Tax Haven Activities and the Tax Liabilities of Multinational Groups

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Abstract

This paper investigates the effect of tax haven operations on the tax liabilities of corporate groups headquartered in 15 OECD countries. Using consolidated accounting data from ORBIS (2003–2007), this work finds that, at the mean, an additional tax haven subsidiary reduces tax liabilities over total assets by 7.4 per cent in the long run. At the mean, the marginal effective tax rate (ETR) of a corporate group with tax haven subsidiaries is one percentage point lower than it is for groups without low-tax offshore operations. The results also show that the marginal ETR of companies headquartered in countries with a territorial system is lower than that of companies headquartered in jurisdictions with a worldwide system of taxation on corporate profits. More specifically, corporate groups headquartered in the United States have the highest marginal ETR.

Keywords: Corporate Income Tax; Multinationals; Profit shifting; Tax Havens.

JEL Classification: F23; H25; H32.

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1 Introduction

The debate on the role of tax havens has lately gained great momentum, beyond any expectations one might have entertained at the beginning of 2008. In the wake of the credit crunch and the following severe economic downturn, with heavy government intervention, declining tax revenues, and pleas for new market regulation, pressure on tax havens has mounted to unprecedented levels. Under the threat of being placed on an OECD black-list of "jurisdictions that have not committed to internationally agreed tax standard" on transparency, low-tax countries agreed just before the Group of Twenty (G20) meeting of April 2009 to curtail bank secrecy rules. The affected countries include Switzerland, Monaco, and Liechtenstein; traditionally they have been very reluctant to amend their rules on bank secrecy and the exchange of information. In May 2009, Andorra, Liechtenstein, and Monaco were removed from the OECD list of uncooperative tax havens, after agreeing on a timetable to implement the standards of transparency and effective exchanges of information set out by the organisation. Now more and more low-tax jurisdictions are signing treaties in accordance with the OECD principles on tax matters. In June 2009, Bermuda signed its twelfth treaty (with the Netherlands) crossing the OECD threshold between being a tax haven or not. The OECD moved Bermuda to a list of jurisdictions that have substantially implemented the internationally agreed tax standard. This is the list which includes Group of Eight (G8) countries. A month later,

Luxembourg signed its twelfth treaty with Norway. These are the first tax treaties satisfying OECD guidelines ever signed by Luxembourg with another OECD member (OECD (2009)). In August 2009, the Cayman Islands and the British Virgin Islands signed their twelfth bilateral agreements with New Zealand and they now also appear in the OECD list of jurisdictions that have substantially implemented the internationally agreed tax standard. At 28 August 2009, the OECD list of jurisdictions that have not committed to internationally agreed tax standard was empty. These developments concern mainly evasion of personal taxation; therefore they are not likely to affect tax avoidance by multinational corporate groups. They are nonetheless a sign that in recent months tax havens have come under unprecedented pressure.

More relevant for corporations, in May 2009 the US Presidency announced measures which could reduce the incentives for corporations to shift profits to tax havens. The measures aim at preventing the use of the check-the-box rules to avoid Sub-part F regulations for intra-group debt[1]. Additionally, they would disallow expenses deductions associated with deferred foreign profits and they would introduce a pooling system of foreign tax credits which should reduce tax planning of multinationals (Shaviro (2009)).[2]

[1]Sub-part F of the US Internal Revenue Code was introduced in 1962 and it prescribes that certain income earned by a controlled foreign corporation has to be taxed, even if it is not repatriated (for example, income from intra-group loans). The check-the-box rules introduced in 1996 allow for choosing whether certain entities are to be treated as separate corporations for US tax purposes. The rules have unintentionally weakened Sub-part F (Shaviro (2009)).

[2]The measures are likely to be included in the 2009 US budget document. They have

Critics of these proposals argue that the measures will reinforce the deviation of the US tax system from those of most other countries. After Japan and the United Kingdom adopted a territorial (exemption) system in 2009, the United States remained the only major country with a worldwide taxation system on corporate income (credit system). Under a territorial system which exempts foreign profits, companies have an incentive to maximise overall the group profit by locating their real activities and by shifting some of their earnings into low-tax jurisdictions. Under a worldwide system of taxation, this incentive is smaller as foreign profits are taxed at the same rate as domestic profits when they are repatriated (Dharmapala (2008)). This could imply a higher tax burden for companies headquartered in credit countries.

Critics of tax havens argue that offshore tax centres erode tax revenues, undermine fair competition, and dangerously reduce transparency. Other analysts suggest that even though tax haven activity might reduce the tax burden of multinational companies (MNCs), it enhances economic activity in nearby non-haven countries by lowering the cost of capital (Desai et al. (2006a); Dharmapala (2008)). But are offshore low-tax jurisdictions really important in reducing the tax burden of multinational groups and hence in eroding the tax base of higher-tax countries?

to be approved by the Congress. For more details on the US legislation and the proposed changes, see Shaviro (2009).

This paper studies whether in the aggregate MNCs are successful in reducing their tax liabilities by shifting profits in tax havens. More specifically, it identifies the effect of tax haven operations on the group tax bill, and it investigates whether the presence of group operations in offshore low-tax jurisdictions reduce the tax burden of the corporate group.

Despite a variety of contributions on the extent to which multinational companies shift profits to low-tax jurisdictions through manipulation of transfer-prices and (or) debt financing,[3] direct evidence of the effect of tax haven operations on tax liabilities is minimal. The emerging small body of literature focuses mainly on US-owned companies (with the exception of Markle and Shackelford (2009)).

This paper compares the marginal effective tax rate (ETR) of corporate groups headquartered in credit countries with that of groups headquartered in exemption countries, where the marginal ETR measures the increase in the tax liabilities when accounting profits increase by one US dollar. Corporate

[3]For contributions that report findings of direct evidence of transfer-pricing activities among US multinationals, see Swenson (2001); Clausing (2003); Bernard et al. (2006). Altshuler and Grubert (2002) and Desai et al. (2004), among others, find direct evidence of debt shifting with US data. Huizinga et al. (2008) report evidence of debt shifting using European data from AMADEUS. For more information on the dataset, see Table A.10 in Maffini (2007). Several researchers find direct evidence of debt shifting using the German Bundesbank MiDi dataset (see Mintz and Weichenrieder (2005); Buettner et al. (2006); Buettner and Wamser (2009)). For more information on the dataset, see Table A.13 in Maffini (2007).

groups whose ultimate owner is resident in jurisdictions with a worldwide system are characterized by a higher ETR. In particular, companies headquartered in the United States display the highest ETR.

The analysis is carried out by merging two datasets: ORBIS and ZEPHYR. ORBIS contains accounting data derived from profit and loss (P&L) accounts and balance sheet items. In the online version of ORBIS used here, for each global ultimate owner, the country of residence of its first-level subsidiaries is available.[4] ZEPHYR contains information on M&A deals which may have changed the ownership structure of the group. Information includes acquisition and (or) sell-off of affiliates in tax havens. Therefore, a time-varying ownership structure can be created by merging ORBIS with ZEPHYR. Our sample consists of about 3,400 ultimate owners between 2003 and 2007 located in 15 countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, the Netherlands, Norway, Spain, Sweden, Switzerland, the United Kingdom, and the United States. A common problem of the previous literature is that the effect of tax haven operations on tax liabilities is not identified properly because of endogeneity issues which are not tackled. The decision to boost or to reduce tax haven activity is likely to be influenced by both unobserved group fixed effects such as the ability of the tax department, and by unobservable time-varying shocks likely to affect

[4]The online version of ORBIS contains information on second- and further-level subsidiaries but it is not possible to download it in a format which can be processed with a standard econometric softwares.

the tax liabilities simultaneously. Desai et al. (2006b) control for group fixed effects but none of the studies in the literature controls for the simultaneous determination of the tax bill and of tax haven activities. By merging two datasets and creating a time-varying ownership structure, this cross-country research is able to investigate tax payments of corporate groups with tax haven operations, whilst dealing with the identification issues underlying the relationship between offshore low-tax operations and tax liabilities.

Differently to Desai et al. (2006b), this paper employs consolidated accounts and therefore it identifies the determinants of the tax liabilities of the group instead of the single affiliate. Unconsolidated accounts could lead to an overestimation of the ETR. Suppose company A owns a subsidiary B located in a tax haven. Suppose that A borrows US$ 100 from B and pays 10 per cent interest. The parent company can deduct interest payments from its tax base. If in the home country the statutory corporate tax rate is 30 per cent and A reports a pre-tax profit of US$ 100, then its ETR is 30 per cent.[5] Suppose additionally that B reports profits only from interest payments received, and that its relevant statutory corporate tax rate is zero. If consolidated data are used, the profit of the tax haven subsidiary will be added to the profit of the parent and the ETR will drop to 27 per cent.[6] Additionally, unconsolidated data only give a partial picture of how offshore low-tax jurisdictions

[5] $\lfloor \frac{0.3*(100-10)}{(100-10)} \rfloor = 0.30$.
[6] $\lfloor \frac{0.3*(100-10)}{(100-10)+10} \rfloor = 0.27$.

affect tax liabilities. In fact, a reduction in the tax bill of one affiliate could be compensated for by an increased tax bill somewhere else in the group. By failing to provide information on the tax liabilities of the whole group, unconsolidated accounts are not suitable for comparing the tax burdens of corporate groups resident in exemption countries with the tax burdens of companies headquartered in credit countries.

The study is organised as follows. Section 2 reviews the literature. Section 3 presents the data used in the empirical section. Section 4 develops the empirical model and discusses various econometric issues. Section 5 presents the results. Section 6 concludes.

2 Literature

The emerging literature can be partitioned into the accounting literature describing country- or group-level ETRs (Markle and Shackelford (2009); Dyreng and Lindsey (2009)) and the studies trying to establish a causal relationship between affiliate-level tax payments and the tax haven operations of multinational firms (Desai et al. (2006b)). The accounting literature is descriptive because it does not control for observable characteristics of the firm such as profitability, which clearly affects tax liabilities.

The accounting literature employs consolidated data whilst Desai et al. (2006b)

employ unconsolidated confidential affiliate-level data. Unfortunately, as discussed in Section 1, unconsolidated data fail to provide a complete picture of the real tax burden faced by a corporate group.

The literature differs across various dimensions but it has a common, important problem. The common actor is that it does not deal with identification issues arising from the simultaneous determination of tax liabilities and offshore low-tax operations. This implies that the effect of tax haven operations is not correctly identified.

Markle and Shackelford (2009) describe country-level ETRs between 1988 and 2007 for 85 different countries. They employ consolidated accounting data from OSIRIS.[7] The authors distinguish aggregate country-level ETRs between domestic and multinational firms using time-invariant ownership information for 2008. OSIRIS contains information on tax haven subsidiaries. Given the time-invariant nature of the ownership information, the research employs a pooled OLS. Markle and Shackelford (2009) calculate the ETR as the ratio of book total tax expenses divided by net income before taxes (NIBT). They employ only companies with positive NIBT and positive tax charges.[8] Regressing the ETR on a set of country dummies identifying the

[7]OSIRIS is also produced by Bureau van Dijk. It contains financial information for listed companies, banks, and insurance companies around the world. For more information on the dataset, see Table A.10 in Maffini (2007).

