimize total profit shifting costs as follows

$$L = -\frac{\gamma}{2} \sum_{j=1}^k \left[ \frac{(S_i^j)^2}{B_i^j} \right] + \lambda \left[ \sum_{j=1}^k S_i^j - S_i \right]$$

The first order condition with respect to  $s_{ij}$  is  $-\gamma_i \frac{S_i^j}{B_i^j} + \lambda = 0$ , which shows that  $S_i^j$  optimally is

proportional to  $B_i^j$  so that  $S_i^j = B_i^j \frac{S_i}{B_i}$ . Now total shifting costs in country  $i$  are given by

$$\frac{\gamma}{2} \sum_{j=1}^k \frac{(S_i^j)^2}{B_i^j} = \frac{\gamma}{2} \sum_{j=1}^k \left[ B_i^j \frac{S_i}{B_i} \right]^2 \frac{1}{B_i^j} = \frac{\gamma (S_i)^2}{2 B_i},$$

which demonstrates that shifting costs in country  $i$  are not affected by the aggregation of establishments in country  $i$ .

## Appendix 2. Variable definitions and data sources

Variable	Definition	Source
Statutory tax rate	Top statutory tax rate on corporate income (between 0 and 1)	Taxation of Companies in Europe, International Bureau of Fiscal Documentation; Tax Analysts (www.taxanalysts.com); Corporate Taxes 1999-2000 Worldwide Summaries, PriceWaterhouseCoopers; and Worldwide Corporate Tax Guide, Ernst & Young
Average tax rate	Average tax rate constructed as ratio of taxes paid to pre-tax earnings	Amadeus
C	Composite tax variable (constructed using information on sales (not in log) and statutory tax rates	Data on sales and pre-tax profits from Amadeus. Data on statutory tax rates from: Taxation of Companies in Europe, International Bureau of Fiscal Documentation; Corporate Taxes 1999-2000 Worldwide Summaries, PriceWaterhouseCoopers; and Worldwide Corporate Tax Guide, Ernst & Young
Capital	Amount of fixed assets in log	Amadeus
Employment	Number of employees in log	Amadeus
Labor	Total labor compensation	Amadeus
Financial leverage	Ratio of total debt to total assets	Amadeus
Pre-tax earnings	Earnings before interest and taxes in log	Amadeus
Pre-tax profits	Pre-tax profits in logs	Amadeus
Sales	Total sales	Amadeus
Per capita income	Per capita GDP in log	World Bank Development Indicators
Corruption	Index of corruption with higher values denoting less corruption	International Country Risk Guide