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True Profit-Shifting

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Abstract

Do multinationals exploit corporate tax differences across countries to their benefit? The answer that this paper gives is affirmative, and as such is similar to the answer given within the profit-shifting literature. However, the novelty of this paper is on the measurement of what "profit" is. While the previous literature uses tax-authority data on reported profits (data that can easily be distorted), we estimate true profit margins (i.e. price–marginal cost ratios) and examine how these margins change with corporate tax differences — we call such effects true profit-shifting. Using a unique firm-level dataset that identifies multinationals and their ownership structure, we apply the Roeger (1995) method for estimating markups for the multinational concern. We find a robust positive effect of corporate tax differences to price-cost markups. If high markups are interpreted as a sign of market power, our results point to a reason that creates such market power.

Keywords: Profit-shifting, price-cost ratio, multinational firms.


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1 Introduction

Corporate tax differences and the resulting profit-shifting behaviour of multinational firms is a hotly debated issue in Europe. The single market initiative with all its mobility provisions has, and rightly so, created incentives for corporations to locate activities into countries that have specific advantages. However, with taxes being at the hands of national governments, the issue of corporate tax competition is seen as a distortion to the single market. Governments are simply accused of undercutting each other taxes in order to attract firms, which in turn react by creating a complicated nexus of subsidiaries with the sole target being profit-shifting and tax minimization. Clearly, this profit-shifting creates costs both to MNEs, that pay extravagant amounts to accounting companies that help navigating through country-specific tax laws, and to governments, that have hard time explaining why they have to shift taxation to other less mobile sources.¹

The extent to which MNEs react to corporate tax differentials is well documented. Starting with the pioneering studies of Grubert and Mutti (1991) and Hines and Rice (1994), a number of more recent papers use detailed firm-level data sets to explore particular mechanisms for profit shifting (e.g. transfer pricing and/or thin capitalization).² While the quantitative results may differ according to the mechanism used, or the country in case, the qualitative message is the same: firms do manipulate their reported profits in a tax-minimizing way, i.e. they report low profits to high-tax countries and high profits to low-tax countries.

A common feature of this literature is the use of tax-reporting data. That is, firms’ profits are taken from the information that firms report to their official financial statements and thus to the tax authorities. This of course makes perfect sense when the focus is how much profits firms report to different tax authorities. However, a tax mis-reporting issue

¹While easy solutions (e.g. tax harmonization) have been abandoned from the political agenda, other more elaborated proposals are currently discussed. Following a 2001 report by the European Commission, the discussion is whether or not to remove the current Separate Accounting system of corporate taxation — where taxes are paid according to the reported profit in a particular country — and introduce the Formula Apportionment system — where taxes will be paid according to the activity (measured by sales, labour, and/or assets) that a firm has in a particular country. Clearly, the perceived advantage of the latter is that activity is not as easy to manipulate as reported profits are (see Nielsen et al.; 2010).
²See, among others, Mintz and Smart (2004), Bernard et.al. (2006), and Huizinga and Laeven (2008). A comprehensive survey of this literature can be found in Devereux and Maffini (2007).
may arise here. If we accept the premise that MNEs shift profits for tax minimization purposes, then we should also accept that MNEs have incentives for distorting the data reported to the tax authorities. To put it bluntly, the issue simply is why to report high profits to low tax countries when you can report low(er) profits to all countries?3

An indication for such incentives is for example the fact that many MNEs have two sets of books; an external one that is presented to tax authorities, and an internal one that is used for managerial purposes. While the theoretical underpinnings for such behaviour is covered in Baldenius et al. (2004) and Hyde and Choe (2005), the empirical research shows how widespread such practice is. While an early study by Czechowicz et al. (1982) found that 11% of the U.S. MNEs use two sets of books, Eden (1998, pp. 295–299) reports that since 1982 the extent of two sets of books has increased considerably in the non-merchandise intra-firm trade flows. A recent survey by Ernst and Young (2003) indicates that over 20% of MNEs use two sets of books for management and tax purposes. Note, that having two sets of books is not illegal in the majority of the OECD countries.

Accepting our premise that tax-reporting data can be distorted, the question becomes whether there exist other methods and data that could be used to estimate MNEs’ profit-shifting behaviour. To our knowledge, two such attempts exist in the literature: Clausing (2003) and Bartelsman and Beetsma (2003).

