# Private Equity and Taxes*

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**Abstract**

We study companies' tax avoidance behavior after being acquired in a private equity transaction. Exploiting rich European firm-level data in a matched-sample difference-in-differences setting, we find that target companies' effective tax rates decrease by 13 percent. This finding is in line with the hypothesis that private equity investors create shareholder value by extracting money from the government. While our evidence suggests that target firms engage more heavily in profit shifting, we do not find strong evidence for a tax-motivated leverage channel. Target firms experience lower asset and productivity growth when they engage in significant tax avoidance after the deal.

**Keywords:** Private Equity, Leveraged Buyouts, Corporate Taxation, Taxes, Profit Shifting, Leverage, Investments, Productivity

**JEL classifications:** G31, G34, H26

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# 1 Introduction

With more than USD 3 trillion assets under management in 2017 and growing, private equity will soon be the largest alternative asset class (Financial Times, 2018). This growing importance leads regulators to ask how private equity firms create shareholder value. The bright side view argues that private equity-backed portfolio firms increase in value through operating efficiencies and better-aligned incentive contracts (Kaplan and Strömberg, 2009). The dark side view points towards value extraction from other stakeholders, such as employees or the government. While recent studies provide evidence that private equity transactions adversely affect employees (e.g., Davis et al., 2014), there is little evidence on value extraction from the government. Our analysis supports the claim that private equity firms transfer money from the government to shareholders. We document significant reductions in their target firms' effective tax rate (ETR) with no accompanying increases in investments or productivity. The average increase in tax efficiency, or loss in relative tax revenue, is estimated at 1.71m EUR per deal.

Through tax claims, national and local governments are a significant passive stakeholder of firms in the corporate sector. Private equity buyout firms can thus impose a negative externality on the governments' tax revenues through the implementation of tax avoidance strategies at their targets. We analyze three major channels by which target firms engage in tax avoidance post-buyout. First, we examine general tax efficiency. This category encompasses strategies that map into lower effective tax rates, such as generating additional tax deductions, making use of tax consolidation at the business group level, and general tax aggressiveness. A second potential channel is profit shifting. Firms can engage in internal trade with other subsidiaries, manipulate prices for such intracompany trade, and thereby shift profits to low-tax countries. Third, target firms benefit more from the interest tax shield that allows firms to deduct interest payments from taxable income. Private equity firms are notorious for the extensive use of debt financing, which

increases the value of these tax shields. We document a substantial increase in target firms' general tax efficiency after being acquired by a private equity firm. We further find evidence for profit shifting, while financial leverage seems to play a secondary role for target firms' tax avoidance. Last, we document lower investment rates and a decline in productivity for target firms that engage heavily in tax avoidance.

We examine a representative sample of 10,776 European private equity transactions between 2001 and 2016 from the Zephyr database. Our deal data is matched to the firms' financial and ownership data from Orbis as well as additional country-level tax regulation data. To address concerns that private equity ownership is endogenous, we perform a matched sample difference-in-differences estimation with the acquisition as treatment. Our approach is similar to that in Boucly et al. (2011). In addition to an exact matching on eight discrete variables, including firms' country, year, and industry, we perform a nearest-neighbor matching on seven continuous variables. These variables are carefully selected following the tax literature to control for potential tax avoidance opportunities. They include the effective tax rate, ROA, cash ratio, growth, size, financial leverage, and the tax rate differential between the firm and its affiliated subsidiaries. The large pool of more than 50 million potential control observations assures an excellent matching quality. We then use a difference-in-differences and triple differences methodology to analyze the development of tax-motivated outcome variables after the acquisition.

First, we investigate companies' tax efficiency by analyzing the effective tax rate as the standard accounting measure of tax avoidance (Hanlon and Heitzman, 2010; Dyreng et al., 2017). Reductions in the ETR directly increase profits that can be distributed to shareholders. We find an immediate drop in the effective tax rate of 1.38 percentage points directly following the acquisition. Three years after the deal, target firms report effective tax rates that are 2.43 percentage points lower than those of control firms, which represents a 12.93% decrease relative to the unconditional sample mean. This result is

consistent with the hypothesis that private equity investors reduce tax-related costs to maximize firm value and benefit from economies of scale as well as lower marginal costs of tax planning (Badertscher et al., 2013).[1] In line with our argument that financial sophistication leads to higher tax efficiency, we find that effects are strongest in target firms with lower levels of ex-ante tax avoidance and that are located in countries with more lenient international tax laws. Interestingly, we find that the reduction of the effective tax rate is entirely driven by pre-tax earnings growth (20.40% in three years) while absolute tax payments remain mostly constant. This finding indicates that private equity firms combine increases in operational performance with tax efficiency.

We then investigate whether private equity target firms engage in profit shifting. Firms that belong to a multinational group can use transfer pricing to shift pre-tax income from high- to low-tax countries (Huizinga and Laeven, 2008). This behavior erodes the tax base and thereby reduces tax payments without necessarily affecting the effective tax rate of target firms. Since we cannot observe internal transactions directly, we follow the literature and analyze the target firms' post-deal earnings depending on whether they have pre-deal opportunities for profit shifting.[2] These opportunities include the difference between the tax rate of the target firm's country and its subsidiaries' countries (denoted *tax differential* hereafter) as well as the existence of foreign or tax

[1] John Samuels, as of 2019 Chairman of Global Tax at Blackstone, constitutes one real-world example of this assertion. In 2011, he made the front page of the New York Times (2011) while working for General Electric: "Its [General Electric] extraordinary success is based on an aggressive strategy that mixes fierce lobbying for tax breaks and innovative accounting that enables it to concentrate its profits offshore. G.E.'s giant tax department, led by a bow-tied former treasury official named John Samuels, is often referred to as the world's best tax law firm." NYU Law Magazine (2013) later labeled him as "the most influential person in the tax world". He is now employed at Blackstone, the world's largest private equity buyout firm.

[2] To provide an example, we assume a firm is located in a country with a corporate income tax rate of 30% and belongs to a multinational group with another affiliated subsidiary in a country with a tax rate of 20%. As the subsidiaries are independent corporate taxpayers in each country, the group's management has an incentive to maximize (minimize) reported pre-tax income at the subsidiaries' level in the low (high) tax country. This strategy maximizes the group's after tax profits, which accrue at the level of the ultimate parent corporation that can distribute them to shareholders, i.e., the private equity firm. See De Simone (2016) and De Simone et al. (2017) for recent evidence on firms' profit shifting behavior in the European setting.

haven subsidiaries in the target or acquirer firms' business group structure (Hines and Rice, 1994; Dowd et al., 2017; Bennedsen and Zeume, 2018). We find that target firms with high tax rate differentials and ownership of foreign as well as tax haven subsidiaries experience lower post-deal earnings growth. Furthermore, we analyze the development of the group structure after the deal. Our results show that private equity firms increase the target firms' international tax rate differentials by about one percentage point and their likelihood of owning a foreign (tax haven) subsidiary by about 11.72% (2.91) relative to the control group. Both these findings support the notion that private equity firms both exploit and create profit-shifting opportunities at their targets.

In our third set of tests, we analyze target firms' financial leverage after the acquisition. Higher interest payments reduce the firms' pre-tax earnings. Similar to profit shifting, this tax base erosion reduces final tax payments without showing up in the target's effective tax rate. We study the target firms' and its direct parents' net interest paying leverage after the acquisition. Our results show increases in the target firms' leverage ratio of 4.79 percentage points, while the direct parents' leverage increases by about 8.92 percentage points. These moderate increases from contemporary buyouts contrast with the common notion of heavy debt financing of 60-90% from earlier transactions (Kaplan and Strömberg, 2009). Tax considerations are not the only driver of leverage (Axelson et al., 2013), in particular in more recent buyouts (Gompers et al., 2016). Therefore, we gauge the extent to which the additional leverage is related to country-specific tax laws that affect the value of the tax shield of debt. Our findings do not support the notion that leverage increases should be larger in high-tax countries. However, in line with our expectations, we find that effects are stronger when the country allows for the consolidation of profits and losses of individual firms belonging to the same international business group and smaller when thin capitalization rules restrict the tax-deductibility of interest. Given our mixed results, we conclude that private equity firms take the tax

deductibility of interest into consideration when deciding on the optimal capital structure, but that it is not the primary driver of buyout leverage.

Last, we look at different subsets of deals depending on their predicted level of post-deal tax avoidance. We find that investments into assets and target firms' productivity are about 2.56 and 5.65 percentage points lower for deals with above median changes in ex-post tax avoidance. When splitting the data at the top and bottom quartiles of the tax savings distribution, the effects amount to an annual -3.85 and -8.69 percentage points decline in asset and productivity growth. These findings indicate that private equity target firms that engage in substantial tax avoidance after the buyout are accompanied with lower growth and less improvements in operational efficiency.