[8]As explained in Section 4, this might lead to sample selection bias.

location of the ultimate owner and of its subsidiaries, the authors find that the ETR of corporate groups with tax haven affiliates is 0.5 percentage points lower than the ETR of the ultimate owners without low-tax offshore operations.[9] More specifically, the ETR of US firms with offshore low-tax operations is between 0.1 per cent and 0.7 per cent lower than that of US companies without tax haven operations. For UK multinationals, the ETR of those with tax haven operations is between 0.1 per cent and 0.2 per cent lower than the ETR of companies without offshore low-tax jurisdictions. For countries with a territorial system such as France and Germany, the ETR of the multinationals with tax haven operations is 2.4 per cent and 0.1 per cent lower, respectively, than the ETR of companies without tax haven operations. Also, within the same country multinationals overall do not seem to enjoy a lower ETR than do domestic companies, but multinationals domiciled in tax havens have a slightly lower worldwide ETR, as explained above.[10] Markle and Shackelford (2009) also investigate whether companies headquartered in credit countries have a higher ETR with respect to companies headquartered in exemption countries. They do not report results for this analysis. They simply say that the additive dummy recording whether the ultimate owner is resident in a credit country is not statistically significant.

Dyreng and Lindsey (2009) estimate the worldwide, federal, and foreign tax

[9]The only exception is Japan.
[10]Markle and Shackelford (2009).

burdens on the corresponding worldwide, domestic, and foreign incomes of US-owned multinationals. They use a panel of consolidated accounting data from Compustat for the period 1995 to 2007.[11] The time-varying presence of a corporate group in low-tax jurisdictions is derived from Exhibit 21 of form 10-K submitted to the US Security and Exchange Commission. Form 10-K is an annual report that publicly traded companies incorporated in the United States are required to submit according to the US federal securities laws. The form contains business and financial information, including audited financial statements. In particular, Exhibit 21 gathers information on the subsidiaries of the registrant, including their name and location. Using an OLS estimator, the authors find that the effect of tax haven operations on the worldwide tax charges of US multinationals is small. The worldwide ETR (inclusive of US state taxes) for US multinationals is about 36 per cent. For groups with at least one subsidiary in a low-tax jurisdiction, the ETR is one and a half percentage points lower than the ETR of other MNCs. Foreign taxes on the foreign income of US multinationals are on average 26 per cent, but for groups with tax haven operations the foreign ETR is about 3.2 percentage points lower than the ETR of companies without those low-tax operations. The paper also finds that the federal tax on foreign profits is on average 4.4 per cent with no significant difference between companies with and without tax haven operations. This measures the US federal taxes on repatriated profits. Operations in low-tax jurisdictions do not seem to in-

[11]For more information on Compustat, see Table A.9 in Maffini (2007).

fluence the federal ETR on domestic profits which is 36 per cent at the mean.

The aforementioned studies are descriptive. They do not establish a causal relationship between tax haven operations and the tax burden. The presence in tax havens could be proxying some other characteristics such as the unobserved ability of the tax department to reduce the fiscal burden of the group effectively,[12] or the observable size and profitability of the company over which they do not have controlled. Also, the presence in tax havens could be determined at the same time as the tax burden. In this context, to prove a causal relationship between the fiscal burden of a multinational group and its low-tax subsidiaries, one has to control for the heterogeneity of observable characteristics such as profitability, intangibles intensity, and size and for unobservable characteristics such as the aggressiveness of the tax department. To this aim, a time-varying ownership structure is useful as this allows the researcher to control for the unobservable group-level fixed effects.

Desai et al. (2006b) provide a quantification of the extent to which tax haven operations reduce the tax burden of affiliates of US multinationals. Using group dummies and affiliate dummies, they control for unobserved fixed effects. Unfortunately, they do not control for the endogeneity of the decision to set up operations in an offshore low-tax jurisdiction even if the data con-

[12]In this case, one would attribute a lower tax bill to the presence in tax havens when in fact, the ability of the tax department determines both the tax bill and the decision to locate some operations offshore.

tain a time-varying ownership structure. They employ a panel of unconsolidated confidential accounts of US-owned affiliates for the period from 1982 to 1999. The data are drawn from the affiliate-level confidential data of the US Bureau of Economic Analysis.[13] The authors find that US firms use tax haven operations to reduce their domestic and foreign tax bills. In general, affiliates whose parent company owns operations in offshore regional tax centres reduce their ratio of taxes to sales by about 2 per cent with respect to companies without operations in regional tax havens. More specifically, the authors distinguish operations between small tax havens such as the Cayman Islands and large tax havens such as Ireland and Switzerland. The presence only in regional small tax havens reduces the tax bill by less than the broader ownership of tax havens. At the same time, companies with many low-tax affiliates are more likely to have operations in small tax havens, whilst groups with many subsidiaries located in high-tax countries are more likely to have operations in large tax havens also. The authors argue that these findings are consistent with affiliates in large low-tax countries such as Ireland and Switzerland being used to shift profits away from high-tax locations, and with affiliates in small tax havens being employed to defer US taxation. Desai et al. (2006b) also show that companies with operations in offshore territories (or belonging to a group which owns subsidiaries in tax havens) are larger, more international, and have extensive intra-firm trade and higher R&D intensity.

[13]For more information on the dataset, see Table A.12 in Maffini (2007).

3 Data

This paper investigates the effect of tax haven operations on group tax payments using ORBIS, a database recording balance sheet and profit and loss account items for companies all over the world. The dataset is created by Bureau van Dijk and is based on the mandatory information from filed and publicly available accounts.[14] The online version of ORBIS used here[15] includes only large and very large companies.[16] The unit of observation is a group of companies which file consolidated accounts together and under the name of a parent company, called the global ultimate owner (GUO). The GUO is a company that ultimately owns at least one subsidiary (with at least a share of more than 50 per cent of capital). For the definition used by Bureau van Dijk, at least one of the shareholders of the GUO must be known and this shareholder cannot own more than 50 per cent.

The sample consists of 3,389 industrial corporate groups[17] over five years (2003–2007) for a total of 12,876 observations distributed across 15 OECD countries.[18] The distribution of the observations across years is shown in

[14]For more information on the dataset, see Table A.10 in Maffini (2007).

[15]The version of ORBIS used in this paper has been accessed on 16 October 2008.

[16]Bureau van Dijk defines large and very large companies as those having operating revenue greater than 13 million $US (10 million EUR) or total assets greater than 26 million $US (20 million EUR) or a number of employees greater then 150 headcounts.

[17]This excludes GUOs which are insurance companies, financial companies, banks, hedge funds, private equity firms, venture capital firms, mutual and pension funds, and public authorities. The different sectors represented in the sample are showed in Table 1.

[18]For more details on the sample construction, see Table 2.

Table 3. There are large differences in the number of companies reported for each country (see Table 4). Differences are due to different reporting requirements and different industrial structures. For example, France, the United Kingdom, and the United States have large multinationals, whilst countries such as Spain are characterised by smaller and less internationalised groups. US and UK global ultimate owners represent about 55 per cent and 19 per cent of the sample respectively, together forming a total of almost 75 per cent. More than half of the remaining quarter are German, French, and Swedish groups.[19]

Following Desai et al. (2006b), 38 countries are classified as tax havens and divided between large and small low-tax jurisdictions (see Table 5). Among others, the former group includes two OECD countries (Ireland and Switzerland) and two Asian tigers (Hong Kong and Singapore). Small tax havens include differing jurisdictions ranging from Caribbean islands such as the Bahamas and the Cayman Islands to archipelagos in the Indian Ocean such as Mauritius and the Seychelles, through to European small countries such as Liechtenstein, Luxembourg, and Malta.[20]

[19]The observations are less than 27,120 (see last rows of Table 2) because companies with only one year of data are dropped in a dynamic model with one lagged dependent variable. Also, the use of the instrumental variables and their lags reduces the sample.

[20]Table 5 does not provide an exhaustive list of low-tax jurisdictions. Some tax havens such as the Maldives, the Isle of Man, and the Channel Islands are not included. Table 5 includes only the offshore fiscal centres in which the ultimate owners in the sample own a subsidiary. Interestingly, for US global ultimate owners, the pattern of tax haven operations is similar to the one in Dyreng and Lindsey (2009) who find that US companies locate their low-tax subsidiaries mainly in Singapore, Switzerland, Ireland, Barbados,

In the sample, the most popular low-tax jurisdictions are large countries such as Switzerland, Singapore, Ireland, and Hong Kong reflecting the wider opportunities of their larger and more developed economies (see Table 6). Ultimate owners of all 15 countries are present in the four large low-tax jurisdictions. More specifically, Switzerland has a prominent role among continental European countries. It is the most popular low-tax location for Austrian, German, Danish, Finnish, French, Dutch, and Swedish companies. Ireland is the favourite destination of UK companies whilst Singapore is the prevailing choice for US multinationals, followed by Hong Kong and Ireland. Among small tax havens, the most popular is Luxembourg. It is the first destination for Belgian GUOs whilst remaining important for Spanish, Greek (second destination), French, and Swiss companies (third destination). Bermuda, the Cayman Islands, the British Virgin Islands, and Barbados are also prominent small tax havens. Bermuda, the Cayman Islands, and Barbados are strongly dominated by US companies whilst about one fourth of the subsidiaries in the British Virgin Islands are UK-owned.

The identification strategy of this paper relies on measuring the change in the consolidated tax bill after tax haven operations have been expanded or reduced: groups with more extensive offshore operations are expected to have a lower tax bill. To implement this strategy, the extent of tax haven operations of each group must be identified. This can be done in ORBIS as it pro-

Bermuda, and the Cayman Islands (see Table 6).

vides information on the country of residence of the immediate subsidiaries of the ultimate owner filing the consolidated accounts. Unfortunately, ORBIS contains only time-invariant information on the ownership structure.[21] To create a time-varying variable recording the number of subsidiaries in offshore low-tax centres, the dataset is merged with ZEPHYR.[22] The latter contains M&A deals that occurred between 1999 and 2007. By merging the two datasets, it is possible to create a time-varying ownership structure using ORBIS ownership information as a starting point. In other words, if a company in ORBIS appears in ZEPHYR as an acquirer and (or) as a vendor of a subsidiary located in a tax haven, a time-varying variable recording the number of subsidiaries in offshore centres can be built. For an example of how such a variable as been constructed see Table 8.[23]

Descriptive statistics for the entire sample are shown in Table 9. Ultimate owners are classified as multinationals if they own foreign subsidiaries (with more than 50 per cent of their capital). The rest of the companies are classi-

[21]The information refers to the last available year, mainly 2007.

[22]ZEPHYR is also produced by Bureau Van Dijk. For a summary of the final dataset downloading and construction, see tables 2 and 7. For more information on the dataset, see Table A.11 in Maffini (2007).