Clausing (2003) collects directly US import price data on intra- and inter-firm trade, i.e. transfer prices and arms-length prices, respectively. She documents that transfer prices are consistently above arms-length prices when taxes abroad are lower than US taxes, and vice versa. Clearly, such direct evidence for transfer pricing, and thus for profit shifting, are hard to ignore. However, such evidence are also hard to collect.4

Using an easily accessible dataset (OECD industry data) Bartelsman and Beetsma (2003) propose a method that addresses the mis-reporting issues mentioned above. Instead of focusing on reported profits, they focus on reported value added, i.e. total sales minus intermediate transactions. By regressing this reported value added (which is less prone

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3 There are of course auditing procedures that restrain firms from abusing the system. Still, for our argument to hold, it is enough to accept that international accounting standards are flexible enough so as to provide firms with some advantage over the tax authorities.

4 Clausing (2006) uses the same data to investigate how tax minimization incentives affect international trade statistics.
to manipulation than reported profits) to corporate tax differentials they are able to document significant profit-shifting effects. While the use of industry-based data is not ideal, the main contribution of their work is in combining accessible activity-based data for estimating some form of real "profit" shifting. The present paper aims in making a similar contribution albeit using a different method that leads to different conclusions.

We focus on estimating the true profit margin (i.e. price-marginal cost ratio) of MNEs and how that is affected by corporate tax differences using the method developed in Roeger (1995). We pay, thus, attention to the fact that MNEs are imperfectly competitive firms earning positive mark-ups and how these mark-ups are affected by international corporate tax differences. We name such effects true profit-shifting. Clearly, such effects do not identify any particular mechanism which multinationals use for increasing their profits (e.g. transfer pricing, thin capitalization, re-location of activity, etc.). What they do identify, however, is an overall positive effect on the multinationals’ market power.

The story that we have in mind is the following. By operating in multiple countries a multinational firm is able to reduce its costs, e.g. by exploiting corporate tax differences. If competition was perfect, such a reduction of costs would be accompanied by a similar reduction of prices. However, when corporate tax differences lead to even higher price-cost markups for the multinationals, then markets are not competitive and the multinationals are the beneficiaries of that.

Our analysis is based on a unique firm-level financial dataset that identifies firms’ ownership structure as that is retrieved from the Amadeus database. We use the extensive version of Amadeus containing approximately 8 million firms within 27 European countries for the period 1997-2007. Being able to follow the firms’ ownership structure, we constrain ourselves to the set of multinational firms (i.e. firms that operate in more than one countries) that have decision control over subsidiaries (> 50% ownership).

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5Mokkas and Maffini (2009) turn to firm-level data and investigate something related to Bartelsman and Beetsma (op.cit), viz. how country tax differences affect MNEs’ productivity.

6The use of Roeger (1995) in estimating profit margins is also the main theme in Konings, et al. (2005) and Konings and Vandenbussche (2005). In both papers the focus is in estimating whether particular reforms or policy initiatives create more or less competition.

7We focus on more than 50% control because in that case parent firms have control over the transfer price.
end up collecting firm-activity data, i.e. sales, labour, capital, material input costs, for approximately 85,000 firms that operate within the manufacturing and service industries. This data define the so-called unconsolidated dataset, where firms that belong to the same multinational are reported as individual firms (plant level data). However, a great advantage of Amadeus is that it also provides a consolidated dataset, where activity data are reported for the global multinational operations. Consolidating the approx. 85,000 firms/plants into multinational concerns, we end up with approximately 17,000 firms which is also the dataset that we use for estimating the profit margin of a multinational firm. \footnote{Assuming that subsidiaries do not maximize own profits, we can not use the data from the unconsolidated dataset to estimate true profit margins.} Finally, we combine this dataset with information about international (and not only European) corporate taxes for the whole period of our analysis. Thus, while we focus on European multinationals, i.e. firms that have headquarters in one of the 27 European countries contained in Amadeus, we do take into account that these firms own subsidiaries outside Europe and thus can exploit international tax differences.