Several robustness tests confirm our results. As a crucial prerequisite for a difference-in-differences approach, both our graphical and numerical analyses support a common pre-trend for the treated and control group. Next, consistent with the acquisition being (plausibly) exogeneous after the matching, we find that the inclusion of additional covariates does not alter our results. In line with established approaches in the literature on tax avoidance (Dyreng et al., 2008), we further study two long-run effective tax rate measures. Results are consistent and show that private equity investors introduce sustainable tax planning strategies. Another concern stems from the uneven data availability for firms across Europe. We show that our results remain unchanged when weighting our firm-year observations with the overall deal count per country. Next, we make sure that our results are not driven by survivorship bias. To that end, we test three different samples in which we only consider survivors, positive EBT firms, and positive tax expenses firms. Our main result holds across all three sub-samples. Using an an event study approach as recommended by Atanasov and Black (2016) and two alternative matching strategies, we further show that the treatment effects are not driven by our control firms. Last, in a valid difference-in-differences design, the outcome of interest should only be affected by

the actual event. In line with this assumption, we do not find any effect when setting the event year four years prior to the actual event.

Our paper contributes to two strands of the literature. First, it adds to previous research in finance on the real effects of private equity investments.[3] Some studies on the bright side view of private equity, such as Boucly et al. (2011) and Guo et al. (2011), find positive effects of acquisitions on growth and profitability. Value extraction from employees, as theorized by Shleifer and Summers (1988), is not supported strongly by empirical evidence (e.g., Davis et al., 2014; Antoni et al., 2019). Cohn et al. (2019) provide recent evidence that employees might actually benefit from private equity buyouts through increased workplace safety. On the consumer side, Eaton et al. (2019) find that private equity buyouts in higher education adversely affect the acquired schools' students. Evidence on value extraction from the government is scarce. Kaplan (1989) measures the benefits of interest tax shields from 76 public-to-private management buyouts. Cohn et al. (2014) and Guo et al. (2011) both find increases in target firms' financial leverage but are not able to directly relate these increases to tax considerations. Our study is, therefore, the first to fully explore the tax effects of private equity acquisitions. We further provide evidence that some private equity investors pursue (tax) cost-cutting strategies that result in value extraction from the government, while others seem to forgo tax benefits and create value through more investments and higher productivity. This finding suggests that two widely discussed channels of value creation through private equity, financial engineering (i.e., cutting taxes) and operational engineering, seem to be substitutes instead of complements (Kaplan and Strömberg, 2009).

Our paper further contributes to the literature on firm ownership and tax avoidance.[4] Recent studies find that institutional ownership (Khan et al., 2017; Chen et al., 2019)

[3]For an overview of the private equity literature, consult Kaplan and Strömberg (2009).

[4]See Hanlon and Heitzman (2010) and Wilde and Wilson (2018) for reviews of the corporate tax avoidance literature.

and hedge fund participation in particular (Cheng et al., 2012) are associated with higher levels of tax avoidance of publicly traded US firms. Chen et al. (2010) and Badertscher et al. (2013) find US firms owned by family founders or managers to be less tax aggressive and explain this finding by reputation concerns and managers' incentives to not engage in risky tax avoidance. We particularly build on Badertscher et al. (2013) who argue that private equity firms benefit from economies of scale in tax planning. They show that private U.S. firms with public debt have lower effective tax rates when owned by private equity investors compared to management-owned firms. We extend their study by providing economic estimates of within-firm changes in general tax avoidance and investigate additional profit shifting and leverage channels. Overall, our study sheds new light on how private equity owners affect tax avoidance based on a large, representative sample of target firms.

This paper proceeds as follows. The data and the methodology are discussed in Section 2. Section 3 presents the findings on target firms' tax efficiency. In Section 4, we further investigate the tax base by looking at the profit shifting and leverage channels. We study the real effects of tax avoidance in Section 5 and conduct robustness tests in Section 6. Section 7 concludes.

# 2 Data and Methodology

## 2.1 Sample Construction

To analyze the impact of private equity transactions on firm-level tax payments, we merge several datasets. We use private equity deals from Zephyr, which we merge with company financial and ownership data from Bureau van Dijk's (BvD) Orbis database. Then, we add country-level data from the OECD, and tax rate and regulation data from KPGM as well as the IBFD European Tax Handbooks.

To construct our sample, we first retrieve all transactions marked as completed private equity acquisitions in Zephyr.[5] In addition to the 28 countries that are members of the European Union as of 2016, we also include deals from Iceland, Norway, Switzerland, and Turkey. Our sample covers transactions between 2001 and 2016. Before 2001, coverage in Zephyr is very limited. Since we require at least one year of financial data after the acquisition, our sample stops in 2016. At this point, our sample comprises 26,747 deal observations.

The deal data is then matched to the financial and ownership data from BvD's Orbis database. We use the flat files from July 2018 for the financial data to circumvent the limitations that were inherent to previous versions from Orbis.[6] These data are then merged to the annual BvD ownership data, which allow us to reconstruct the target's as well as the acquirer's subsidiary structure.[7] Country-specific data on, for example, corporate tax rates and GDP are obtained from the OECD. We hand-collect further tax regulation data from the IBFD European Tax Handbooks and include additional tax rate data from KPMG. In total, 10,945 deals can be merged to Orbis firm data on the matching variables that are further specified in Section 2.2. Of these firms, we are able to match 10,776 to at least one suitable control firm.

Table 1 provides an overview of the sample construction. In addition to the number of observations of each sub-sample, it presents the relative loss of observations at each sample selection step. We lose most observations due to the matching of Zephyr and Orbis financial data (52.66%). This loss is due to the lack of available data on some of

[5]For a description of the Zephyr database and a comparison with Thomson One's SDC, see Bollaert and Delanghe (2015).

[6]In addition to the data cleaning suggested by Kalemli-Ozcan et al. (2015), we interpolate the financial data linearly to obtain better-balanced panel data.

[7]We access each annual update of the BvD database to create dynamic panel data that allow us to track ownership structures before and after each buyout. After downloading the universe of firms with available ownership data, we identify corporate global ultimate owners and then iteratively search for majority-owned subsidiaries to construct each business group with a maximum vertical depth of 27 ownership layers. Data on ownership are available from 2005 until 2017. For details, see Olbert (2019).

**Table 1: Private Equity Deals Sample Construction**

This table presents the construction of the private equity deal dataset. Five steps are described. The number of observations that remains after each step and the corresponding relative loss when compared to the original deal sample is provided. In addition, the number of observations with information on deal value and the respective average deal value is given for each of the sub-samples. These values are depicted to underline the representativeness of the final sample.

| | | | Deal Value (m EUR) | |
|---|---|---|---|---|
| Description | Observations | Loss | N | Mean |
| (1) All private equity deals in Zephyr with the target from one of the 32 countries in the period 2001-2016 and a non-missing BvD identifier | 26,747 | | 13,846 | 124.79 |
| (2) Only deals that are completed or completed-assumed deals | 26,478 | 1.01% | 13,628 | 117.30 |
| (3) Only unique firm-year deals with one target firm | 25,029 | 5.42% | 12,757 | 111.13 |
| (4) Only target firms with data on the matching variables from Orbis | 10,945 | 52.66% | 5,464 | 125.98 |
| (5) Only target firms that can be matched to a control firm | 10,776 | 0.63% | 5,365 | 123.75 |

the matching variables because reporting requirements over time and across countries are not always comprehensive. To show that our sample is nonetheless representative, we further provide the number of observations with a deal value and the average deal value at each step, which are provided by Zephyr. About 50% of the observations have the deal value filled throughout all steps. The average deal value barely changes and ranges from 111m to 126m EUR. Therefore, we conclude that, in terms of deal size, our final sample is representative of all deals listed in Zephyr.

## 2.2 Matching

To address concerns stemming from the non-random selection of target firms by private equity investors, we perform a nearest-neighbor matching on all targeted companies one year prior to the acquisition. We aim to create a setting in which target and control

firms are sufficiently similar such that the ultimate choice of the investor to select one of the potential targets is plausibly exogenous. The dataset of potential control variables comprises as many as 51,943,428 firm-year observations, which reduces the potential bias from the estimation of the treatment effect in our regression analyses (Imbens, 2004). A description of the construction of the potential control dataset can be found in Table A-1 in the Appendix. We match our samples with replacement. Our choice of matching variables is based on the tax accounting literature (e.g., Wilde and Wilson, 2018), where these variables are commonly described as determinants of tax planning opportunities. As they include, among others, growth, size, and profitability, they should also proxy for determinants of private equity acquisitions in general. The matching algorithm is the following:

1.) All firm-year observations of companies that were targeted at one point in time are removed from the set of potential control firms.

2.) We create cells for all firm-year observations according to nine discrete matching variables. These are country, year, NACE Rev. 2 industry section, two dummies indicating whether the firm reports positive or negative EBT and tax expenses,[8] and three business group dummies indicating the ownership of a subsidiary, a foreign subsidiary, and an international tax haven subsidiary.[9] This step creates 360,448 distinguished cells.