[23]The datasets used have some limitations. First, the variable recording the number of tax haven subsidiaries is built starting from the static information recorded in ORBIS. This includes only first-level subsidiaries. If there is relevant information in second and further levels subsidiaries, the estimates might be biased. Second, the time-varying changes in the variable are built using ZEPHYR. The latter only records M&A deals. It does not record whether a new subsidiary has been created. More generally, there might be an underestimation of their presence in tax havens. Despite the drawbacks of the sample used here, this is one of the first cross-country datasets constructed with time-varying information on tax haven operations.

fied as domestic. For descriptive purposes, multinationals are then classified further into two groups: those with at least one subsidiary in tax havens and those without any operations in offshore centres[24] (see Table 10). In the sample, multinationals are evenly split between those with and those without first-level tax haven subsidiaries. Each of the two groups represents about 40 per cent of the total GUOs. Most of the individual countries are characterised by a higher proportion of multinational ultimate owners without offshore first-level subsidiaries, with the exception of Austria, Belgium, France, Germany, the Netherlands, and Switzerland.

Multinationals with operations in tax havens are on average not only the most profitable but also the least likely to run losses (see tables 10 and 11). Additionally, their losses are the smallest on average. These factors explain their higher tax bill (divided by total assets): higher profits lead to higher tax charges, *ceteris paribus*. Ultimate owners with subsidiaries in low-tax jurisdictions are also the largest in terms of number of employees and the number of total subsidiaries, including non-tax havens subsidiaries.

[24]See Table 5 for a classification of tax havens.

4 Empirical Model and Main Empirical Challenges

The purpose of this paper is to assess how tax haven operations impact on the tax bill of a corporate group. Tax payments can be affected by various characteristics of the tax base such as deductions for labour costs and interest payments. Given these characteristics, a group with tax haven operations has the ability to reduce its tax bill to a relatively greater extent than can groups without operations in low-tax jurisdictions. To motivate the empirical analysis illustrated later in this paper, the consolidated profit of a corporate group with operations in a tax haven can be described with a stylised model where a MNC headquartered in country H owns a subsidiary in a low-tax country F and $t^H > t^F$:

$$\begin{aligned} \Pi^* = \pi^A - t^H[\pi^A(1-\xi-s_1) - s_2K - s_3I] + \\ -t^F[s_1\pi^A + s_2K + s_3I] + \\ -\frac{\gamma_1}{2}s_1^2 - \frac{\gamma_2}{2}s_2^2 - \frac{\gamma_3}{2}s_3^2 \end{aligned} \tag{1}$$

π^A is accounting profit which is generated only in the home country H; t^H is the statutory corporate tax rate in the home country and t^F is the statutory corporate tax rate in a foreign country F. ξ represents the proportion of accounting profit which does not form part of the taxable profit; K represents consolidated total assets. The amount of profit shifted to low-tax jurisdictions can either be proportional to accounting profit (s_1) and (or) be

associated with other characteristics of the firm such as size K (s_2) or the amount of intangible assets I (s_3). Two corporate groups with the same profitability may be able to shift different amounts of profits around the world. In particular, larger firms may have more opportunities to relocate earnings in one of their many subsidiaries. The same can be said for intangible assets whose role in profit-shifting activities has been widely recognised in the literature. For US-owned MNCs, Grubert (2003) argues that half of the difference between their profitability in low-tax and high-tax subsidiaries can be explained by transfer of intellectual property. The terms $\frac{\gamma_1}{2}s_1^2$, $\frac{\gamma_2}{2}s_2^2$, and $\frac{\gamma_3}{2}s_3^2$ represent the cost of profit shifting entailed by the resources needed to set up tax avoidance schemes and by the legal expenses arising if such schemes are contested by the tax authorities or by the minority shareholders. Such costs are assumed not to be tax deductible.

Suppose the only decision variables are the amounts of profit shifted from H to F. The firm maximises its overall profit by choosing to shift optimal amounts of profits s_1^*, s_2^*, and s_3^* such that:

$$s_1^* = \frac{(t^H - t^F)\pi^A}{\gamma_1} \tag{2}$$

$$s_2^* = \frac{(t^H - t^F)K}{\gamma_2} \tag{3}$$

$$s_3^* = \frac{(t^H - t^F)I}{\gamma_3} \tag{4}$$

Equations (2), (3), and (4) indicate that the corporate group shifts profits to the low-tax jurisdiction F insofar as $t^H > t^F$.

The data described in Section 3 do not contain information on the flows of profits between the low-tax subsidiaries and the ultimate owner. Only the number of tax havens subsidiaries is available. Given the restrictions placed on this analysis by the data, there are two ways in which the profit-shifting functions s_1, s_2, and s_3 can be modeled. First, profit shifting to tax havens can be represented as a function of a dummy recording whether the corporate group has at least one subsidiary in tax havens.[25] Second, profit shifting can be thought of as a general quadratic function of the number of tax havens subsidiaries such that:

$$s_1 = \delta_1 n + \delta_2 n^2 \tag{5}$$

$$s_2 = \phi_1 n + \phi_2 n^2 \tag{6}$$

$$s_1 = \lambda_1 n + \lambda_2 n^2 \tag{7}$$

To empirically investigate the effects of profit shifting into tax havens on the

[25]Robustness checks on this specification are presented in Section 5 and in Table 13.

tax liabilities, it is useful to represent the group tax bill as

$$\begin{aligned} T = t^H[\pi^A(1-\xi-s_1^*) - s_2^*K - s_3^*I] + \\ +t^F[s_1^*\pi^A + s_2^*K + s_3^*I] \end{aligned} \tag{8}$$

Substituting (5), (6), and (7) in equation (8) and dividing through by K:

$$\begin{aligned} \frac{T}{K} = \phi_1(t^F - t^H)n + \phi_2(t^F - t^H)n^2 + \\ +[t^H(1-\xi)]\frac{\pi^A}{K} + \\ +\delta_1(t^F - t^H)\frac{\pi^A}{K}n + \delta_2(t^F - t^H)\frac{\pi^A}{K}n^2 + \\ +\lambda_1(t^F - t^H)\frac{I}{K}n + \lambda_2(t^F - t^H)\frac{I}{K}n^2 \end{aligned} \tag{9}$$

Equation (9) is estimated as:

$$\begin{aligned} Y_{i,t} = \alpha_0 + \alpha_1 n_{i,t} + \alpha_2 n_{i,t}^2 + \\ +\alpha_3(\frac{\pi^A}{K})_{i,t} + \alpha_4(\frac{\pi^A}{K}n)_{i,t} + \alpha_5(\frac{\pi^A}{K}n^2)_{i,t} + \\ +\alpha_6(\frac{I}{K}n) + \alpha_7(\frac{I}{K}n^2) + f_i + \epsilon_{i,t} \end{aligned} \tag{10}$$

where

$$\begin{aligned} \alpha_1 = \phi_1(t^F - t^H);\ \alpha_2 = \phi_2(t^F - t^H); \\ \alpha_3 = t^H(1-\xi); \\ \alpha_4 = \delta_1(t^F - t^H);\ \alpha_5 = \delta_2(t^F - t^H); \\ \alpha_6 = \lambda_1(t^F - t^H);\ \alpha_7 = \lambda_2(t^F - t^H) \end{aligned} \tag{11}$$

and i indexes a group filing consolidated accounts, and t denotes a year. $Y_{i,t}$

is the tax (**430**)[26] charged to the consolidated P&L account divided by total assets (**412**). The tax variable used here reflects book taxes. There might be discrepancies between the tax charges reported in the financial accounts and the real taxes paid. In particular, in countries with a worldwide system of taxation of corporate profits, tax charges can be reported in the financial accounts because profits will be repatriated and taxes paid on them sometimes in the future. If the tax liabilities charged to the P&L account reflect only accounting adjustments and not real taxes paid, this research would not estimate a real effect but only an accounting effect. This is a problem common to the rest of the literature.[27]

The literature traditionally employs the ETR (that is, tax bill divided by profitability) as the dependent variable (for example, Markle and Shackelford (2009)) where both the numerator and the denominator are positive. The sample used here contains positive and negative values for both the tax bill and profitability. Selecting only profitable companies and companies paying positive taxes might lead to biased results as explained below.[28]

The extent of tax haven operations is represented by n and it is measured

[26]The variables codes in ORBIS are given in parenthesis and in bold.

[27]For more details on the debate about the advantages and disadvantages of using accounting tax charges, see Markle and Shackelford (2009), footnote 14 and references therein.

[28]Using sales instead of profitability as in Desai et al. (2006b) also mitigates the problem. Unfortunately, the variable net sales is scarcely available in the working sample.

by the number of subsidiaries located in the low-tax jurisdictions listed in Table 5. π^A symbolises accounting profitability which is measured as P&L before taxation (**429**); K represents the capital stock and it is measured by the book value of total assets (**412**). I represents intangibles measured by the book value of intangible fixed assets (**405**); f_i is an unobserved time-invariant group-specific effect; and $\varepsilon_{i,t}$ is an idiosyncratic shock likely to be correlated with the right-hand side variables.

This model allows the group tax payments to change when the extent of operations in tax havens changes. The coefficient α_1 captures the effect of tax haven operations independently of profitability (direct effect); α_1 is expected to be negative. α_2 captures any non-linear relationship between tax haven operations and the corresponding conditional expectation of $Y_{i,t}$. In this model, it is possible to estimate the extent to which the group ETR drops when more offshore operations become available within a corporate group. In equation (10), α_3 measures the marginal ETR[29] for a group without tax haven operations. α_4 and α_5 measure the additional effect on the marginal ETR for a group which switches from zero to one subsidiary in tax havens; α_4 is expected to be negative, as the marginal ETR should decline when tax haven operations are available; α_5 captures the non-linear effects of tax haven operations on the marginal ETR.

[29]In fact, $\alpha_3 = \frac{\partial(\frac{tax\ bill}{tot.\ assets})}{\partial(\frac{P\&L}{tot.assets})} = \frac{\partial(tax\ bill)}{\partial(P\&L)}$ for a group without tax haven operations. A similar approach is used in Dyreng and Lindsey (2009).

For companies with tax haven operations, the marginal ETR is given by $(\alpha_3 + \alpha_4 n + \alpha_5 n^2)$. Thus, as shown in (11), the marginal ETR depends on the corporate statutory tax rates t^F of the countries where profits have been shifted. Empirically, the marginal ETR will be determined not only by the corporate statutory tax rates of tax havens but also by the statutory tax rates of other countries where real profits are located or where profits have been shifted. The data used here do not contain information on the location of all subsidiaries of a corporate group. This implies there is no information on all the relevant foreign corporate tax rates. When comparing marginal ETR across different companies, it is therefore not possible to control for the different foreign tax rates relevant for calculating the overall group tax burden.

Intangible assets such as patents are often used to transfer profits from high- to low-tax jurisdictions: they can be moved easily and arm's length prices are difficult to establish for them. Since a higher concentration of intangibles creates more opportunities for transfer-pricing, α_6 is expected to be negative. α_7, like α_5 captures non-linear effects of low-tax operations.