In brief, the results that we get are the following. The overall profit margin that we estimate for the average European multinational firm in our data is 28%. However, such an estimate covers all multinationals, no matter whether they operate in countries with similar or different tax rates. Focusing on the group of multinationals that operate in countries with different corporate taxes makes the average profit margin to jump up with 5 percent points and reach 33%. In this sense, exploiting tax differences is indeed a source of significant market power for multinational firms.

Thus, while the existing profit-shifting literature focuses on losses that accrue to tax authorities due to the ability of multinationals of avoiding paying taxes, we focus on real efficiency losses that stem from an increased market power. Clearly, such effects are far more distortionary than those previously identified. \footnote{If corporate tax differences only create losses for tax authorities, one may be tempted to argue in favour of such tax differences as they discipline the size of the public sector (see e.g. ........).} We believe that such effects have not been previously identified in the profit-shifting literature.

The remaining of the paper is structured as follows. The next section presents the Roeger (1995) method for estimating true-profit margins. Our estimating specification
follows directly and is presented by the end of section 2. Section 3 describes the data in
detail. The main results and the different robustness test that we made are presented in
section 4. Finally, section 5 concludes.

2 Estimating true-profit margins

The estimation of price-costs markups falls traditionally within the industrial economics
domain. It is linked with the Lerner index of market power and it is used for determining
the extend of market power abuse. The industrial economic approach is based on detailed
product level information on own price elasticities, market shares, cross price elasticities
etc. Prior to this, careful assessment of markets and their boundaries has to be made.
Clearly, such a detailed knowledge of market characteristics is not available at the macro-
economic level. By-passing these problems, Hall (1988) pioneered the use of production
data for recovering price-costs markups. Roeger (1995) improved this method and since
then numerous methodology developments and applications have been made.10 In what
follows, we briefly present this production function technique of estimating price-cost
markups.

Consider a firm \( i \) with output \( Q = A F(L, K, M) \), where \( A \) is a firm-specific productivity shock, and \( F \) is a CRS technology using labour \( (L) \), capital \( (K) \), and other inputs \( (M) \),
where \( M \) stands for materials and other expenditures. Hall (1988) showed that the primal
(read, quantity based) Solow residual (i.e. changes between the output growth and the
input growth) can be decomposed into an imperfect competition term and a productivity
term as follows:11

\[
\dot{Q} - a_L \dot{L} - a_K \dot{K} - a_M \dot{M} = b(\dot{Q} - \dot{K}) + (1 - b)\dot{A}
\]

where \( a_j = \frac{P_j J}{PQ} \) is the factor \( J \)'s expenditure share of total sales \( PQ \), with \( P_j \) being the
price of the input \( J \) \( (j, J = L, K, M) \); \( b \) is the Lerner index of market power \( \frac{P - MC}{P} = 1 - \frac{1}{\mu} \)

\( ^{10} \) For an excellent survey of this literature see De Loecker and Warzynski (2009) and their references
within.

\( ^{11} \) Dots over variables represent growth rates.
with $\mu = P/MC$ being the price-marginal cost ratio. While the variables in the left hand side are easily recoverable from production data, there are two unobservable variables in the right hand side: the Lerner index ($b$) and the productivity shock ($\lambda$). In order to estimate one of the two, some information about the other is needed. To proceed, Hall (1988) uses instrumental variables that should capture the productivity variable. The critique since then has been focused on whether the instrumental variables used are the correct ones.

Roeger (1995) solves this problem by deriving the dual (read, price based) Solow residual:12

$$
\dot{P} - a_L \dot{P}_L - a_K \dot{P}_K - a_M \dot{P}_M = b(\dot{P} - \dot{P}_K) - (1 - b)\dot{A}
$$

(2)

Combining (1) and (2) gives:

$$
(\dot{Q} + \dot{P}) - a_L (\dot{L} + \dot{P}_L) - a_M (\dot{M} + \dot{P}_M) - a_K (\dot{K} + \dot{P}_K) = b \left[ (\dot{Q} + \dot{P}) - (\dot{K} + \dot{P}_K) \right]
$$

(3)

As seen, the unobservable productivity shock variable ($\lambda$) disappears. Thus, we can now use observable data, i.e. sales growth, labour costs growth, capital costs growth and material costs growth, to directly estimate $b$ from (3).