3.) We then compute the normalized Euclidean distance from every treated company for all observations within the respective cells. The seven continuous matching variables used are the effective tax rate, EBIT over total assets (ROA), cash ratio,

[8]The two requirements make sure we compare each treated firm to a control firm with a similar tax status. Our main dependent variable is the effective tax rate measured as the tax expense scaled by EBT. Our matching requirements ensure that this ratio is positive or negative for the same reasons (same signs of the numerators and denominators).

[9]We do not have ownership data on firms prior to 2005. Therefore, we set the business group dummies tentatively to 0 for matching purposes.

three-years log. asset growth, log. total assets, leverage ratio, and international tax differential.[10]

4.) Potential control observations that deviate more than 20 percentage points in their ETR from the treated firm are removed from the sample. This restriction is intended to reduce the noise caused by the ETR's large variation in sparse cells.

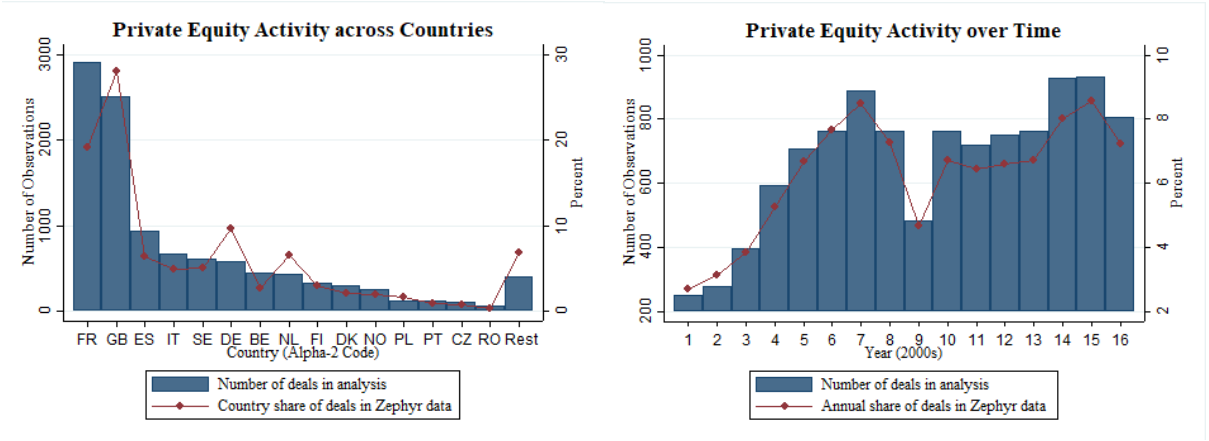
5.) The remaining control firms are ranked according to the normalized Euclidean distance and the best control is selected for each treated firm, resulting in a one-to-one matching.

The distribution of the country and year matching variables for target firms is presented in Figure 1.[11] Given the one-to-one matching, the distribution of these variables is identical for control firms. In Figure 1a, the distribution with respect to countries is presented. The number of observations is shown for the 15 most active private equity markets in terms of target firm locations, while the other 17 countries are summarized under *Rest*. Less than 500 firms are acquired in these less active markets. The majority of transactions, almost 3,000, take place in France, directly followed by the UK. Some portion of this distribution is due to data availability on the matching variables. In some countries the requirements to produce, report, and publish financial statement information are less stringent than in others. To show that our sample is nonetheless representative, we further depict the relative number of deals per country from Zephyr. The difference between the blue bars and the red points indicates that deals from France are slightly overrepresented (strong reporting requirements), while deals from Germany are underrepresented (weak reporting requirements). In Section 6, we test the robustness of our results to this potential distortion.

[10] As the firm's tax differential computation relies on ownership information, it is again tentatively set to zero prior to 2005.

[11] Table A-2 in the Appendix shows the distribution of the other six discrete matching variables.

**Figure 1: Private Equity Deals across Countries and over Time**




**(a)** This figure shows the distribution of private equity deal observations across target firm countries. The blue columns illustrate the total number of observations used in the regression analysis with available data on target and control firm observations. The red dots illustrate the actual share of private equity deals in each country relative to the total private equity activity in the 32 sample countries from Zephyr ($N = 25,029$, see Table 1). All observations in countries other than the 15 most active private equity markets are subsumed under *Rest*.

**(b)** This figure shows the distribution of private equity deal observations over time. The blue columns illustrate the total number of observations used in the regression analysis with available data on target and control firm observations. The red dots illustrate the actual share of private equity deals in each year relative to the total private equity activity in the period 2001-2016 from Zephyr ($N = 25,029$, see Table 1). Some of the more recent deals are missing due to data availability.

Figure 1b shows the distribution over time. The private equity deals included in the sample range from 2001 until 2016. Their number increases steadily until the years of the financial and sovereign debt crisis in 2008 and 2009. After 2010, deal volume resumes to pre-crisis levels. Deal numbers from the more recent years are potentially downward biased because of the, on average, two years reporting lag of data in the Bureau van Dijk's databases. Again, we also show the relative number of deals per year from Zephyr. Overall, the distribution of deals indicates that our sample is representative of the average reported private equity transaction in Europe.

Table 2 presents matching statistics for the continuous matching variables. The mean and median of the seven matching variables are computed separately for treated and

**Table 2: Matching Statistics**

This table presents matching statistics for the final sample in the year prior to the deal. After matching on year, country, industry, positive earnings and tax dummies as well as dummies for domestic, foreign, and tax haven subsidiaries (for the distribution of these variables, see Table A-2), firms are matched based on a nearest-neighbor matching on seven continuous variables using the Euclidean distance metric. Summary statistics for the matching variables *Effective Tax Rate (ETR)*, *EBIT over Assets (ROA)*, *Cash Ratio*, *Log. Asset Growth (3-year)*, *Log. Total Assets*, *Leverage Ratio*, and *Target Tax Differential* are provided. The mean and median are computed for samples of target and control firms. In addition, the relative differences and the standardized differences (Imbens and Wooldridge, 2009) in respective mean values are calculated to underline the matching quality.

| | Target firms (N = 10,776) | | Control firms (N = 10,776) | | Differences in means | |
|---|---|---|---|---|---|---|
| | Mean | Median | Mean | Median | Rel. | Std. |
| Effective Tax Rate (ETR) | 19.35 | 23.16 | 19.36 | 23.63 | 0.00 | 0.00 |
| EBIT over Assets (ROA) | 3.34 | 6.80 | 4.03 | 5.92 | 0.17 | 0.02 |
| Cash Ratio | 14.69 | 8.05 | 13.30 | 6.43 | 0.10 | 0.06 |
| Log. Asset Growth (3-year) | 44.06 | 29.07 | 39.88 | 24.90 | 0.10 | 0.04 |
| Log. Total Assets | 16.72 | 16.56 | 16.47 | 16.34 | 0.02 | 0.09 |
| Leverage Ratio | 67.44 | 65.34 | 66.55 | 65.80 | 0.01 | 0.02 |
| T. Tax Diff. | 1.45 | 0.00 | 1.35 | 0.00 | 0.07 | 0.02 |

control firms. In addition, the relative differences of the means and normalized differences as proposed by Imbens and Wooldridge (2009) between the two sub-samples are presented. The average target (control) firm has an effective tax rate of 19.35% (19.36), a return on assets (ROA) of 3.34% (4.03), a cash ratio of 14.69% (13.30), a three-years log. asset growth of 44.06% (39.88), a leverage ratio of 67.44% (66.55), and a firm tax differential of 1.45% (1.35). The relative differences of these averages never exceed 17% and the Imbens-Wooldridge statistics, which remain well below 0.25, indicate a high matching quality.

## 2.3 Summary Statistics

We present summary statistics for all relevant variables in Table 3.[12] The table categorizes variables into firm-level and country-level variables. Each category is then further grouped

[12]For the definition and source of the respective variables, consult Table A-3 in the Appendix.

into dependent, interaction, and control variables depending on their implementation in the later analysis. Prefixes *T.*, *A.*, and *P.* indicate that the variable is computed based on information from the target, the acquirer, or the target's direct parent firm. The suffix *t=-1* indicates that the variable's value is based on information one year prior to the acquisition. Descriptive statistics for the number of observations, mean, median, minimum, maximum, and standard deviation are shown. The sample period covers the event years from $t = -3$ to $t = 3$ relative to the year of the acquisition. Thus, each treated and control firm can have up to seven firm-year observations. Where applicable, we present values in percentage terms to improve readability. All firm-level dependent and control variables are winsorized at the 1 and 99% level to mitigate the influence of outliers.