In the setting analysed here, there are three econometric issues that need to be addressed. The first one is related to the possible endogeneity of tax haven operations. The choice of setting up operations in low-tax jurisdictions

might be determined by the profit and hence by the tax bill itself. Table 11 shows that groups without tax haven operations are more likely to report losses, and their losses are larger than those of groups present in tax havens. Unprofitable companies have less profits to shift and therefore they will gain less from tax haven operations, as they are already able to reduce their tax bill through the loss carryforward provisions. This result is important. It shows that the selection of only profitable companies can bias the estimations towards finding a negative effect of tax haven subsidiaries on tax liabilities as profitable firms have a greater incentive to locate part of their operations in offshore low-tax jurisdictions. Two key implications can be drawn from Table 11. First, unprofitable entities and unprofitable years have to be included in the sample. Second, the presence in tax havens is likely to be determined endogenously by previous tax positions. This is connected with the second econometric issue. This second issue stems from the likely presence of unobservable group fixed effects and unobservable time-variant shocks which simultaneously affect the tax bill and the decision to locate activities in tax havens. The third issue concerns regressors other than the number of tax haven subsidiaries. Important determinants of the tax bill such as profitability and intangibles intensity could be determined simultaneously with the tax bill. This paper tackles the first issue by including unprofitable entities and years in which a group reports an aggregate loss. It deals with the last two issues by first constructing a time-variant indicator for tax haven operations and then by using the difference generalised method of moments (GMM-diff)

estimator described in Arellano and Bond (1991).

5 Main results

Table 12 presents results for the basic specification of equation (10) where the dependent variable is the ratio of consolidated tax charges to the consolidated book value of total assets. Presence in low-tax jurisdictions is measured by the number of first-level subsidiaries in tax havens. All specifications include a lagged dependent variable which controls for slow adjustments in the tax bill. Tax liabilities might depend on previous tax payments for many reasons. For example, a company might arise the suspicion of tax authorities if it shifts an amount of ernings that is too high with respect to previous years. All specifications also include country-year dummies which control for factors in the country of the GUO likely to affect tax liabilities. Examples of such factors are the statutory corporate income tax rate, the extent of deductions from the tax base, the effectiveness of the anti-avoidance legislation, the effectiveness of tax authorities in detecting tax avoidance and tax evasion, and the economic cycle.

Column 1 of Table 12 shows the results from a pooled OLS regression. In this context, the estimator does not control for group-specific effects, nor does it deal with the likely correlation of the regressors with the error term. The

within-group estimator in column 2 controls for group fixed effects, but it does not deal with the bias arising from the correlation between the regressors and the error term. Blundell et al. (2000) showed that the pooled OLS estimator of the coefficient of the lagged dependent variable is upward-biased, whilst the within-group estimator is downward-biased. Hence, columns 1 and 2 are useful for setting an upper and a lower bound to the estimates of the lagged dependent variable shown in columns 3 to 5 and obtained using a GMM-diff estimator.

As explained above, the GMM-diff controls for unobservable group fixed effects, and at the same time it deals with the likely correlation of unobservable shocks with the first-difference of the lagged dependent variable and of other regressors. The set of instruments used in the GMM-diff of columns 3 to 5 includes the first and second lag of the previous two periods' average tax bill divided by total assets.[30] The average tax bill in the two previous periods is likely to be a good predictor of whether the company decides to expand its tax haven operations or not. A group with a low-tax bill will be less willing to incur the costs of expanding its operations in low-tax jurisdictions, *ceteris paribus*. As standard in Arellano and Bond (1991), other instruments employed are the second and further lags of the number of subsidiaries in tax

[30]The average value of the tax bill divided by total assets for the previous two periods is calculated as follows: $\frac{(\frac{tax\ bill_{t-1}}{tot.assets_{t-1}})+(\frac{tax\ bill_{t-2}}{tot.assets_{t-2}})}{2}$. The instruments used are therefore $\frac{(\frac{tax\ bill_{t-2}}{tot.assets_{t-2}})+(\frac{tax\ bill_{t-3}}{tot.assets_{t-3}})}{2}$ and $\frac{(\frac{tax\ bill_{t-3}}{tot.assets_{t-3}})+(\frac{tax\ bill_{t-4}}{tot.assets_{t-4}})}{2}$.

havens, of profitability, intangible intensity, size, and of their interactions with the number of subsidiaries in tax havens. Country-year dummies are also included in the instrument set. Instruments are collapsed as described in Roodman (2009) to contain their proliferation. In the specifications of columns 3 to 5, the test for over-identification and the tests for first and second order serial correlation are satisfactory. The null hypothesis of first order serial correlation is rejected and the null hypothesis of second order serial correlation is not rejected. Under the Sargan-Hansen test, the joint null hypothesis that the instruments are uncorrelated with the error term, and that they are correctly excluded from the estimated equation is not rejected.

The estimates of Table 12 are consistent with the model presented in Section 4. In columns 3 to 5, the estimated coefficient of the lagged dependent variable lies between the pooled OLS value of column 1 and its within-group equivalent displayed in column 2. More specifically, the estimated coefficient of the lagged dependent variable varies between 0.068 and 0.071.
Column 3 reports results for the model displayed in equation (10). The direct effect of the number of tax haven subsidiaries on the tax bill over total assets is not significant; it remains so across all specifications in Table 12. The marginal ETR estimated by the coefficient of profitability α_3 is highly statistically significant. It remains so across all specifications in Table 12. Its magnitude is estimated to be around 34 per cent. This means that for companies without tax haven operations, a one US dollar increase in the

consolidated accounting profit leads to about a 34 cents increase in the consolidated tax liabilities. As expected, the coefficient on the interaction term between profitability and the number of tax haven subsidiaries α_4 is negative but not significant.

As discussed in Section 4, it is important to control for losses, as companies with negative earnings might have less incentive to expand in tax havens. The coefficient of the dummy indicating an aggregate loss is positive and significant. This might seem counter-intuitive. However it is possible that an ultimate owner has a positive tax bill even when it reports losses in the consolidated accounts. In fact some of its subsidiaries might be profitable and therefore might be paying taxes, even if total group losses are larger than the profits of those subsidiaries. The presence of a consolidated loss interacted with tax haven subsidiaries reduces the tax bill, as shown by the negative and statistically significant coefficient on the interaction between the dummy for losses and the number of subsidiaries in tax havens.

It is known that larger firms tend to have more intangibles. It is therefore useful to control for both intangibles and size[31] in the same regression, as shown in column 4. The coefficient of intangible intensity is not statistically significant at conventional levels. However, the coefficient of the interaction between intangible intensity and the number of subsidiaries in tax havens

[31]Size is measured by the logarithm of the number of employees (**425**).

is negative and significant. This indicates that intangibles *per se* might not influence the tax bill, but it is their role in conjunction with tax havens that really reduces tax charges. The effect of size on the tax bill seems more complex to analyse. The significant and positive coefficient of the interaction between the logarithm of employment and the presence in tax havens points to a slightly higher tax over total assets for larger entities with operations in tax havens.

Column 4 of Table 12 shows that the marginal ETR is around 33 per cent and highly significant across different specifications. It also indicates that there is a negative and statistically significant effect of low-tax operations on the marginal ETR as α_4 is negative and statistically significant. The coefficient α_5 is instead not significant. Considering a corporate group with two tax haven subsidiaries,[32] the coefficient estimates imply that its marginal ETR will be 0.4 percentage points lower than the marginal ETR of companies without tax haven subsidiaries, *ceteris paribus*. Considering the mean number of subsidiaries in tax havens for the group of companies with at least one offshore subsidiary (five), the marginal ETR will be about one percentage points lower (that is, at about 32 per cent) than the marginal ETR of companies without tax haven operations. As explained above, the coefficient of the dummy recording whether the corporate group reports a consolidated loss is

[32]The sample mean value of the variable number of subsidiaries in tax havens is 2. For more details see Table 9.

positive and statistically significant. This positive effect is however reduced by the use of tax haven operations as indicated by the negative and statistically significant value of the coefficient on the interaction term between the indicator for losses and the number of subsidiaries in tax havens. This provides evidence that the combined presence of aggregate losses and operations in low-tax jurisdictions reduces the tax burden of the corporate group.

The specification in column 5 controls for the size of losses. The coefficient of the value of losses is not significant. The same can be said for the coefficients of the interaction between the value of losses and the number of tax haven subsidiaries and its squared value. The other coefficients confirm the results in column 4. α_4 is negative and statistically significant pointing to a reduction of the marginal ETR through tax haven operations. Low-tax offshore operations also reduce the tax liabilities through the use of intangibles (see the negative and significant coefficient of the interaction between tax haven subsidiaries and intangible assets) and losses. The number of operations in tax havens do not seem to have a non-linear relationship with the tax bill and with the marginal ETR. The coefficient of the variables interacted with the squared value of the number of tax haven subsidiaries is never significant, except than in the case of size proxied by the logarithm of the number of employees.

In a polynomial model with interaction terms, coefficients are not directly

interpretable as the effect of their associated covariates depends on the value of the covariate itself and on the value of the other regressors. To quantify the overall effect of an additional tax haven subsidiary, it is useful to write:

$$\begin{aligned}\frac{\partial y}{\partial n} = \alpha_1 + 2\alpha_2 n + \alpha_4 \frac{\pi^A}{K} + 2\alpha_5 \frac{\pi^A}{K} n + \\ + \alpha_6 \frac{I}{K} + 2\alpha_7 \frac{I}{K} n + \\ + \alpha_8 d_{loss} + 2\alpha_9 d_{loss} n + \\ + \alpha_{10} log(employees) + 2\alpha_{11} log(employees) n\end{aligned} \tag{12}$$

It is possible to calculate the value of equation (12) for each observation of the sample by multiplying the value of the estimated coefficients by the relevant variables. In this way, it is possible to obtain a sample mean value for the derivative in equation (12). The sample mean value for the derivative is -0.0013, which applied to the sample mean value of the dependent variable (0.019) indicates that an additional tax haven subsidiary reduces the tax liabilities over total assets by about 7 per cent. The long-run effect is very similar, at about 7.4 per cent.[33]

Table 13 introduces a slightly different model by employing dummy indicators for tax haven activity. Each specification of Table 13 includes a dummy *d1* which records whether the corporate group owns at least one low-tax

[33]The calculations of the long-run effect are as follows: $\frac{-0.0013}{(1-0.0703)} = -0.0014$ and $\frac{-0.0014}{0.019} = -0.074$

offshore subsidiary. To capture additional effects of a large number of tax haven subsidiaries, dummies registering whether the group has two or more, three or more, four or more, and 30 or more[34] offshore subsidiaries are employed in columns 1, 2, 3, and 4, respectively. Dummies vary very little in the sample. Table 14 shows that only a few companies switch from owning zero to owning some tax haven subsidiaries. The variation is even smaller for the dummies recording whether the corporate group has more than 2, 3, 4, or 30 low-tax offshore subsidiaries. With so little variation the dummies are unlikely to pick up the effects being studied here. Contrary to the number of subsidiaries in Table 12, in columns 1 to 3 of Table 13 the dummy *d1* identifies a negative and statistically significant direct effect on total tax liabilities divided by total assets. Column 4 instead identifies only the effect of tax havens on the marginal ETR. The estimated coefficient of the dummies recording more than two, three, four, or 30 tax haven subsidiaries are never statistically significant. The same can be said for the estimated coefficients of the variables interacted with those dummies. This is probably a consequence of the little within-group variation of the dummies. Most of the ultimate owners enter and exit the sample with either some or no tax haven subsidiaries whilst many groups frequently vary the number of offshore operations. Therefore, dummies may not be able to pick up adequately the effect this paper attempts to analyse. The number of subsidiaries in tax havens employed in Table 12 seems therefore a more suitable measure for corporate

[34]The top percentile for the variable 'number of subsidiaries in tax havens' is 30.

groups' activity in low-tax jurisdictions.