Rewriting (3) in terms of the price-marginal cost margin $\mu$, gives:

$$
\frac{(\dot{Q} + \dot{P}) - (\dot{K} + \dot{P}_K)}{\Delta X} = \mu \left( a_L \left[ (\dot{L} + \dot{P}_L) - (\dot{K} + \dot{P}_K) \right] + a_M \left[ (\dot{M} + \dot{P}_M) - (\dot{K} + \dot{P}_K) \right] \right)
$$

(4)

The LHS ($\Delta X$) is the change in sales per value of capital ($\frac{dPQ}{P_K K}$), and similarly in the RHS ($\Delta Y$) we have $dP_L L$ and $dP_M M$. Thus the only data that are needed to estimate the price-cost margin $\mu$ are the nominal values of sales, labour expenditure, capital expenditure,13 and other inputs expenditure in a time series format (so that we can calculate changes and thus growth rates).

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12 This derivation assumes constant returns to scale. Basu and Fernald (1997) correct this and show how the coefficient $b$ is affected by other return to scale assumptions.

13 For calculating capital expenditure Konnings and Vandenbussche (2005) use for capital stock the book value of fixed assets, and for the capital price they use the Hall and Jorgenson (1967) formula $P_K = P_I (r + \delta)$, where $P_I$ is the price deflator for investment and $r$ is the long-term interest rate in the country the firm operates in, and $\delta$ is the depreciation rate taken to be 10%.
Note that an equation such as the one derived above holds for any firm that maximizes profits. Clearly, for firms that are part of a multinational concern and thus do not maximize own profits, the above equation may not hold. It will hold, however, for the multinational concern that maximizes global profits. Thus, in using equation (4) for estimating the price-marginal cost markups we need to use consolidated data, i.e. data that represent the whole multinational and not the particular plants that it controls.14

The empirical specification that we use below builds directly on (4). In addition, and in order to isolate the effect that corporate tax differentials have on markups, we interact the composite \( \Delta Y \) variable with the tax differential \( t^i - T \), where \( t^i \) represents the statutory tax rate in the country where the multinational is registered, and \( T \) is the minimum statutory tax rate that the multinational faces in the countries that it operates.15 Moreover, and in order to take into account any business cycle effects on markups,16 we also interact \( \Delta Y \) with the GDP growth in the multinational’s home country \( GDP^i \). The resulting equation is thus:

\[
\Delta X^i = \alpha^i + \mu^i \Delta Y^i + \mu_1^i \left[ \Delta Y^i x(t^i - T) \right] + \mu_2^i \left[ \Delta Y^i xGDP^i \right] + \beta_1(t^i - T) + \beta_2 GDP^i + \varepsilon^i
\]

where \( \alpha^i \) should capture some firm-specific effects; \( \beta_1 \) and \( \beta_2 \) should capture the direct effect of the tax differential and GDP growth variables; and \( \varepsilon^i \) is the error term. If the multinational’s home country is also the country with the lowest tax rate, then only the second term in the RHS exists. However, if taxes are different, the third term enters and the overall mark up is now \( \mu^i + \mu_1^i (t^i - T) \). Taking into account also a potential business cycle effect, the overall mark-up becomes \( \mu^i + \mu_1^i (t^i - T) + \mu_2^i GDP^i \). Clearly, our focus is on the second term of this overall markup estimate.

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14 Still, having knowledge of which plants the multinational owns is essential to our analysis as we use the plant’s country taxes to derive tax differentials (more on the tax differential data later on).

15 Instead of the minimum tax that the multinational faces around the world, we also use the average tax of all its foreign operations, as Bartelsman and Beetsma (2003), and Huizinga and Laven (2008) do — see the section about robustness tests (to come...).

3 Data: sources and statistics

Financial data and detailed ownership information on a company’s direct and ultimate owners, their country of origin, their percentage ownership as well as information on a company’s subsidiaries, their location, and the share that the company holds in each subsidiary are taken from the Amadeus database, provided by Bureau Van Dijk. This database contains information on European companies except financial institutions and insurance companies. The included companies are not necessarily quoted in stock exchanges. For multinational companies Amadeus reports both unconsolidated and consolidated financial accounts. The unconsolidated statements report the financial situation of a sole company (the parent firm or one of its subsidiaries) while consolidated statements take into account the whole activity of a multinational reflecting the activities of the parent company and of all its domestic and foreign subsidiaries.