The dependent firm-level variables used in the analysis are the current year (three- and five-year) effective tax rates (ETR), the natural logarithms of earnings before taxes (EBT) and tax expenses, five target business group variables (the firm's tax differential and dummies indicating the ownership of at least one foreign subsidiary, at least one domestic subsidiary and no foreign ones, a tax haven subsidiary in the EU, and an international tax haven subsidiary),[13] net interest-paying leverage, parent's net interest-paying leverage, log. asset growth, log. employment growth, and total factor productivity (TFP).[14] Some variables are not fully balanced throughout the sample. The 3-year (5-year) long-run ETRs are set to missing for the event years $t = -1$ ($t = -2$) until $t = 0$ ($t = 1$) to avoid an overlap with the acquisition event in the estimation. Logarithms

[13]The *firm's tax differential* is measured as the difference between the target firm's applicable corporate tax rate and the lowest corporate tax rate in one of the target firm's subsidiaries at any lower level of its business group hierarchy. *Tax havens in the EU* are Ireland, Luxembourg, Malta, or the Netherlands. While these countries are not labeled as tax havens by the European Commission, they are typical locations of conduit entities for tax planning purposes. We refer to the blacklist of the Tax Justice Network available at http://datafortaxjustice.net/paradiselost/. An *international tax haven* is defined in accordance with one of the lists used in Bennedsen and Zeume (2018).

[14]We proxy total factor productivity by the regression residuals based on a Cobb Douglas production function estimated separately for each industry-country-year segment.

## Table 3: Summary Statistics

This table presents summary statistics for all variables included in the analysis. The mean, median, minimum, maximum, and standard deviation of each of these variables are computed. All variables are defined in Table A-3. Ratios and dummy variables are stated in percentage terms. The variables can be categorized into firm- and country-level variables. Within these categories, variables are further grouped into dependent, interaction, and control variables depending on their later implementation. Prefixes *T.*, *A.*, and *P.* indicate that the variable is based on the information of the target, acquirer, or direct parent, respectively. Suffix *t=-1* indicates that the variable's value relates to its value in the year prior to the deal. All firm-level dependent and control variables are winsorized at the 1 and 99% level.

| Firm-level Variables | Obs | Mean | Median | Min | Max | SD |
|---|---|---|---|---|---|---|
| *- Dependent Variables* | | | | | | |
| Effective Tax Rate (ETR) | 131,061 | 18.80 | 22.41 | -143.81 | 171.01 | 37.35 |
| 3-year long-run ETR | 59,551 | 19.31 | 22.64 | -160.40 | 191.34 | 41.92 |
| 5-year long-run ETR | 20,277 | 18.96 | 22.22 | -198.46 | 223.53 | 46.96 |
| Log. EBT | 96,552 | 14.20 | 14.26 | 8.35 | 19.89 | 2.15 |
| Log. Tax Expenses | 104,147 | 11.58 | 12.60 | 0.00 | 18.48 | 4.16 |
| T. Tax Diff. | 111,538 | 1.77 | 0.00 | 0.00 | 38.00 | 4.85 |
| T. Foreign Sub. | 111,538 | 21.73 | 0.00 | 0.00 | 100.00 | 41.24 |
| T. Dom. Sub. | 111,538 | 27.66 | 0.00 | 0.00 | 100.00 | 44.73 |
| T. Haven EU | 111,538 | 6.20 | 0.00 | 0.00 | 100.00 | 24.11 |
| T. Haven | 111,538 | 5.03 | 0.00 | 0.00 | 100.00 | 21.85 |
| Net Int. Paying Lev. | 120,141 | 9.55 | 5.55 | -74.00 | 119.08 | 33.55 |
| P. Net Int. Paying Lev. | 58,560 | 14.23 | 11.16 | -72.84 | 119.83 | 33.81 |
| Log. Asset Growth | 133,619 | 8.93 | 5.32 | -93.17 | 142.83 | 32.65 |
| Log. Employment Growth | 110,800 | 4.80 | 1.94 | -69.31 | 91.63 | 22.67 |
| TFP | 108,429 | -15.52 | -5.17 | -448.33 | 229.05 | 102.12 |
| *- Interaction Variables* | | | | | | |
| Tax Potential, t=-1 | 135,774 | 50.32 | 100.00 | 0.00 | 100.00 | 50.00 |
| Inst. Vendor, t=-1 | 135,774 | 39.61 | 0.00 | 0.00 | 100.00 | 48.91 |
| Public Target, t=-1 | 135,774 | 9.49 | 0.00 | 0.00 | 100.00 | 29.31 |
| T. Tax Diff., t=-1 | 106,159 | 1.72 | 0.00 | 0.00 | 38.00 | 4.78 |
| T. Foreign Sub., t=-1 | 106,159 | 21.42 | 0.00 | 0.00 | 100.00 | 41.03 |
| T. Dom. Sub., t=-1 | 106,159 | 28.11 | 0.00 | 0.00 | 100.00 | 44.95 |
| T. Haven EU, t=-1 | 106,159 | 6.12 | 0.00 | 0.00 | 100.00 | 23.97 |
| T. Haven, t=-1 | 106,159 | 4.65 | 0.00 | 0.00 | 100.00 | 21.06 |
| A. Tax Diff., t=-1 | 83,241 | 8.01 | 0.00 | 0.00 | 55.00 | 13.81 |
| A. Foreign Sub., t=-1 | 83,241 | 34.89 | 0.00 | 0.00 | 100.00 | 47.66 |
| A. Dom. Sub., t=-1 | 83,241 | 19.46 | 0.00 | 0.00 | 100.00 | 39.59 |
| A. Haven EU, t=-1 | 83,241 | 25.91 | 0.00 | 0.00 | 100.00 | 43.82 |
| A. Haven, t=-1 | 83,241 | 20.77 | 0.00 | 0.00 | 100.00 | 40.57 |
| *- Control Variables* | | | | | | |
| Log. Total Assets | 135,330 | 16.60 | 16.47 | 0.00 | 28.31 | 2.13 |
| EBIT over Assets (ROA) | 133,057 | 3.32 | 5.48 | -135.47 | 61.69 | 25.60 |
| Cash Ratio | 133,609 | 13.71 | 6.92 | 0.01 | 82.14 | 17.29 |

**Table 3: Summary Statistics** (continued)

| | | | | | | |
|---|---|---|---|---|---|---|
| Firm-level Variables | | | | | | |
| Intan. Fixed Assets Ratio | 133,611 | 7.36 | 0.62 | 0.00 | 61.48 | 13.82 |
| Tan. Fixed Assets Ratio | 133,737 | 18.95 | 9.73 | 0.00 | 91.32 | 22.20 |
| Leverage Ratio | 135,017 | 66.43 | 64.87 | 1.84 | 269.86 | 36.45 |
| Country-level Variables | | | | | | |
| *- Interaction Variables* | | | | | | |
| T. Tax Rate | 135,774 | 30.09 | 30.00 | 9.00 | 52.03 | 5.58 |
| T. Cross-b. Group Tax | 102,923 | 13.40 | 0.00 | 0.00 | 100.00 | 34.06 |
| T. Interest Lim. | 102,921 | 48.78 | 0.00 | 0.00 | 100.00 | 49.99 |
| P. Tax Rate | 80,025 | 29.31 | 30.00 | 0.00 | 55.00 | 5.66 |
| P. Cross-b. Group Tax | 77,871 | 34.77 | 0.00 | 0.00 | 100.00 | 47.62 |
| P. Interest Lim. | 77,871 | 35.25 | 0.00 | 0.00 | 100.00 | 47.77 |
| *- Control Variables* | | | | | | |
| GDP / Capita (th) | 135,740 | 35.99 | 35.88 | 5.58 | 104.09 | 7.73 |
| GDP (tn) | 135,748 | 1.66 | 1.93 | 0.01 | 4.19 | 0.95 |
| Long-Term Interest Rate | 132,040 | 3.47 | 3.65 | -0.36 | 22.50 | 1.39 |
| Short-Term Interest Rate | 132,294 | 2.13 | 1.39 | -0.78 | 19.91 | 1.88 |

are only defined for positive EBT and tax expenses values. The target business group variables are only available from 2005 onwards. Information on parent net interest paying leverage is only available for roughly 50% of the observations. The effective tax rate is our main independent variable and is measured as the ratio of a firm's tax expenses to EBT according to its financial accounts in a given year.[15]

The firm-level interaction variables used are the target's tax savings potential,[16] two dummy variables indicating prior institutional ownership as well as publicly listed targets, and five target as well as acquirer business group variables in $t = -1$. We use the same target business group variables as dependent and interaction variables. However, the interactions' values are always defined in event year $t = -1$. It is further noteworthy that the acquirer business group variables are based on all affiliated firms and not just

[15]The effective tax rate is the most commonly used measure for corporate tax avoidance in the literature on corporate tax avoidance (Hanlon and Heitzman, 2010; Dyreng et al., 2017).