The findings of the model measuring offshore activities with the number of subsidiaries in tax havens are robust to various changes in the sample, as shown in Table 15. For ease of comparison, column 1 of Table 15 reports the preferred specification initially introduced in column 4 of Table 12. About 3 per cent of the ultimate owners in the sample are resident in Ireland or Switzerland, two countries considered as tax havens for the purpose of this research. Groups headquartered in low-tax jurisdictions may profit less from tax haven operations, as they already enjoy mild taxation in the home country. The results of the preferred specification are robust to the exclusion of GUOs located in Ireland or Switzerland, as displayed in column 2 of Table 15. Column 3 shows that when excluding companies classified as domestic entities at least once between 2003 and 2007, the results remain very close in magnitude to those of column 1. As for corporations headquartered in low-tax jurisdictions, companies reporting losses are likely to profit less from tax haven operations. However, results are also robust to the exclusion of companies always reporting aggregate losses between 2003 and 2007, as shown in column 4. The same can be said of a set of companies with a total number of tax haven subsidiaries smaller than 30 (column 5 of Table 15).[35]

All countries in the sample exempt foreign profits with the exception of Ire-

[35]The top percentile for the variable 'number of subsidiaries in tax havens' is 30.

land, the United Kingdom, and the United States. The United Kingdom shifted to a territorial system in 2009 and the new rules will apply from the fiscal year 2009–2010. The change in the taxation of foreign profits has spurred a debate on whether the new system will be more vulnerable to tax avoidance. In a territorial system, there is an incentive for a corporate group to both locate the real activities and shift profits to low-tax jurisdictions as foreign profits from low-tax jurisdictions bear no taxation at home even if they are repatriated. In a worldwide taxation system, foreign profits enjoy mild or zero taxation only insofar as they are not repatriated. In theory, tax haven operations are more effective in reducing the overall tax burden for multinationals headquartered in countries with a territorial system, although this does not hold in practice if multinationals rarely repatriate their profits to a home jurisdiction with a worldwide system. The question becomes an empirical one. Table 16 investigates this issue in two ways. First, it investigates whether tax haven operations are more effective at reducing the tax burden of corporate groups headquartered in exemption countries, rather than of groups resident in jurisdictions with a worldwide taxation system. Second, it evaluates whether the marginal ETR of the former set of countries is statistically different from the marginal ETR of the latter group, at conventional significance levels.

The specification in column 1 of Table 16 is obtained by interacting the variables of the preferred specification (column 4 of Table 12) with a dummy dCR

which takes the value one when the GUO is resident in a jurisdiction which applies a worldwide system for the taxation of corporate profits. Some interacted variables are then dropped if their estimated coefficient is not statistically significant at conventional levels in all specifications presented in Table 16. This should reduce multicollinearity problems and shrink the number of instruments. For all companies, the specification is able to identify both a negative and statistically significant direct effect of tax haven operations on the tax bill (α_1) and a negative statistically significant effect of low-tax activities on the marginal ETR (α_4). In column 1 the effect of offshore operations on tax liabilities does not differ statistically between territorial and worldwide systems of corporate income taxation. None of the coefficients of the variables recording the number of tax haven subsidiaries interacted with the credit dummy *dCR* is significant, except for those interacted with the dummy recording an aggregate loss.

Column 2 excludes companies classified at least once as domestic. When only MNCs are considered, the effect of tax haven subsidiaries on the marginal ETR is larger for companies headquartered in countries with an exemption system than for companies headquartered in a credit country. The effect for the former group of companies is given by the coefficient of the variable interacting profitability with the number of tax haven subsidiaries (0.8 percentage points). The effect for the latter set of firms is 0.1 percentage points (0.008 - 0.007). The differential effect of tax haven operations between territorial and credit countries is also robust to the specifications of the last two columns of

Table 16. Column 4 excludes GUOs headquartered in Ireland and Switzerland whilst column 5 drops GUOs reporting only losses between 2003 and 2007. The direct effect of low-tax offshore operations on the tax bill (α_1) and the effect on the marginal ETR (α_4) are robust to the specifications of columns 3 to 6.

A crucial result for the comparison of territorial and worldwide systems of taxation is that the marginal ETR is substantially lower for corporate groups headquartered in jurisdictions which exempt foreign profits. Depending on the sample considered, the group marginal ETR of companies with a GUO resident in an exemption country is between 13 and 14 percentage points lower than the marginal ETR of groups headquartered in credit countries. This is shown by the coefficient of the profitability variable multiplied by the dummy for credit countries. The difference is statistically significant at 1 per cent. Corporate groups headquartered in countries which exempt foreign profits may be able to reduce their overall tax liabilities by locating their real activities and by shifting profits into jurisdictions that can guarantee a lower fiscal burden without being tax havens. The difference between the marginal ETR of the two groups cannot be entirely attributed to the different ways in which the territorial and the worldwide systems tax foreign profits and therefore to the amount of tax avoidance activity in the two systems. The marginal ETR of each company is influenced by many characteristics of the tax system of each country where the corporate group has some oper-

ations. These characteristics include the statutory corporate tax rates and the deductions allowed on the tax base. Also, for credit countries, the taxes reported in the P&L accounts could be higher than those really paid. In fact, taxes could be reported in the financial accounts in anticipation of profits repatriation in future accounting periods. Because of constraints in the data, this study is unable to control for these characteristics.

Columns 5 and 6 investigate the difference in marginal ETRs further. By interacting country dummies with the profitability for the three credit countries (Ireland, the United Kingdom, and the United States), the last two columns of Table 16 explain in more details the determinants of such difference. The corporate groups headquartered in the United States are characterised by the highest marginal ETR which is between 13 and 15 percentage points higher than the mean marginal ETR of groups headquartered in exemption countries. Companies headquartered in the United Kingdom have a marginal ETR of about 29 per cent, 7.7 percentage points higher than companies headquartered in exemption countries. The difference in marginal ETRs between US- and UK-owned groups might reflect a tougher stance taken by the United States on profit shifting for example through the implementation of passive income rules and interest allocation rules. Irish companies display an overall marginal ETR lower than that of groups headquartered in exemption countries. This is expected as Ireland has the lowest corporate tax rate among OECD countries (12.5 per cent). These results do not describe the

tax revenues of an individual country or of a group of countries. They instead describe the overall tax burden of corporate groups headquartered in a specific jurisdiction or in a specific set of jurisdictions. They are consistent with the idea that the territorial system is more flexible in allowing corporations to minimise their tax burden by choosing where to locate real activities and profits.

6 Conclusions

This paper investigates the effect of tax haven operations on tax liabilities of multinational groups headquartered in 15 OECD countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, the Netherlands, Norway, Spain, Sweden, Switzerland, the United Kingdom, and the United States. Using consolidated accounting data from ORBIS (2003–2007) and ownership changes constructed by merging ZEPHYR with ORBIS, this paper finds that, at the mean, an additional tax haven subsidiary reduces tax liabilities over total assets by about 7 per cent in the short run and 7.4 per cent in the long run. More specifically, at the mean, the marginal ETR of a corporate group with tax haven subsidiaries is about one percentage point lower than groups without low-tax offshore operations. The results are likely to underestimate the effect of offshore low-tax operations on the tax bill, as the number of subsidiaries in tax havens may not pick up the entire extent

of profit shifting into low-tax jurisdictions.

This paper also investigates whether a territorial system for the taxation of corporate profits entails a lower consolidated tax burden than a worldwide taxation system. The results show some evidence consistent with tax haven operations reducing tax liabilities more in territorial systems. Multinational companies headquartered in exemption countries reduce their marginal ETR more from low-tax offshore operations than do corporate groups headquartered in a credit country. The results also indicate that the marginal ETR of the first set of companies is lower than the marginal ETR of corporate groups headquartered in jurisdictions which do not exempt foreign profits. More specifically, companies headquartered in the United States are characterised by the highest marginal ETR. Cross-country variations in statutory corporate tax rates, in the way the tax base is calculated, and in the way future tax liabilities are recorded into the accounts can only partially explain such a divergence.

The results on the marginal ETRs presented in this paper do not describe the tax revenues of countries with a territorial or a worldwide system. They instead describe the overall tax burden of corporate groups headquartered in countries with either one or the other system of taxation of corporate profits. The findings are consistent with the territorial system being more flexible in allowing corporations to minimise their tax burden by choosing where to

locate real activities and profits.

[Table 1 about here.]

[Table 2 about here.]

[Table 3 about here.]

[Table 4 about here.]

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List of Tables

Table 1: Corporate Groups by Sector

Sector	No. of corporate groups	Per cent
Mining and quarrying	110	3.25
Manufacturing of food products and beverages	92	2.71
Manufacturing of tobacco products	5	0.15
Manufacturing of textiles	22	0.65
Manufacturing of wearing apparel	28	0.83
Manufacturing of leather products	11	0.32
Manufacturing of wood	10	0.30
Manufacturing of paper	36	1.06
Publishing and printing	54	1.59
Manufacturing of coke, petroleum, and nuclear fuel	14	0.41
Manufacturing of chemicals	220	6.49
Manufacturing of rubber and plastic products	46	1.36
Manufacturing of other non-metallic products	31	0.91
Manufacturing of basic metals	51	1.50
Manufacturing of fabricated metal prods	46	1.36
v machinery and equipment	172	5.08
Manufacturing of office machinery and computers	65	1.92
Manufacturing of electrical machinery	61	1.80
Manufacturing of radio, TVs, and communication equipment	280	8.26
Manufacturing of medical, precision, and optical instruments	192	5.67
Manufacturing of transport equipment	99	2.92
Manufacturing of various	68	2.01
Electricity, gas and water supply	83	2.45
Construction	76	2.24
Wholesale and retail trade	307	9.06
Hotels and restaurants	73	2.15
Transport	97	2.86
Post and telecommunication	130	3.84
Financial intermediation	102	3.01
Real estate activities	43	1.27
Renting of machinery and equipment	22	0.65
Computer and related activities	348	10.27
Research and development	35	1.03
Other business activities	244	7.20
Recreational, cultural, and sport activities	116	3.42
Total	3,389	100.00

[(i)] Sectors correspond to the two-digit NACE codes (Rev. 1.1).