Apart from the cost of capital, all the other firm level variables specified by our model are entries in a company’s statement (Table 1 contains the definitions and data sources for the variables we used in our empirical analysis). Thus to account for the nominal output we use a company’s operating revenue, for labor expenditure we used the cost of employees (including employer and employee social contributions), and for the expenditure on material inputs we used the costs of material inputs. To compute the cost of capital we multiplied net total tangible fixed assets with the capital price, $P_t (r + \delta)$, where $P_t$ is the price deflator of the capital goods, $r$ is the real interest rate, and $\delta$ is the capital depreciation rate. The price deflator, $P_t$, we computed ourselves based on the price deflators of gross fixed capital formation and the gross fixed capital formation at current prices for construction and equipment. These data comes from the AMECO database provided by the European Commission. We used the same source to get data on a country’s real long-term interest rates that we used as a proxy for the real interest rate, $r$. We considered a depreciation rate, $\delta$, of 10%.

Table 1: about here

To a company’s financial information we have added, in both data sets, information
on the statutory tax in its location, and on the average and the lowest statutory tax rate faced by the multinational in which the company is integrated. To compute the latter two taxes, we tracked the parent and subsidiary companies that are part of the same multinational and thus the countries in which the multinational is present. To reconstruct a multinational’s structure we have considered only subsidiaries in which parent companies have at least 50% ownership. Data on statutory tax rates come from World Bank’s World Development Indicators (WDI) which uses the information published by Pricewaterhouse Coopers in Corporate Taxes: Worldwide Summaries. Also, in both data sets, we added the GDP growth rate from the AMECO database.

Table 2 contains summary statistics for the variables we used to estimate our model and for the data we used to construct these variables. Table 3 reports correlations for the variables we used in our estimations. This latter table shows that there is a strong correlation between the interaction terms and $dx$ indicating that differences between domestic taxes and the minimum or the average tax faced by a multinational might be important determinants of a company’s price markups. The correlations between the interaction terms that use the minimum tax with $dx$ are higher than those that use the average tax. This seems to indicate that the lowest rather than the average tax a multinational is facing is the relevant tax one needs to consider when assessing the extent of transfer pricing in multinational companies.

**Table 2 and 3:** about here

In practice, we use a slightly attenuated dataset which excludes extreme outliers. Additional complications arise from the fact the subsidiaries of multinational enter and exit the sample. So far, we have not addressed this but simply taken the attenuation of panels to be random. However, to the extent that establishing, or closing, new subsidiaries in other countries is not random, but rather a strategic decision made partly in order to facilitate shifting profits, this will need to be taken into account.

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17 The country of origin of the parent company or the host country of a subsidiary might not be European. Therefore when reconstructing a multinational’s structure and thus when computing the average and the lowest international statutory tax rate a multinational is facing we take into account its presence in non-European countries.
4 The empirical results

Taking (5) to the data turned out not to be straightforward. Our initial regressions revealed the following picture.

Table 4: Mark-ups and tax differentials: Panel data estimation

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</table>

Panel data random effects estimation

Clustered standard errors (cols. 1-2) / robust standard errors (cols. 3-8) in brackets

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

where \( T_{d_{\text{min}}} \) denotes the country tax difference from the lowest possible tax the multinational faces \( (t_i - T_{\text{min}}) \).

Column (1) shows the initial regression with the full set of observations (after having removed those that had some data missing). As it is seen, the coefficient of \( dy \) is below unity, indicating that the price is set below marginal costs — a result that makes little sense. In that regression, corporate tax differences do not seem to have any influence

\[ \text{Table 4: Mark-ups and tax differentials: Panel data estimation} \]

\[ \text{Panel data random effects estimation} \]

\[ \text{Clustered standard errors (cols. 1-2) / robust standard errors (cols. 3-8) in brackets} \]

\[ *** p<0.01, ** p<0.05, * p<0.1 \]

where \( T_{d_{\text{min}}} \) denotes the country tax difference from the lowest possible tax the multinational faces \( (t_i - T_{\text{min}}) \).\(^{18}\)