[16]The firm's tax savings potential is a dummy variable indicating whether the firm has above median values for the difference between its ETR and corporate income tax rate. Above median values should proxy for the the firm's tax planning potential.

the acquirer's subsidiaries. An illustrative depiction of the creation of business group variables can be found in Figure A-1 in the Appendix. Again, ownership data are only available from 2005 onwards, which explains the approximate drop of 30% in observations for the business group variables. Further, data on acquirer identifiers is sometimes missing in Zephyr, reducing the availability of acquirer business group variables by about 20%.

Firm-level control variables comprise log. total assets and log. asset growth, ROA, cash ratio, tangible and intangible fixed assets ratios, and the leverage ratio. All control variables are almost always filled in our sample. The average firm has log. total assets of 16.60 (16.2m EUR), ROA of 3.32%, a cash ratio of 13.71%, (in)tangible fixed asset ratios of 18.95% (7.36), and leverage ratio of 66.43%.

Interaction variables on the country-level cover the corporate income tax rate, a dummy indicating the possibility for a cross-border group taxation, and a dummy for the presence of an interest deductibility limit for tax purposes (so-called thin capitalization rules).[17] Summary statistics for these variables are shown for both the targets and the targets' parents when available. The Orbis ownership data provides this information in roughly 50% of the cases. The average corporate tax rate of target firms' (parents') countries of incorporation amounts to 30.09% (29.31). Target firms (parents) operate in countries with a cross-border group taxation in roughly 13.40% (34.77) of the cases. Restrictions on interest deductibility are effectively in place in jurisdictions where about 48.78% (35.25) of the firms (parents) are incorporated. Interestingly, we already see in the summary statistics that firms' parents are more likely to be located in countries allowing for a cross-border group taxation and without interest limitations than the average firm.

[17]Some countries (e.g., Austria) allow firms to consolidate their operating profits with losses of their controlled foreign subsidiaries for tax purposes. The opportunity to form such a fiscal group across borders is labeled *cross-border group taxation*. Other countries (e.g., Germany) limit the relative amount of interest payments that firms can deduct from their operating income for tax purposes. Thin capitalization rules limiting the tax deductibility of interest payments are labeled *interest limit*. Firms incorporated in these countries can only deduct interest expenses up to a pre-defined threshold, such as 30% of EBITDA in Germany.

This stylized fact points towards tax considerations during the setup of a business group.

Country-level control variables comprise GDP per capita, total GDP, the long-term interest rate and the short-term interest rate. The average company is incorporated in a country with an average GDP per capita of 35.990 EUR, a total GDP of 1.66tn EUR, a long-term government interest rate of 3.47%, and a short-term interest rate of 2.13%.

# 3 Buyouts and Tax Efficiency

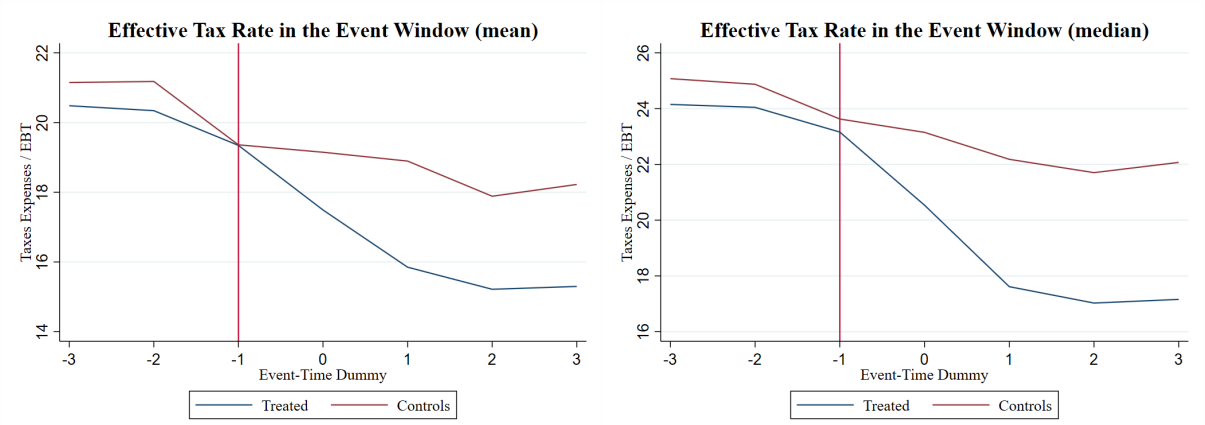
In this section, we estimate various models in a difference-in-differences setting. Our approach is similar to the individual-level analysis in Antoni et al. (2019). Our regression model takes the following form

$$Y_{it} = \alpha_i + \sum_{t=-3}^{T=3} \gamma_t D_{it} + Treated_i * \sum_{t=-3}^{T=3} \beta_t D_{it} + \epsilon_{it} \ , \tag{1}$$

where $Y_{it}$ denotes the outcome of interest. Firm fixed effects $\alpha_i$ are included in each specification. The event window for our analysis runs from $t = -3$ to $T = 3$ to fully capture the pre-trend and the time delay until firms implement tax planning strategies. $D_{it}$ are indicator variables equal to one for each event year $t$ and $Treated_i$ is an indicator variable equal to one for target firms. Subscripts $i$ and $t$ denote the company and event time, and $\epsilon_{it}$ is an error term. Additional controls are included in some specifications to underline the robustness of our results. In our setup, we are interested in the estimated coefficients on the interaction term $\beta_t$.

We begin by presenting evidence on target firm's tax efficiency after being acquired in a private equity transaction. The event window for our analysis runs from $t = -3$ to $t = 3$ to fully capture the pre-trend and the time delay until firms implement tax planning strategies. The main dependent variable is the target firm's effective tax rate which is defined as the total tax expenses divided by earnings before taxes in a given year.

**Figure 2: Effective Tax Rates around the Event**




**(a)** This figure shows the development of the mean effective tax rate (%) from event year $t = -3$ to event year $t = 3$ for both the treated firms and the control group. The red line at $t = -1$ indicates the time of the matching, which is one year prior to the deal.

**(b)** This figure shows the development of the median effective tax rate (%) from event year $t = -3$ to event year $t = 3$ for both the treated firms and the control group. The red line at $t = -1$ indicates the time of the matching, which is one year prior to the deal.

Lower effective tax rates decrease the share of pre-tax earnings for the tax authorities and thereby increases the share of distributable profits. As private equity investors aim at firm value maximization and can benefit from economies of scale and lower marginal costs of tax planning (Badertscher et al., 2013), we expect target firms to reduce their relative tax expenses after being acquired. We present our findings in two different ways. First, we analyze our results graphically. Second, we show that the effects are also statistically significant in our regression results as well as robust to using alternative measures and including control variables.

Figure 2 depicts our graphical analysis and contains two graphs. In both graphs, we show the average development of the effective tax rate over the event horizon for the treated as well as the control group. The red vertical line in $t = -1$ indicates the year in which the samples are matched one year prior to the acquisition. Figure 2a presents the development of the mean effective tax rate. Since the effective tax rate represents a ratio and is, therefore, susceptible to outliers, we also present our findings for the development

of the median in Figure 2b.

One crucial assumption for the validity of a difference-in-differences design is the common trend assumption. The pre-trend from $t = -3$ to $t = -1$, in which we should not see any effect, does not indicate any different development of the treated and control groups. Due to the outliers in the ETR, we see, unsurprisingly, that the median tax rate develops more smoothly over time than the mean. In both figures, we see that the event at $t = 0$ induces an immediate impact on the effective tax rate. However, the decrease of the effective tax rate for the treated firms seems to take at least one additional year to reach a stable level. This level for the treated group is about 2.5 percentage points below the one for the control group. Although making use of, e.g., tax deductions is possible retrospectively, we believe it is reasonable to assume that the full implementation of efficient tax strategies takes some time. In summary, our graphical analysis suggests that treated and control firms have roughly the same effective tax burden prior to the acquisition, while target firms decrease their effective tax rate by about 2.5 percentage points after the transaction.