Table 2: Construction of the Dataset used in the Empirical Analysis

	No. of companies	No. observations
ORBIS (online version 16/10/2008)		
Selecting on large and very large companies	1,093,428	
Exclude companies with no financial information	739,989	
Region: Western Europe (26), Canada, and the United States	427,331	
Industrial companies only	401,944	
Number of employees available non missing	293,906	
Only Global Ultimate Owners	26,193	
Active companies only	25,201	
Firms with consolidated accounts only	17,876	
Total assets available for last year	17,863	
Companies with majority owned subsidiaries[(i)]	17,816	
Real download from online version[(ii)]	15,207	136,863
Drop if accounting period different from 12 months	15,207	134,360
Drop if total assets negative or zero	15,207	134,257
Drop non-suitable sectors	14,592	128,833
Drop countries with less than 300 observations	14,555	128,503
Drop if incorporation year is missing	13,918	122,842
Drop outliers[(iii)]	13,710	117,495
Drop if total assets, P&L before tax, or tax bill missing	13,089	76,445
Drop if information on ownership structure missing	12,959	75,930
MERGE WITH ZEPHYR ACQUIRERS	12,959	75,930
- of which present in ZEPHYR (acquirers)	*295*	*348*
MERGE WITH ZEPHYR VENDORS	12,959	75,930
- of which present in ZEPHYR (vendors)	*190*	*271*
- of which present in ZEPHYR (acquirers and (or) vendors)	*437*	*606*
Drop if number of subs in tax havens is negative	12,908	75,532
- of which present in ZEPHYR (acquirers and (or) vendors) also	*386*	*541*
Drop if number of employees missing	5,161	35,288
Drop if (intangibles/total assets) missing	4,618	28,882
Drop if (debt/total assets) missing	4,618	28,882
- of which present in ZEPHYR (acquirers and (or) vendors) also	*335*	*471*
Drop if observations not contiguous in the time for same company	4,618	27,120
- of which present in ZEPHYR (acquirers and (or) vendors) also	*323*	*452*

[(i)] Subsidiaries are of the following type: industrial, insurance, banks, or financial institutions.
[(ii)] The number of companies obtainable through the real download is slightly smaller than the number of companies potentially available from the online version of ORBIS. This happens because the some observations are dropped during the download as they miss all the variables, including the company name and identification number. [(iii)] Outliers are defined as the observations with a value of $\frac{P\&L\ before\ taxation}{total\ assets}$, $\frac{Tax\ bill}{P\&L\ before\ taxation}$, $\frac{Fixed\ assets}{no.\ employees}$, or age within the top or bottom 1 per cent. The observations dropped are 4.35 per cent of the sample.

Table 3: Distribution of Observations Across Years

Year	Frequency	Percent
2003	2,115	16.43
2004	2,387	18.54
2005	2,610	20.27
2006	2,813	21.85
2007	2,951	22.92
Total	12,876	100.00

Table 4: Country Distribution by Type of Group

	MNCs with TH subs	MNCs without TH subs	Domestic groups	Total (%)
Austria	15 [63]	9 [37]	0	24 (0.71)
Belgium	15 [68]	6 [27]	1 [5]	22 (0.65)
Denmark	15 [44]	18 [53]	1 [3]	34 (1.00)
Finland	21 [34]	36 [59]	4 [7]	61 (1.80)
France	112 [56]	68 [34]	20 [10]	200 (5.89)
Germany	105 [50]	83 [40]	22 [10]	210 (6.18)
Greece	8 [32]	16 [64]	1 [4]	25 (0.74)
Ireland	9 [29]	20 [65]	2 [6]	31 (0.91)
Netherlands	34 [69]	12 [24]	3 [6]	49 (1.44)
Norway	10 [26]	28 [72]	1 [3]	39 (1.15)
Spain	20 [44]	24 [53]	1 [2]	45 (1.33)
Sweden	36 [42]	45 [53]	4 [5]	85 (2.51)
Switzerland	42 [70]	16 [27]	2 [3]	60 (1.77)
United Kingdom	242 [38]	255 [40]	142 [22]	639 (18.86)
United States	635 [34]	710 [38]	520 [28]	1,865 (55.03)
Total	1,319 (38.92)	1,346 (39.72)	724 (21.36)	3,389 (100)

(i) Figures indicate the number of ultimate owners. (ii) In parenthesis, percentage of ultimate owners over the total sample. (iii) In brackets, percentage over the total number of ultimate owners within a single country.

Table 5: Classification of Tax Havens in the Sample

Small tax havens	Large tax havens
Andorra (AD)	Hong Kong (HK)
Anguilla (AI)	Ireland (IE)
Antigua and Barbuda (AG)	Lebanon (LB)
Aruba (AW)	Liberia (LR)
Bahamas (BS)	Panama (PA)
Bahrain (BH)	Singapore (SG)
Barbados (BB)	Switzerland (CH)
Belize (BZ)	
Bermuda (BM)	
Cayman Islands (KY)	
Cyprus (CY)	
Dominica (DM)	
Gibraltar (GI)	
Grenada (GD)	
Iceland (IS)	
Jordan (JO)	
Liechtenstein (LI)	
Luxembourg (LU)	
Macau (MO)	
Mauritius (MU)	
Malta (MT)	
Marshall Islands (MH)	
Monaco (MC)	
Netherlands Antilles (AN)	
Saint Kitts and Nevis (KN)	
Saint Lucia (LC)	
Saint Vincent and the Grenadines (VC)	
Samoa (WS)	
Seychelles (SC)	
Vanuatu (VU)	
Virgin Islands (British) (VG)	

(i) Table 5 does not provide an exhaustive list of low-tax jurisdictions. Some tax havens such as the Maldives, the Isle of Man, and the Channel Islands are not included. Table 5 includes only the offshore fiscal centres in which the ultimate owners in the working sample own a subsidiary.

Table 6: Subsidiaries in Each Tax Haven, by Country of GUO

	Country of Ultimate Owners															
Tax havens	AT	BE	CH	DE	DK	ES	FI	FR	GR	IE	NL	NO	SE	UK	US	Total
AD						2 (67)		1 (33)								3 [0.10]
AG				1 (33)										1 (33)	1 (33)	3 [0.13]
AI														2 (100)		2 [0.07]
AN		2 (5)	5 (11)	1 (2)				2 (5)			6 (14)		1 (2)	2 (5)	25 (57)	44 [1.56]
AW				1 (17)							2 (33)			1 (17)	2 (33)	6 [0.20]
BB			1 (1)	1 (1)				1 (1)			2 (3)			5 (6)	68 (87)	78 [2.69]
BH			1 (6)	2 (12)		1 (6)		2 (12)						6 (35)	5 (29)	17 [0.63]
BM			7 (4)	1 (0.6)				3 (2)		1 (0.6)	2 (1)	1 (0.6)	2 (1)	15 (9)	128 (80)	160 [5.64]
BS			1 (3)	1 (3)				2 (6)			3 (9)		1 (3)	3 (9)	22 (67)	33 [1.19]
BZ															1 (100)	1 [0.07]
CH	11 (2)	3 (0.5)	58 (11)	79 (15)	11 (2)	3 (0.5)	11 (2)	57 (11)	1 (0.2)	1 (0.2)	17 (3)	1 (0.2)	20 (4)	56 (10)	211 (39)	540 [12.74]
CY	3 (5)	1 (2)	4 (7)	1 (2)				4 (7)	8 (13)	2 (3)	3 (5)	1 (2)		7 (12)	26 (43)	60 [2.36]
DM			1 (33)					2 (67)								3 [0.10]
GD															1 (100)	1 [0.03]
GI	1 (4)		1 (4)										1 (4)	4 (17)	16 (70)	23 [0.83]
HK	1 (0.2)	3 (1)	21 (6)	21 (6)	4 (1)	1 (0.2)	5 (1)	31 (8)	1 (0.2)	1 (0.2)	2 (0.5)	1 (0.2)	9 (2)	69 (19)	198 (54)	368 [13.47]
IE	1 (0.2)	4 (1)	10 (2)	13 (3)	1 (0.2)	7 (2)	5 (1)	21 (5)	1 (0.2)	28 (7)	15 (4)	1 (0.2)	11 (3)	113 (27)	181 (44)	412 [15.13]
IS				1 (9)	2 (18)			2 (18)					1 (9)		5 (45)	11 [0.36]
JO	1 (6)		3 (19)	2 (12)				2 (12)						3 (19)	5 (31)	16 [0.53]
KN															1 (100)	1 [0.03]
KY			1 (1)	5 (3)			1 (1)	1 (1)	1 (1)		5 (3)		1 (1)	17 (11)	117 (79)	149 [1.76]
LB			3 (15)	1 (5)		1 (5)		8 (45)							6 (30)	20 [0.76]
LC				2 (33)										2 (33)	2 (33)	6 [0.20]
LI	1 (6)		4 (25)	2 (12)				1 (6)			1 (6)			3 (19)	4 (25)	16 [0.56]
LR				1 (9)										1 (9)	9 (81)	11 [0.50]
LU	1 (0.3)	9 (3)	11 (4)	19 (7)	1 (0.3)	6 (2)	3 (1)	38 (15)	2 (0.8)	1 (0.3)	8 (3)		7 (3)	47 (18)	108 (41)	261 [9.59]
MC						1 (10)		5 (50)						2 (20)	2 (20)	10 [0.40]
MH														1 (20)	4 (80)	5 [0.23]
MO				1 (10)	1 (10)									2 (20)	6 (60)	10 [0.33]
MT	3 (10)		2 (6)	8 (28)				2 (7)	1 (3)		1 (3)			7 (24)	5 (17)	29 [1.19]
MU	1 (1)		3 (4)	4 (5)	1 (1)			10 (13)						3 (4)	54 (71)	76 [2.75]
PA			7 (11)	4 (7)		4 (7)		5 (8)			3 (5)		1 (2)	6 (10)	31 (51)	61 [2.32]
SC					1 (33)			1 (33)							1 (33)	3 [0.13]
SG	2 (0.4)	3 (0.6)	27 (5)	31 (6)	6 (1)	1 (0.2)	4 (1)	46 (9)	1 (0.2)	2 (0.4)	12 (2)	6 (1)	10 (2)	69 (14)	276 (56)	496 [17.55]
VC					1 (50)									1 (50)		2 [0.07]
VG	1 (1)		2 (2)	1 (1)		1 (1)	2 (2)	1 (1)	1 (1)	2 (2)	2 (2)	1 (1)	1 (1)	19 (23)	48 (59)	82 [3.52]
VU															4 (100)	4 [0.13]
WS														1 (50)	1 (50)	2 [0.10]
Total	27 (1)	25 (1)	173 (6)	204 (7)	29 (1)	28 (1)	31 (1)	248 (8)	17 (0.5)	38 (1.2)	84 (3)	12 (0.4)	66 (2)	468 (15)	1,577 (52)	3,026 [100]

(i) Figures are taken from the 2007 ORBIS static ownership structure. (ii) In parentheses per cent of country of ultimate owner (columns) for each specific tax haven (rows). (iii) In brackets per cent of subsidiaries in each tax haven over total number of tax haven subsidiaries.

Table 7: Download of ZEPHYR

ZEPHYR ACQUIRERS (online version 06/01/2009)	No. firms (acquirers)	No. obs	No. deals
Acquirer located in OECD country			379,323
Target located in tax haven			11,348
Deal type: merger or acquisition			6,634
Deal completed from 1999 onwards			4,295
Real download[i]	3,963	4,762	4,256
Drop if acquirer's ID missing	2,405	3,204	3,142
Drop if country of target missing	2,362	3,143	3,138
Keep if final stake is majority	1,792	2,248	2,244
Drop if year of deal 2008 or missing	1,579	1,957	1,957
Drop if acquirer's country not relevant	1,523	1,886	1,957
Drop if country of target not tax haven	1,491	1,841	1,886
Create a panel with only one observation for each year and each company	1,491	1,701	
ZEPHYR VENDORS (online version 06/01/2009)	**No. firms (vendors)**	**No. obs**	**No. deals**
Vendor located in OECD country			140,425
Target located in tax haven			5,166
Deal completed from 1999 onwards			3,252
Real download[i]	3,224	4,097	3,223
Drop if aquirer's ID missing	1,528	2,401	2,086
Drop if country of target missing	1,392	2,189	2,084
Drop if year of deal 2008 or missing	1,257	1,822	1,822
Drop if country of target not tax haven	1,220	1,773	1,773
Create a panel with only one observation for each year and each company	1,220	1,528	

(i) The number of deals obtainable through the real download is slightly smaller than the number of deals potentially available from the online version of ZEPHYR. This happens because some observations are dropped during the download as they miss all the variables, including the company name and identification number.