Column (1) shows the initial regression with the full set of observations (after having removed those that had some data missing). As it is seen, the coefficient of \( dy \) is below unity, indicating that the price is set below marginal costs — a result that makes little sense. In that regression, corporate tax differences do not seem to have any influence

\(^{18}\) We only report the variables that turn out to be statistically significant.
whatevsoever, and the service industry seems to have lower markups than the manufacturing industry. Looking at the scatter plot and removing observations that constituted outliers (those with $|dy| < 5$) the regression improves considerably with the average mark-up being now being close to unity: $\mu_0 + \mu_1 \cdot T_{d \min} = 0.899 + 0.011 \cdot 7.3 = 0.9826$. Looking at the individual countries, however, shows a totally different picture as the tax differential seems only to be important for French multinationals. Clearly, the unbalanced nature of the Amadeus database creates problems for our estimations.

To proceed, we choose to use a robust estimator that removes the outliers in each country and weights the remaining observations appropriately (explain more here..... and refer to the econometric papers ...........). The results are now the following:

Table 5: Mark-ups and tax differentials: Robust data estimation

<table>
<thead>
<tr>
<th>Country</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>All</td>
<td>All</td>
<td>FR</td>
<td>SE</td>
<td>DE</td>
<td>IT</td>
<td>FI</td>
<td>ES</td>
</tr>
<tr>
<td>[0.002]</td>
<td>[0.002]</td>
<td>[0.009]</td>
<td>[0.003]</td>
<td>[0.005]</td>
<td>[0.008]</td>
<td>[0.007]</td>
<td>[0.007]</td>
<td></td>
</tr>
<tr>
<td>Td_min</td>
<td>-0.000*</td>
<td>-0.000*</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.000]</td>
<td></td>
</tr>
<tr>
<td>dy_Td_min</td>
<td>0.001***</td>
<td>0.001***</td>
<td>0</td>
<td>0.002***</td>
<td>-0.002***</td>
<td>0.007***</td>
<td>0</td>
<td>0.003***</td>
</tr>
<tr>
<td>[0.000]</td>
<td>[0.000]</td>
<td>[0.001]</td>
<td>[0.001]</td>
<td>[0.001]</td>
<td>[0.001]</td>
<td>[0.001]</td>
<td>[0.000]</td>
<td></td>
</tr>
<tr>
<td>Service industry</td>
<td>0.004***</td>
<td>0.004***</td>
<td>0.010**</td>
<td>-0.005</td>
<td>0.001</td>
<td>0.002</td>
<td>-0.002</td>
<td>0.008***</td>
</tr>
<tr>
<td>(rel. to manuf.)</td>
<td>[0.001]</td>
<td>[0.001]</td>
<td>[0.004]</td>
<td>[0.004]</td>
<td>[0.003]</td>
<td>[0.003]</td>
<td>[0.003]</td>
<td>[0.003]</td>
</tr>
<tr>
<td>Year dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Sample</td>
<td>All</td>
<td>abs(dy)&lt;5</td>
<td>abs(dy)&lt;5</td>
<td>abs(dy)&lt;5</td>
<td>abs(dy)&lt;5</td>
<td>abs(dy)&lt;5</td>
<td>abs(dy)&lt;5</td>
<td>abs(dy)&lt;5</td>
</tr>
<tr>
<td>Observations</td>
<td>14716</td>
<td>14701</td>
<td>1695</td>
<td>5576</td>
<td>1339</td>
<td>2842</td>
<td>1228</td>
<td>2021</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.982</td>
<td>0.98</td>
<td>0.964</td>
<td>0.971</td>
<td>0.986</td>
<td>0.958</td>
<td>0.977</td>
<td>0.98</td>
</tr>
</tbody>
</table>

Clustered standard errors (cols. 1-2) / robust standard errors (cols. 3-8) in brackets

*** p<0.01, ** p<0.05, * p<0.1
In all regressions the mark-up is well above unity and significant as theory predicts. European multinationals seem to be able to set in average prices 28.5% above marginal costs, with multinationals in individual countries charging from 30.4% high in Germany to 21% low in Spain. The effect of the tax differential is statistically significant but small in size. In particular the tax differential in average increases the mark-up by 0.76 percent points ($\mu_1 \cdot T_d \min = 0.001 \cdot 7.6 = 0.0076$). However, when we look at the individual countries we detect some large effects.