Table 4 shows our regression results. The seven models present the difference-in-differences coefficients for the years prior to and after the acquisition. We choose $t = -1$ as the base year and, therefore, omit the coefficients. Models (1) to (3) show the results with the *Effective Tax Rate (ETR)* as dependent variable. We present three different specifications, one baseline model without control variables, another one including controls, and finally one with the outcome variable winsorized at 5 and 95%. For further robustness, we present Models (4) and (5) using the *3-year* and *5-year long-run ETR* as dependent variables that measure whether firms engage in sustainable tax avoidance strategies (Dyreng et al., 2008). In Models (6) and (7), *Log. EBT* and *Log. Tax Expenses* are used as outcomes. Control variables are selected in accordance with the literature on tax avoidance (e.g., Chen et al., 2010). They comprise log. total assets, leverage, the

## Table 4: Tax Efficiency around Private Equity Deals

This table presents estimation results for seven different models using a matched-sample difference-in-differences framework. The dependent variables are the *Effective Tax Rate (ETR)* for Models (1) to (3), the *3-year* and *5-year long-run ETR* for Models (4) and (5), and *Log. EBT* and *Log. Tax Expenses* for Models (6) and (7), respectively. Controls refer to log. total assets, leverage and cash ratios, the share of intangible and tangible assets, profitability (ROA), GDP per capita, GDP, and long- as well as short-term interest rates. In Models (6) and (7), log. total assets is excluded as a control. Standard errors are clustered at the firm-level and t-statistics are presented in parentheses.

| | Effective Tax Rate (ETR) | | | 3-year long-run ETR | 5-year long-run ETR | Log. EBT | Log. Tax Expenses |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Event (t=-3) * Treated | -0.70 | -0.37 | -0.52 | -0.85 | . | -4.07** | -4.72 |
| | (-1.08) | (-0.56) | (-1.47) | (-1.19) | | (-2.45) | (-1.13) |
| Event (t=-2) * Treated | -0.87 | -0.69 | -0.43 | . | | -1.32 | 0.27 |
| | (-1.41) | (-1.09) | (-1.33) | | | (-0.93) | (0.08) |
| Event (t=-1) * Treated | . | . | . | | | . | . |
| Event (t=0) * Treated | -1.60** | -1.57** | -1.38*** | | | 5.63*** | -4.20 |
| | (-2.49) | (-2.39) | (-4.11) | | | (3.59) | (-1.08) |
| Event (t=1) * Treated | -2.75*** | -2.39*** | -2.22*** | -2.52*** | | 9.13*** | -1.60 |
| | (-3.94) | (-3.31) | (-5.80) | (-2.82) | | (4.82) | (-0.33) |
| Event (t=2) * Treated | -2.35*** | -2.56*** | -2.41*** | -1.95** | -1.86 | 12.55*** | -12.32** |
| | (-3.12) | (-3.27) | (-5.74) | (-2.06) | (-1.42) | (5.85) | (-2.18) |
| Event (t=3) * Treated | -2.47*** | -2.52*** | -2.43*** | -0.81 | -2.25* | 20.40*** | -1.56 |
| | (-3.10) | (-3.05) | (-5.42) | (-0.80) | (-1.65) | (8.63) | (-0.24) |
| Winsorization | 1, 99 | 1, 99 | 5, 95 | 1, 99 | 1, 99 | 1, 99 | 1, 99 |
| Standard Errors | Cluster | Cluster | Cluster | Cluster | Cluster | Cluster | Cluster |
| Firm Fixed Effects | Y | Y | Y | Y | Y | Y | Y |
| Year Fixed Effects | | Y | Y | Y | Y | Y | Y |
| Controls | | Y | Y | Y | Y | Y | Y |
| adj. R2 | 0.00 | 0.01 | 0.02 | 0.01 | 0.01 | 0.25 | 0.06 |
| Observations | 131,061 | 125,211 | 125,211 | 77,508 | 36,992 | 92,097 | 99,228 |

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

share of intangible and tangible assets, cash ratio, profitability (ROA), GDP per capita, GDP, and long- as well as short-term interest rates. In the last two Models (6) and (7), log. total assets is omitted to avoid including bad controls. Standard errors are clustered at the firm-level throughout all models.

Models (1) to (3) present our results for the *ETR*. Our estimates indicate no statistically significant pre-trend. Treatment effects range from -1.60 to -1.38 percentage points in the year of the acquisition to -2.52 to -2.43 three years after. All coefficients are highly statistically significant. From the consistency of our estimates across all three models, we conclude that our findings are robust to the inclusion of control variables and different degrees of winsorization. Hence, we select Model (3) as our main specification for its higher precision. In Models (4) and (5), we use the *long-run ETRs* as dependent variables. Estimates are of similar magnitude as in the previous models, albeit exhibit lower statistical significance. Given the higher data requirements and the corresponding lower number of observations, the loss of statistical power is not surprising. Models (6) and (7) show our results for *Log. EBT* and *Log. Tax Expenses*. We observe a statistically significant pre-trend for log. EBT in $t = -3$, which can have two reasons. First, the matching might not be perfect, which is supported by the difference in asset growth rates by roughly 4 percentage points (see Table 2). Alternatively, it is very well possible that some of the many pre-trend coefficients that we estimate throughout the paper turn out to be significant by chance. After the treatment, log. EBT increases steadily until reaching a highly significant level of 20.40 percentage points in $t = 3$. Log. Tax Expenses stay mostly flat and are estimated as an insignificant -1.56 percentage points in the same year.

Our estimate for the effective tax rate supports our hypothesis that private equity firms introduce a higher degree of tax efficiency at the target firms. Relative to the unconditional sample mean (18.80), the decrease of 2.43 percentage points in $t = 3$

amounts to a decline in the ETR of 12.93%.[18] Interestingly, this decline is entirely driven by growth in pre-tax earnings. In the three years after the acquisition, earnings increase by roughly 20%, while absolute tax expenses remain constant. Therefore, tax authorities do not lose revenues in absolute terms. Taking an average of a 5-year holding period (Braun et al., 2017; Bain, 2019), average pre-tax earnings of 14.07m EUR from our profitable firm-year observations, and a reduction in the ETR of 2.43 percentage points allows us to make a back-of-the-envelope calculation for the tax loss. Multiplying these figures estimates the tax loss as roughly 1.71m EUR for each private equity transaction or 42.98bn EUR for the 25,029 European deals from Zephyr in the sample period.

We next conduct cross-sectional tests to support the notion that these effects are driven by private equity firms' higher level of tax sophistication. To that end, we split our sample based on four proxies for tax avoidance opportunities. *Tax Potential* indicates an above median gap between the target firm's ETR and the domestic corporate income tax in the year prior to the deal. A larger gap indicates more potential to increase tax efficiency for the sophisticated private equity investor. *Cross-border Group Tax* indicates whether target firms have access to regimes allowing the consolidation of profits with losses of foreign subsidiaries. Making use of these regimes is often complicated but potentially lowers firms' tax liability while keeping accounting profits constant, resulting in a reduced ETR (Rünger, 2019).[19] *Institutional Vendor* indicates whether the target firm was previously owned by other corporations rather than individuals. A lower share of institutional ownership is associated with lower tax efficiency and a lower level of tax

[18] Our baseline estimate is in the range of results in recent studies on the determinants of tax avoidance of public U.S. firms. Chen et al. (2019) exploit a discontinuity in the share of institutional ownership and report significant decreases of 2.7-3.7 percentage points. Cen et al. (2017) find decreases of 3 percentage points two years after firms establish close customer-supplier relationships.

[19] Group tax consolidation allows firms to form a fiscal group consisting of several separate legal entities that can pool profits and losses for tax purposes. Cross-border regimes allow target firms to consolidate pre-tax income with losses of affiliated firms in the same and other countries. As a result, pre-tax profits of target firms reported to the tax authorities (via the tax return) decrease leading to lower tax expenses. The profits in the financial accounting statements that we observe typically remain unaffected. Thus, the effective tax rate reported in the financial accounts decreases.

avoidance (Khan et al., 2017; Chen et al., 2019). Finally, *Public Target* indicates whether the target firm has been publicly listed at any point. Public firms already employ equity-based CEO contracts that incentivize managers to engage in tax planning and might, therefore, have less potential for additional tax avoidance (Desai and Dharmapala, 2006; Rego and Wilson, 2012).

We present the cross-sectional results in Table 5. The eight models present the *Post * Treated* difference-in-differences coefficient for the collapsed event years $t = 0$ to $t = 3$. The dependent variable is *Effective Tax Rate (ETR)* throughout all models. We use the baseline Model (3) of Table 4 and run separate tests on the sub-samples split by the four cross-sectional variables *Tax Potential*, *Cross-border Group Tax*, *Institutional Vendor*, and *Public Target*. We report the differences in our coefficient of interest below the sample splits based on untabulated auxiliary regressions to test the sample differences for statistical significance.

Models (1) and (2) show the treatment effect for target firms with above and below median *Tax Potential*. Low (high) tax-potential targets experience ETR declines of -0.96 (-2.91) percentage points after the acquisition, resulting in a statistically significant difference of -1.95. In Models (3) and (4), target firms incorporated in a legislation not allowing (allowing) for a *Cross-border Group Tax* are estimated to reduce their ETR by -1.23 (-3.05) percentage points The difference amounts to statistically significant -1.81. Models (5) and (6) present treatment coefficients for target firms sold by a corporation or private investors. Reductions in the ETR amount to -1.29 (-2.00) percentage points for corporate sellers (private sellers). The difference of -0.71 is not statistically significant. Finally, Models (7) and (8) show estimates for public and private target firms. Changes in the ETR are estimated to be -1.66 (-1.76) percentage points for public (private) targets. The respective difference of -0.10 is neither economically nor statistically meaningful.