Table 8: Construction of 'Number of Tax Havens Subsidiaries' –Example

Year	Static ownership structure from ORBIS											ZEPHYR (vendors)				ZEPHYR (acquirers)	No. subsidiaries in tax havens
	BB	BM	CH	HK	IE	KY	LC	LU	MO	PA	VC	BH	HK	SG	CH	MC	
1999	1	2	1	2	2	1	1	1	1	1	1	0	1	0	0	0	18
2000	1	2	1	2	2	1	1	1	1	1	1	0	1	0	0	0	17
2001	1	2	1	2	2	1	1	1	1	1	1	0	0	1	1	0	15
2002	1	2	1	2	2	1	1	1	1	1	1	0	0	0	0	0	15
2003	1	2	1	2	2	1	1	1	1	1	1	0	1	0	0	0	14
2004	1	2	1	2	2	1	1	1	1	1	1	0	0	0	0	1	15
2005	1	2	1	2	2	1	1	1	1	1	1	0	0	0	0	0	15
2006	1	2	1	2	2	1	1	1	1	1	1	0	0	0	0	0	15
2007	1	2	1	2	2	1	1	1	1	1	1	1	0	0	0	0	14

[(i)] Barbados (BB), Bermuda (BM), Switzerland (CH), Hong Kong (HK), Ireland(IE), Cayman Islands (KY), Saint Lucia (LC), Luxembourg (LU), Macau (MO), Panama (PA), Saint Vincent (VC), Singapore (SG), Monaco (MC). [(ii)] Figures represent the number of subsidiaries located in each tax haven. In the section 'ZEPHYR (vendors)' the figures represent the number of subsidiaries sold by the ultimate owner in that specific year. In the section 'ZEPHYR (acquirers)' the figures represent the number of subsidiaries acquired by the ultimate owner in that specific year. [(iii)] The value of the variable recording the number of subsidiaries located in tax havens for 2007 is created by adding up the static information from ORBIS (column 2 to 12). The value of such a variable for the previous year (2006) is created by adding up the information from ZEPHYR vendors (column 13 to 16, row 2007) and by subtracting the information from ZEPHYR acquirers (column 17, row 2007). The process continues backwards until the last year (here 1999).

Table 9: Descriptive Statistics of the Main Variables

Variable	Mean	Std. Dev.	Min	Max
Tax bill/total assets	.019	.026	-.190	.222
Number of subsidiaries in tax havens	2	6.134	0	192
Dummy - at least one tax haven subsidiary	.409	.492	0	1
Dummy - more than two tax haven subsidiaries	.184	.388	0	1
Dummy - more than three tax haven subsidiaries	.184	.388	0	1
Dummy - more than four tax haven subsidiaries	.184	.388	0	1
Dummy - more than 30 tax haven subsidiaries	.184	.388	0	1
P&L before tax/total assets (if gain)	.070	.070	0	.521
P&L before tax/total assets (if loss)	-.056	.227	-6.964	0
Dummy - aggregate loss				
Intangibles/total assets	.203	.190	0	.975
Log(employees)	7.390	2.175	0	14.557

(i) Intangibles include goodwill (ii) The total number of ultimate owners is 3,389 and total number of observations is 12,876.

Table 10: Descriptive Statistics by Type of Group

	Obs.	Mean	Std. Dev.	Min	Max
MNCs with Subsidiaries in Tax Havens					
Tax bill/total assets	5,407	.022	.025	-.190	.222
Number of total subsidiaries		76	137.29	1	2,288
Number of subs in tax havens		5	8.684	0	192
Dummy - any subs in tax havens		.974	.161	0	1
Dummy - less than 2 subs in tax havens		.534	.490	0	1
Dummy - more than 2 subs in tax havens		.439	.496	0	1
P&L before tax/total assets (if gain)		.077	.070	0	.421
P&L before tax/total assets (if loss)		-.021	.102	-2.434	0
Dummy - aggregate loss		.165	.371	0	1
Intangibles/total assets		.207	.174	0	.934
Log(number of employees)		8.406	1.987	0	14.557
MNCs without Subsidiaries in Tax Havens					
Tax bill/total assets	5,045	.019	.027	-.113	.159
Number total subsidiaries		23	59.13	1	1,398
P&L before tax/total assets (if gain)		.069	.071	0	.521
P&L before tax/total assets (if loss)		-.059	.21	-4.252	0
Dummy - aggregate loss		.256	.437	0	1
Intangibles/total assets		.192	.189	0	.924
Log(number of employees)		6.929	1.905	0	12.806
Domestic Groups					
Tax bill/tot. assets	2,424	.013	.027	-.115	.143
Number total subsidiaries		8	17.71	1	249
P&L before tax/total assets (if gain)		.053	.066	0	.483
P&L before tax/total assets (if loss)		-.128	.338	-6.964	0
Dummy - making a loss		.390	.488	0	1
Debt ratio		.536	.353	.012	4.935
Intangibles/total assets		.213	.224	0	.975
Log(number of employees)		6.023	2.040	0	11.695

(i) GUOs are grouped according to the situation in 2007. (ii) The variable 'Number of subsidiaries in tax havens' and the dummy variables indicating the presence of those subsidiaries are equal to zero for all MNCs without tax haven subsidiaries and for domestic groups.

Table 11: ETRs, Losses, and Tax Charges Across Types of Companies

	MNCs with TH subs	MNCs without TH subs	Domestic groups	MNCs with TH subs	MNCs without TH subs	Domestic groups
	ETR - only positive values (per cent)			ETR - all observations (per cent)		
2003	32	34	34	23	21	18
2004	30	31	33	24	20	17
2005	30	30	32	24	21	17
2006	29	30	33	24	21	17
2007	28	30	31	23	20	17
Mean	30	31	33	23	21	17
	Per cent of groups reporting losses			Per cent of groups reporting negative tax charges		
2003	23	31	40	17	24	40
2004	17	27	37	13	23	38
2005	15	24	38	12	21	36
2006	14	23	39	11	20	37
2007	15	23	39	11	21	34
Mean	17	25	40	12	22	37
	Mean gain size (over total assets)			Mean loss size (over total assets)		
2003	.062	.058	.048	.032	.069	.165
2004	.074	.067	.051	.021	.061	.105
2005	.079	.071	.052	.020	.055	.126
2006	.083	.074	.057	.017	.062	.129
2007	.084	.074	.053	.019	.053	.124
Mean	.077	.069	.053	.021	.059	.128

(i) Mean ETR calculated using only observations with both positive pre-tax profit and positive tax charges
(ii) Mean ETR calculated setting to zero observations with either losses or negative tax charge.
(iii) All values are consolidated.

Table 12: Main Results

	(1)	(2)	(3)	(4)	(5)
Dependent variable: Tax bill/total assets	OLS	WG		GMM-diff	
Lag(tax bill/total assets)	0.292***	-0.023*	0.071***	0.070***	0.068***
	(0.015)	(0.014)	(0.022)	(0.023)	(0.023)
Number of tax havens subsidiaries (α_1)	-0.00003	0.001	0.004	-0.006	-0.007
	(0.000)	(0.001)	(0.006)	(0.006)	(0.007)
Number of tax havens subsidiaries squared (α_2)	0.000	-0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
P&L/total assets (if gain) (α_3)	0.228***	0.226***	0.341***	0.332***	0.336***
	(0.007)	(0.010)	(0.026)	(0.026)	(0.025)
X Number of tax havens subsidiaries (α_4)	0.0004	0.004***	-0.0005	-0.002*	-0.002**
	(0.001)	(0.003)	(0.000)	(0.001)	(0.001)
X Number of tax havens subsidiaries squared (α_5)	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dummy - aggregate loss	-0.001	0.001	0.024***	0.025***	0.024***
	(0.001)	(0.001)	(0.004)	(0.004)	(0.004)
X Number of tax havens subsidiaries	0.000	0.000	-0.001*	-0.002***	-0.001*
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
X No. tax havens subsidiaries squared	0.000	0.000	0.000	0.00003**	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Intangibles/total assets				0.007	0.008
				(0.010)	(0.010)
X Number of tax havens subsidiaries	0.000	0.000	0.008	-0.001**	-0.003*
	(0.000)	(0.000)	(0.002)	(0.000)	(0.002)
X Number of tax havens subsidiaries squared	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log(number of employees)				-0.004	-0.003
				(0.003)	(0.003)
X Number of tax havens subsidiaries				0.001**	0.001**
				(0.000)	(0.000)
X Number of tax havens subsidiaries squared				-0.00001**	-0.00001**
				(0.000)	(0.000)
P&L/total assets (if loss)					-0.007
					(0.007)
X Number of tax havens subsidiaries					0.002
					(0.003)
X Number of tax havens subsidiaries squared					0.000
					(0.000)
Country-year dummies	✓	✓	✓	✓	✓
AR(1)			-13.00	-12.62	-12.62
p-value			[0.000]	[0.000]	[0.000]
AR(2)			-1.080	-0.995	-1.030
p-value			[0.278]	[0.320]	[0.305]
Hansen over-identification test			64.48	86.64	96.63
Degrees of freedom			(68)	(92)	(110)
p-value			[0.462]	[0.638]	[0.815]
Observations	12,876	12,876	12,876	12,876	12,876
Number of groups	3,389	3,389	3,389	3,389	3,389

(i) Regressions run using pooled OLS (column 1), within-group estimator (column 2) and GMM-diff estimator (Arellano and Bond (1991)) in columns 3 to 5. (ii) Standard errors in parentheses. (iii) Instruments used are 2nd and further lags of firm-level variables, 1st and 2nd lag of mean tax bill, and country-year dummies. Instruments are collapsed as described in Roodman (2009). (iv) ***, **, * significant at 1%, 5% and 10% respectively.