Sweden for example faces the largest tax differential with $T_d \min = 39$. Thus, for Sweden the tax differential effect on mark-ups will be $\mu_1 \cdot T_d \min = 0.002 \cdot 39 = 0.078$, i.e., a mark-up increase of 7.8 percent points. In Italy the same effect will be equal to 8.4 percent points while in Germany there will be a reduction of 3 percent points. In this sense, while the German multinationals seem not to be able to exploit country tax differentials in their favour, the Italian and the Swedish multinationals do that quite well. Such effects could be explained by the country’s tax authority ability in curbing profit shifting. Finally, the service industry has in average a higher mark-up than the manufacturing industry. This is exactly what one would expect given the intangible nature of the service industry and the difficulties tax authorities have in controlling the true price of intangible goods. However, such an effect seems to be specific to French and Spanish multinationals.

5 Conclusions

(to be written)

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19 In calculating the marginal effect we use the mean value of the tax differential variable ($T_d \min = t_i - T \min$). This value is 7.6 as it can be seen in table 2.
References


<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition and data source</th>
</tr>
</thead>
</table>
| **Statutory tax rate**   | The highest rate shown on the schedule of tax rates applied to the taxable income of corporations  
Source: World Bank’s World Development Indicators (WDI) which uses the information published by Pricewaterhouse Coopers in *Corporate Taxes: Worldwide Summaries*.  
Coverage (time period): 1998-2004. However, for the year 2000 there is almost no observation. Since statutory taxes do not change very often, if data for a year was missing but the taxes for the year before were the same with the taxes for the next year, we have set the tax for that year to be equal with the tax for the two neighbouring years.  
Coverage (countries): 125 countries†                                                                 |
| **Financial data**       | Source: Amadeus  
Coverage (countries in our samples): Austria, Belgium, Czech Republic, Finland, France, Germany, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Spain, Sweden |
| Nominal output           | Operating revenue in thousands of Euro  
| Labor expenditure        | Cost of employees in thousands of Euro, including employer and employee social contributions.  
| Material inputs expenditure | Costs of material inputs in thousands of Euro  
| Capital                  | Net tangible fixed assets evaluated at book value in thousands of Euro  
| **The price of capital** | Defined as $P_t (r + \delta)$.  
Coverage (countries in our samples): Austria, Belgium, Czech Republic, Finland, France, Germany, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Spain, Sweden  
$P_t$ (the price deflator of investment goods) | Own computation based on the price deflators of gross fixed capital formation and the gross fixed capital formation at current prices for construction and equipment  
Real interest rate        | Source: AMECO dataset, European Commission  
Real long-term interest rates (deflator GDP) | Source: AMECO dataset, European Commission  
Depreciation              | We took it equal with 10%.  
| **GDP growth rate**      | Source: AMECO dataset, European Commission  
Coverage (countries in our samples): Austria, Belgium, Czech Republic, Finland, France, Germany, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Spain, Sweden |