Our finding that targets with a high tax potential reduce their ETR the most suggests

## Table 5: Determinants of Tax Efficiency around Private Equity Deals

This table presents estimation results for four different models using a matched-sample difference-in-differences and triple differences framework. The dependent variable is the *Effective Tax Tate (ETR)* throughout all models. Regression estimates are calculated for different sub-samples with splits according to the variables *Tax Potential, t=-1*, *Cross-border Group Tax*, *Inst. Vendor, t=-1*, and *Public Target, t=-1*. The differences across the sub-samples and their statistical significances are then computed in auxiliary regressions. Controls are the same as in the ETR Models (2) to (5) from Table 4. Standard errors are clustered at the firm-level and t-statistics are presented in parentheses.

| | Effective Tax Rate (ETR) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Tax Potential, t=-1 | | Cross-b. Group Tax | | Inst. Vendor, t=-1 | | Public Target, t=-1 | |
| | Low | High | Not Allowed | Allowed | Yes | No | Yes | No |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Post * Treated | -0.96*** | -2.91*** | -1.23*** | -3.05*** | -1.29*** | -2.00*** | -1.66** | -1.76*** |
| | (-2.63) | (-9.10) | (-4.36) | (-5.91) | (-3.36) | (-6.12) | (-2.09) | (-6.65) |
| Difference | -1.95*** | | -1.81*** | | -0.71 | | -0.10 | |
| | (-4.01) | | (-3.08) | | (-1.41) | | (-0.12) | |
| Winsorization | 5, 95 | 5, 95 | 5, 95 | 5, 95 | 5, 95 | 5, 95 | 5, 95 | 5, 95 |
| Standard Errors | Cluster | Cluster | Cluster | Cluster | Cluster | Cluster | Cluster | Cluster |
| Firm Fixed Effects | Y | Y | Y | Y | Y | Y | Y | Y |
| Year Fixed Effects | Y | Y | Y | Y | Y | Y | Y | Y |
| Controls | Y | Y | Y | Y | Y | Y | Y | Y |
| adj. R2 | 0.02 | 0.06 | 0.02 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 |
| Observations | 61,797 | 63,414 | 93,055 | 32,144 | 49,887 | 75,324 | 12,035 | 113,176 |

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

that private equity firms have the biggest effect in firms with low levels of pre-deal tax planning. The stronger ETR effects when cross-border group taxation regimes are available indicate that private equity investors help firms implement complex international tax planning schemes. This finding is plausible as similar schemes might already exist at other portfolio firms advised by the private equity firm's same tax lawyers or managed by its central tax department. Our evidence does not support the claim that private equity firms induce higher tax efficiency in target firms previously held by non-corporate entities. Although the estimated difference coefficient exhibits the expected negative sign, it is not statistically significant. We further do not find stronger effects in private targets than public ones. However, given the low number of public-to-private buyouts in our sample, this finding might be a result of the low statistical power in our model.

# 4 Buyouts and Tax Base

In this section, we investigate two alternative channels through which target firms can engage in tax avoidance. In addition to the baseline empirical strategy, we estimate various models in a triple-differences setting. Our approach is similar as in Antoni et al. (2019). The regression model takes the following form

$$Y_{it} = \alpha_i + \sum_{t=-3}^{T=3} \gamma_t D_{it} + Treated_i * \sum_{t=-3}^{T=3} \beta_t D_{it} + Char_i * \sum_{t=-3}^{T=3} \delta_t D_{it} + Treated_i * Char_i * \sum_{t=-3}^{T=3} \theta_t D_{it} + \epsilon_{it} \quad (2)$$

with the same notation as in Equation 1. In addition to the previous model, this specification includes interaction terms with $Char_i$ denoting a firm-specific characteristic. In this setup, we are interested in the estimated coefficients on the last interaction term $\theta_t$. Again, most models include year fixed effects as well as firm- and country-level control

variables. Standard errors are clustered at the firm-level throughout all models.

## 4.1 Profit Shifting

First, we look at the profit shifting channel. Target firms can engage in intra-group trade if they are part of a group of firms with subsidiaries in multiple countries. Since international tax law grants firms some leeway in determining and documenting the pricing of internal transactions, firms can shift profits into low-tax countries and thereby reduce the overall tax bill (Huizinga and Laeven, 2008). Transfer pricing strategies relocate the tax base and do not necessarily show up in the effective tax rate of individual target firms because they reduce pre-tax profits in high-tax countries while tax expenses are still proportional to the applicable tax rate. Identifying such conforming tax avoidance thus requires to look at outcomes other than the effective tax rate.

In the first part of our analysis, we follow the profit shifting literature (e.g., De Simone, 2016) and test whether our target firms report lower pre-tax earnings if profit shifting opportunities exist. We use the target or acquirer firms' corporate ownership structure one year prior to the deal to proxy for these profit shifting opportunities.[20] In particular, we construct five variables. First, tax differential (*Tax Differential*) is similar to the tax incentive variable developed by Huizinga and Laeven (2008) and should capture the benefits from shifting profits out of the firm's jurisdiction. Then, *Foreign Subsidiary* and *Domestic Subsidiary* indicate the existence of foreign or domestic-only subsidiaries, respectively. While the former is a prerequisite to engage in tax-motivated intra-group trade across national borders, the latter serves as a placebo outcome capturing inorganic growth. Last, we study *Haven EU* and *Haven* as both anecdotal and empirical evidence suggest that multinational firms use tax haven subsidiaries to shift profits from high to low-tax jurisdictions (Hines and Rice, 1994; Bennedsen and Zeume, 2018).[21]

[20] Figure A-1 details the computation of these measures.

[21] The Wall Street Journal (2018) asserts that "multinational companies shift about 40% of the profits

## Table 6: Profit Shifting using Pre-Deal Opportunities

This table presents estimation results for five different models using a triple-differences framework. The dependent variable is *Log. EBT* throughout all models. Panel A and B present results when using the baseline Model (6) of Table 4 and interacting the *Event* (*Event * Treated*) dummies with the variables *Target (Acquirer) Tax Differential, t=-1*, *Target (Acquirer) Foreign Subsidiary, t=-1*, *Target (Acquirer) Domestic Subsidiary, t=-1*, *Target (Acquirer) Haven EU, t=-1*, and *Target (Acquirer) Haven, t=-1* on the target and the acquirer level, respectively. Only the coefficients of *Event * Treated* and their respective interactions in $t = 3$ are shown to conserve space. Controls are the same as in the EBT Model (6) of Table 4. Standard errors are clustered at the firm-level and t-statistics are presented in parentheses.

| | Log. EBT | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| *Panel A: Pre-Deal Target Profit Shifting Opportunities* | | | | | |
| Event (t=3) * Treated | 24.47*** | 25.97*** | 24.62*** | 23.37*** | 22.99*** |
| | (8.40) | (8.37) | (7.95) | (8.41) | (8.18) |
| * T. Tax Diff., t=-1 | -0.86* | | | | |
| | (-1.70) | | | | |
| * T. Foreign Sub., t=-1 | | -15.42** | | | |
| | | (-2.39) | | | |
| * T. Dom. Sub., t=-1 | | | -7.22 | | |
| | | | (-1.14) | | |
| * T. Haven EU, t=-1 | | | | -14.80 | |
| | | | | (-1.11) | |
| * T. Haven, t=-1 | | | | | -8.03 |
| | | | | | (-0.69) |
| adj. R2 | 0.26 | 0.26 | 0.25 | 0.25 | 0.25 |
| Observations | 71,052 | 71,052 | 71,052 | 71,052 | 71,052 |
| *Panel B: Pre-Deal Acquirer Group Profit Shifting Opportunities* | | | | | |
| Event (t=3) * Treated | 25.14*** | 25.44*** | 22.81*** | 24.58*** | 24.76*** |
| | (6.79) | (6.43) | (6.49) | (6.66) | (6.87) |
| * A. Tax Diff., t=-1 | -0.32 | | | | |
| | (-1.34) | | | | |
| * A. Foreign Sub., t=-1 | | -7.59 | | | |
| | | (-1.14) | | | |
| * A. Dom. Sub., t=-1 | | | -0.80 | | |
| | | | (-0.10) | | |
| * A. Haven EU, t=-1 | | | | -6.89 | |
| | | | | (-0.94) | |
| * A. Haven, t=-1 | | | | | -10.40 |
| | | | | | (-1.35) |
| adj. R2 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 |
| Observations | 54,664 | 54,664 | 54,664 | 54,664 | 54,664 |

they earn outside their home countries into tax havens [...]".