Table 13: Presence in Tax Havens Measured by Dummy Variables

Dependent variable: Tax bill/total assets	(1)	(2)	(3)	(4)
Lag(tax bill/total assets)	0.062***	0.063***	0.064***	0.083***
	(0.019)	(0.019)	(0.019)	(0.012)
Dummy - at least 1 tax haven subsidiary (*d1*)	-0.048*	-0.048*	-0.050*	-0.043
	(0.029)	(0.029)	(0.029)	(0.026)
Dummy - 2 or more tax haven subsidiaries (*d2*)	0.025			
	(0.028)			
Dummy - 3 or more tax haven subsidiaries (*d3*)		0.031		
		(0.039)		
Dummy - 4 or more tax haven subsidiaries (*d4*)			0.010	
			(0.042)	
Dummy - 30 or more tax haven subsidiaries (*d5*)				-0.290
				(0.475)
P&L/total assets (if gain)	0.351***	0.349***	0.354***	0.348***
	(0.028)	(0.028)	(0.028)	(0.026)
X *d1*	-0.028	-0.035	-0.029	-0.077*
	(0.044)	(0.040)	(0.039)	(0.039)
X (*d2*)	-0.016			
	(0.042)			
X (*d3*)		-0.027		
		(0.040)		
X (*d4*)			-0.044	
			(0.039)	
X (*d30*)				0.064**
				(0.028)
Making loss dummy	0.022***	0.024***	0.023***	0.024***
	(0.005)	(0.005)	(0.005)	(0.005)
X (*d30*)				-0.016***
				(0.006)
Intangibles/total assets	0.014	0.008	0.011	0.011
	(0.013)	(0.013)	(0.013)	(0.013)
Log(number of employees)	-0.002	-0.003	-0.002	-0.002
	(0.003)	(0.003)	(0.003)	(0.003)
X (*d1*)	0.005	0.006*	0.006**	0.004
	(0.003)	(0.003)	(0.003)	(0.003)
X (*d2*)	-0.002			
	(0.003)			
X (*d3*)		-0.003		
		(0.003)		
X (*d4*)			-0.003	
			(0.003)	
X (*d30*)				-0.005**
				(0.003)
AR(1)	-13.58	-13.64	-13.68	-13.75
p-value	[0.000]	[0.000]	[0.000]	[0.000]
AR(2)	-1.386	-1.318	-1.402	-1.030
p-value	[0.166]	[0.188]	[0.161]	[0.303]
Hansen over-identification test	98.44	114.6	106.8	88.21
Degrees of freedom	(92)	(92)	(92)	(92)
p-value	[0.304]	[0.0552]	[0.138]	[0.592]

(i) Number of observations is 12,876 and number of corporate groups is 3,389.
(ii) Coefficient estimates of the variable intangible intensity multiplied by different dummies are not reported. They are insignificant. The same is true for the dummy recording an aggregate loss multiplied by the dummies for at least one, 2 or more, 3 or more, and 4 or more tax haven subsidiaries.
(iii) Regressions run using GMM-diff estimator (Arellano and Bond (1991)).
(iv) Standard errors in parentheses. (v) Country-year dummies used in all specifications.
(vi) Instruments used are 2nd and further lags of firm-level variables, 1st and 2nd lag of mean tax bill, and country-year dummies. Instruments are collapsed as described in Roodman (2009).
(vii) ***, **, * significant at 1%, 5% and 10% respectively.

Table 14: Within-group Changes in Tax Haven Dummies

	No. of groups	Per cent of total corporate groups
Dummy - at least one tax haven subsidiary	47	1.3
Dummy - two or more tax haven subsidiaries	37	1.1
Dummy - three or more tax haven subsidiaries	29	0.9
Dummy - four or more tax haven subsidiaries	19	0.6
Dummy - more than 30 tax haven subsidiaries	10	0.3
Total	3,389	

[(i)] Number of corporate groups recording at least one change in the dummy.

Table 15: Different Samples

Tax bill/total assets	(1)	(2)	(3)	(4)	(5)
Lag(tax bill/total assets)	0.070***	0.068***	0.085***	0.070***	0.069***
	(0.023)	(0.012)	(0.013)	(0.012)	(0.018)
Number of tax haven subsidiaries (α_1)	-0.006	-0.006	-0.002	-0.006	-0.002
	(0.006)	(0.004)	(0.004)	(0.004)	(0.016)
Number of tax haven subsidiaries squared (α_2)	0.0001	0.0001**	0.00003	0.0001**	0.0002
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
P&L/total assets (if gain) (α_3)	0.332***	0.332***	0.318***	0.330***	0.361***
	(0.026)	(0.020)	(0.021)	(0.020)	(0.024)
X Number of tax haven subsidiaries (α_4)	-0.002*	-0.002**	-0.002*	-0.002***	-0.014**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.006)
X Number of tax haven subsidiaries squared (α_5)	0.00002	0.00002**	0.00002*	0.00002***	0.0003
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dummy - aggregate loss	0.025***	0.025***	0.025***	0.024***	0.028***
	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)
X Number of tax haven subsidiaries	-0.002***	-0.002***	-0.002***	-0.002***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
X Number of tax haven subsidiaries squared	0.00003**	0.00003***	0.00003***	0.00003***	0.0001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Intangibles/total assets	0.007	0.009	0.008	0.006	0.010
	(0.011)	(0.009)	(0.009)	(0.010)	(0.011)
X Number of tax haven subsidiaries	-0.003*	-0.003***	-0.004***	-0.003***	-0.002
	(0.002)	(0.001)	(0.001)	(0.001)	(0.003)
X Number of tax haven subsidiaries squared	0.00004	0.00004***	0.00005***	0.00004***	0.0001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log(number of employees)	-0.004	-0.004*	-0.003	-0.005**	-0.003
	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)
X Number of tax haven subsidiaries	0.001**	0.001***	0.001**	0.001***	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
X Number of tax haven subsidiaries squared	-0.00001**	-0.0001***	-0.00001**	-0.00002***	-0.00003
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Country-year dummies	✓	✓	✓	✓	✓
AR(1)	-12.62	-13.87	-12.89	-13.88	-13.71
p-value	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
AR(2)	-0.995	-1.136	-0.981	-1.092	-1.060
p-value	[0.320]	[0.256]	[0.327]	[0.275]	[0.289]
Hansen over-identification test	86.64	84.28	87.02	83.97	91.22
Degrees of freedom	(92)	(92)	(92)	(92)	(92)
p-value	[0.638]	[0.704]	[0.627]	[0.712]	[0.503]
Observations	12,876	12,522	10,452	11,951	12,749
Number of groups	3,389	3,298	2,665	3,060	3,359

(i) Regressions run using GMM-diff estimator (Arellano and Bond (1991)). (ii) Standard errors in parentheses. (iii) Instruments used are 2nd and further lags of firm-level variables, 1st and 2nd lag of mean tax bill, and country-year dummies. Instruments are collapsed as described in Roodman (2009). (iv) Column 1 contains results for the entire sample. In column column 2, GUOs resident in Ireland and Switzerland are dropped. In column 3 domestic entities are dropped. In column 4 groups always reporting a consolidated loss are dropped. In column 5 companies with number of tax haven subsidiaries larger than the 99th percentile (30) are dropped. (v) ***, **, * significant at 1%, 5% and 10% respectively.

Table 16: Worldwide versus Territorial Systems of Taxation

Dependent variable: Tax bill/total assets	(1)	(2)	(3)	(4)	(5)	(6)
Lag(tax/total assets)	0.074***	0.083***	0.071***	0.078***	0.071***	0.082***
	(0.010)	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)
Number of tax havens subs. (n) (α_1)	-0.008**	-0.004	-0.007*	-0.009**	-0.010***	-0.007*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Number of tax havens subs. squared ($n2$) (α_2)	0.0002***	0.0001*	0.0002***	0.0002***	0.0002***	0.0001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
P&L/total assets (if gain) (α_3)	0.214***	0.217***	0.229***	0.215***	0.215***	0.219***
	(0.035)	(0.034)	(0.036)	(0.034)	(0.035)	(0.034)
X n (α_4)	-0.007**	-0.008***	-0.006*	-0.005*	-0.008***	-0.009***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
X $n2$ (α_5)	0.0003***	0.0002***	0.0003***	0.0002***	0.0003***	0.0002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
X dCR	0.148***	0.131***	0.133***	0.140***		
	(0.041)	(0.041)	(0.041)	(0.040)		
X dUS					0.152***	0.133***
					(0.041)	(0.041)
X dUK					0.077*	0.075*
					(0.042)	(0.042)
X dIE					-0.046	-0.027
					(0.111)	(0.113)
X dCR X n	0.004	0.007**	0.003	0.002	0.006*	0.007**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
X dCR X $n2$	-0.0002***	-0.0001***	-0.0002***	-0.0002***	-0.0002***	-0.0003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dummy - aggregate loss	0.024***	0.018***	0.025***	0.022***	0.024***	0.018***
	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)
X n	-0.006***	-0.004**	-0.008***	-0.005***	-0.006***	-0.004**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
X $n2$	0.0002***	0.0001*	0.0003***	0.0002**	0.0002***	0.0001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
X dCR	-0.000	0.006	-0.002	0.002	-0.002	0.005
	(0.007)	(0.006)	(0.007)	(0.006)	(0.007)	(0.006)
X dCR X n	0.004**	0.003	0.006***	0.003*	0.004**	0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
X dCR X $n2$	-0.0002**	-0.000	-0.0003***	-0.0001*	-0.0002**	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Intangibles/total assets	0.008	0.007	0.011	0.006	0.007	0.007
	(0.008)	(0.008)	(0.009)	(0.009)	(0.008)	(0.008)
X n	-0.004***	-0.003***	-0.004***	-0.004***	-0.004***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
X $n2$	0.0001***	0.0001***	0.00005***	0.00006***	0.00005***	0.00006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log(number of employees)	-0.013***	-0.012***	-0.011***	-0.012***	-0.013***	-0.013***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
X n	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
X $n2$	-0.00002***	-0.00003***	-0.00002***	-0.00003***	-0.00003***	-0.00003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
X dCR	0.014***	0.016***	0.013***	0.012***	0.014***	0.016***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
X dCR X n	-0.000	-0.000	-0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
X dCR X $n2$	0.000	0.00001*	0.000	0.000	0.000	0.00001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
AR(1)	-13.90	-12.59	-13.76	-13.75	-13.82	-12.52
p-value	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
AR(2)	-0.888	-1.066	-1.039	-0.869	-1.183	-1.251
p-value	[0.357]	[0.274]	[0.364]	[0.282]	[0.206]	[0.211]
Hansen over-identification test	140.0	147.2	133.6	137.4	151.2	156.1
Degrees of freedom	(146)	(146)	(146)	(146)	(158)	(158)
p-value	[0.624]	[0.457]	[0.761]	[0.682]	[0.636]	[0.527]
Observations	12,876	10,452	12,522	11,951	12,876	10,452
Number of groups	3,389	2,665	3,298	3,060	3,389	2,665

(i) Regressions run using GMM-diff estimator (Arellano and Bond (1991)).
(ii) Standard errors in parentheses. (iii) Instruments used are 2nd and further lags of firm-level variables, 1st and 2nd lag of mean tax bill, and country-year dummies. Instruments are collapsed as described in Roodman (2009).
(iv) The dummy dCR takes value one if the group is headquartered in a country with a credit system. The dummies dUS, dUK, and dIE take value one if the group is headquartered in the United States, the United Kingdom, and Ireland, respectively.
(v) Column 1 and 5 show results for the entire sample. In column 2 and 6 domestic entities are dropped. In column 3, GUOs resident in Ireland and Switzerland are dropped. In column 4 groups always reporting a consolidated loss are dropped.
(vi) Country-year dummies are used in all specifications. (vii) The variables $n*dCR$, $n2*dCR$, intangibles/tot. assets*dCR, intangibles/tot. assets*$n*dCR$, and intangibles/tot. assets*$n2*dCR$ not reported as insignificant in all specifications.
(viii) ***, **, * significant at 1%, 5% and 10% respectively.

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