† Countries: Antigua and Barbuda, Argentina, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Barbados, Belgium, Bermuda, Bolivia, Botswana, Brazil, Brunei Darussalam, Bulgaria, Cambodia, Cameroon, Canada, Cayman Islands, Channel Islands, Chile, China, Colombia, Dem. Rep. of Congo, Rep. of Congo, Costa Rica, Cote d'Ivoire, Croatia, Cyprus, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, Arab Rep., El Salvador, Estonia, Faeroe Islands, Fiji, Finland, France, Gabon, Germany, Ghana, Greece, Guatemala, Guyana, Honduras, Hong Kong, Hungary, India, Indonesia, Iran, Ireland, Isle of Man, Israel, Italy, Jamaica, Japan, Kazakhstan, Kenya, Rep. of Korea, Kuwait, Kyrgyz Republic, Latvia, Liechtenstein, Lithuania, Luxembourg, Macao, Malawi, Malaysia, Malta, Mauritius, Mexico, Monaco, Morocco, Mozambique, Myanmar, Namibia, Netherlands, Netherlands Antilles, New Caledonia, New Zealand, Nicaragua, Nigeria, Norway, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Puerto Rico, Qatar, Romania, Russian Federation, Saudi Arabia, Senegal, Singapore, Slovak Republic, Slovenia, Solomon Islands, South Africa, Spain, Sri Lanka, St. Lucia, Swaziland, Sweden, Switzerland, Tanzania, Thailand, Trinidad and Tobago, Turkey, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Uzbekistan, Venezuela, RB, Vietnam, Zambia, Zimbabwe.
Table 2: Descriptive statistics (observations: 16477)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal output</td>
<td>189443.4</td>
<td>1436664.0</td>
<td>3</td>
<td>6.08E+07</td>
</tr>
<tr>
<td>Labor expenditure</td>
<td>28202.8</td>
<td>282666.1</td>
<td>1</td>
<td>1.46E+07</td>
</tr>
<tr>
<td>Material inputs expenditure</td>
<td>93948.6</td>
<td>759719.7</td>
<td>1</td>
<td>3.35E+07</td>
</tr>
<tr>
<td>Capital</td>
<td>53684.2</td>
<td>951970.7</td>
<td>1</td>
<td>7.48E+07</td>
</tr>
<tr>
<td>The price of capital</td>
<td>1.262</td>
<td>0.114</td>
<td>0.18</td>
<td>2.01</td>
</tr>
<tr>
<td>Statutory tax rate (T)</td>
<td>33.702</td>
<td>3.505</td>
<td>19</td>
<td>39</td>
</tr>
<tr>
<td>minimum (T_min)</td>
<td>26.342</td>
<td>7.325</td>
<td>0</td>
<td>39</td>
</tr>
<tr>
<td>average (T_avg)</td>
<td>31.479</td>
<td>3.032</td>
<td>11</td>
<td>45</td>
</tr>
<tr>
<td>GDP growth</td>
<td>2.350</td>
<td>1.459</td>
<td>-0.74</td>
<td>8.44</td>
</tr>
<tr>
<td>Dx</td>
<td>0.023</td>
<td>0.604</td>
<td>-12.78</td>
<td>9.54</td>
</tr>
<tr>
<td>Dy</td>
<td>0.019</td>
<td>5.950</td>
<td>-1062.10</td>
<td>83.27</td>
</tr>
<tr>
<td>T - T_min</td>
<td>7.360</td>
<td>7.617</td>
<td>0</td>
<td>39</td>
</tr>
<tr>
<td>T - T_avg</td>
<td>2.223</td>
<td>3.352</td>
<td>-10</td>
<td>22</td>
</tr>
<tr>
<td>dy * (T - T_min)</td>
<td>0.243</td>
<td>10.599</td>
<td>-1062.10</td>
<td>666.1</td>
</tr>
<tr>
<td>dy * (T - T_avg)</td>
<td>0.019</td>
<td>4.208</td>
<td>-424.8</td>
<td>333.1</td>
</tr>
<tr>
<td>dy * GDP growth</td>
<td>-0.020</td>
<td>29.744</td>
<td>-5363.4</td>
<td>202.4</td>
</tr>
</tbody>
</table>

Table 3: Correlation matrix

<table>
<thead>
<tr>
<th>dx</th>
<th>dy</th>
<th>T - T_min</th>
<th>T - T_avg</th>
<th>dy * (T - T_min)</th>
<th>dy * (T - T_avg)</th>
<th>GDP_growth</th>
<th>dy * GDP growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.187</td>
<td>1</td>
<td>0.004</td>
<td>0.351</td>
<td>0.278</td>
<td>-0.027</td>
<td>0.150</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>0.002</td>
<td>0.001</td>
<td>0.034</td>
<td>0.29</td>
<td>-0.008</td>
<td>0.994</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>0.749</td>
<td>1</td>
<td>0.02</td>
<td>0.04</td>
<td>-0.02</td>
<td>0.002</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
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</tr>
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</tr>
<tr>
<td>6</td>
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<td></td>
<td></td>
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<td>-0.014</td>
<td>0.589</td>
</tr>
<tr>
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<td>0.585</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.005</td>
<td></td>
</tr>
</tbody>
</table>