**Table 6: Profit Shifting using Pre-Deal Opportunities** (continued)

| | | | | | |
|---|---|---|---|---|---|
| Winsorization | 1, 99 | 1, 99 | 1, 99 | 1, 99 | 1, 99 |
| Standard Errors | Cluster | Cluster | Cluster | Cluster | Cluster |
| Firm Fixed Effects | Y | Y | Y | Y | Y |
| Year Fixed Effects | Y | Y | Y | Y | Y |
| Controls | Y | Y | Y | Y | Y |

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

Table 6 presents the results when extending the baseline *Log. EBT* Model (6) of Table 4 based on Equation 2. We report the baseline coefficient of interest, *Event * Treated*, in year $t = 3$ and the corresponding triple-interaction effects of the different profit shifting opportunities in Models (1), (2), (4), and (5). In Model (3), we use *Domestic Subsidiary* as the interaction variable that indicates whether the firm has at least one domestic but no foreign subsidiary. Panel A presents the interaction variables of the target (and control) firms' pre-deal profit shifting opportunities. In Panel B, the analysis is based on the acquirer's pre-deal profit shifting opportunities.

Model (1) presents triple differences coefficients for the target (acquirer) firm's *Tax Differential*. The estimates show that a 1 percentage point increase in tax differential decreases the target firm's earnings' growth by 0.86 percentage points (0.32). Only the effect from the target tax differential is statistically significant. In Models (2) and (3), we estimate the triple interaction with a dummy variable indicating the ownership of at least one *Foreign* or exclusively *Domestic Subsidiaries*, respectively. Only the target firm's ownership of a foreign subsidiary has a significant interaction effect of -15.42 percentage points. Models (4) and (5) present the results for the ownership of a *(EU) Tax Haven* subsidiary. All four coefficients from the target and the acquirer's ownership structure are negative with effects ranging from -14.80 to -6.89 percentage points. However, none of these estimates are statistically significant.

As expected, all estimated coefficients on existing profit shifting opportunities are neg-

ative. Despite slight differences in the methodology, the point estimate on tax differential of almost -1.00 is in the range of the baseline result estimated by Huizinga and Laeven (2008). In line with our hypothesis, the ownership of a foreign subsidiary is strongly related to lower pre-tax earnings growth after the acquisition. The weak and insignificant results on the ownership of domestic subsidiaries further strengthens the claim that we are not picking up mechanical effects from belonging to a business group. Unfortunately, we only have few firms with a tax haven subsidiary in our sample, reducing statistical power in these models. In most models, results are stronger for the target firm's business group. This finding seems reasonable since any profit shifting conducted within the acquirer's group would be limited by the holding period of the target firm. Concluding, our results suggest that target firms use the existing business group structure to engage more heavily in profit shifting after the acquisition.

In the second part of the analysis, we test whether profit shifting opportunities at target firms change after a private equity buyout. To that end, we use the same set of five constructed ownership variables from the previous analysis in a difference-in-differences design. Unlike before, these variables are no longer fixed in $t = -1$ but are allowed to vary over time. As lowering the tax bill by shifting profits to low-tax and tax haven countries can increase firm value, we expect positive treatment effects on these profit shifting opportunities after the buyout. Prior to the acquisitions, firms might not have used such strategies due to the relatively high setup costs (Gumpert et al., 2016).

In Table 7, we study post-deal changes in profit shifting opportunities as measured by the tax differential and the likelihood to set up subsidiaries in foreign and tax haven countries. The coefficients are estimated in a difference-in-differences design and only the treatment effects are reported. Event time $t = -1$ is chosen as the base year and the coefficients are, therefore, omitted. We use the time-varying target-level dependent variables *Tax Differential*, *Foreign Subsidiary*, *Domestic Subsidiary*, *Haven EU*, and *Haven*

**Table 7: Creating Profit Shifting Opportunities**

This table presents estimation results for five different models using a matched-sample difference-in-differences framework. The dependent variables are *Target Tax Differential*, *Target Foreign Subsidiary*, *Target Domestic Subsidiary*, *Target Haven EU*, and *Target Haven* for Models (1) to (5), respectively. Controls are the same as in the EBT Model (6) from Table 4. Standard errors are clustered at the firm-level and t-statistics are presented in parentheses.

| | T. Tax Diff. | T. Foreign Sub. | T. Dom. Sub. | T. Haven EU | T. Haven |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Event (t=-3) * Treated | -0.09 | 0.61 | -0.36 | -0.44 | -0.10 |
| | (-1.43) | (1.24) | (-0.62) | (-1.36) | (-0.34) |
| Event (t=-2) * Treated | -0.05 | 0.38 | 0.50 | 0.02 | -0.12 |
| | (-1.12) | (1.05) | (1.18) | (0.09) | (-0.57) |
| Event (t=-1) * Treated | . | . | . | . | . |
| Event (t=0) * Treated | 0.28*** | 3.41*** | 0.12 | 0.54** | 0.82*** |
| | (6.40) | (9.77) | (0.28) | (2.25) | (3.93) |
| Event (t=1) * Treated | 0.44*** | 6.32*** | 0.38 | 0.88*** | 1.24*** |
| | (7.53) | (13.22) | (0.68) | (2.82) | (4.35) |
| Event (t=2) * Treated | 0.63*** | 8.81*** | -0.30 | 1.05*** | 2.01*** |
| | (9.20) | (15.56) | (-0.45) | (2.85) | (5.84) |
| Event (t=3) * Treated | 0.97*** | 11.72*** | -0.88 | 1.26*** | 2.91*** |
| | (11.99) | (18.18) | (-1.17) | (3.05) | (7.25) |
| Winsorization | . | . | . | . | . |
| Standard Errors | Cluster | Cluster | Cluster | Cluster | Cluster |
| Firm Fixed Effects | Y | Y | Y | Y | Y |
| Year Fixed Effects | Y | Y | Y | Y | Y |
| Controls | Y | Y | Y | Y | Y |
| adj. R2 | 0.04 | 0.05 | 0.01 | 0.00 | 0.02 |
| Observations | 103,662 | 103,662 | 103,662 | 103,662 | 103,662 |

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

for target and control firms in Models (1) to (5), respectively. Except for *Tax Differential*, which is continuous, these outcome measures are dummy variables. Models (2) to (5) can thus be interpreted as linear probability models. Control variables are the same as in Model (6) from Table 4. Standard errors are clustered at the firm-level throughout all models.

All estimated models present statistically insignificant pre-trends. Model (1) shows that the target firm's *Tax Differential* increases steadily after the acquisition reaching 0.97 percentage points in $t = 3$. In Models (2) and (3), the probabilities of having *Foreign*

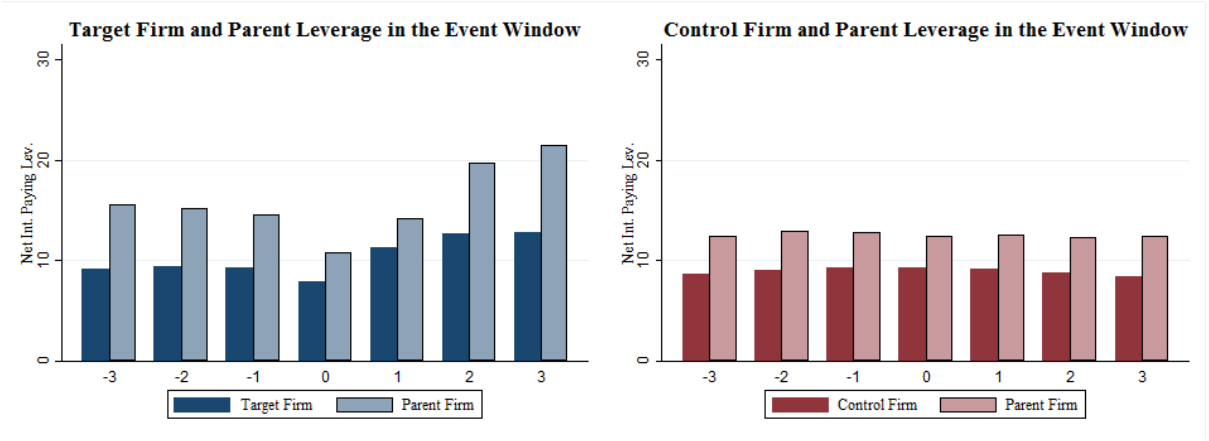
or exclusively *Domestic Subsidiaries* are estimated. Treated firms are 11.72% (-0.88) more likely to have a foreign (domestic) subsidiary after three years. Coefficients on the likelihood of owning a foreign subsidiary are all significant, while the change in domestic subsidiary ownership is never significant. Models (4) and (5) show the treatment effects for the probability of owning at least one *(EU) Tax Haven* subsidiary. The likelihood of owning a (EU) tax haven subsidiary increases for target firms by 2.91% (1.26) relative to the control group. All these effects are highly statistically significant.

In line with our expectations, all coefficients on the creation of profit shifting opportunities are positive. In relative terms, the average treated firm increases its tax differential by 54.80% (0.97 / 1.77) and the likelihood of having a foreign, EU tax haven, or international tax haven subsidiary by 53.93% (11.72 / 21.73), 20.32% (1.26 / 6.20), and 57.85% (2.91 / 5.03), respectively. These findings could indicate that these business groups serve a profit shifting motive but might also represent mere expansions. However, the non-results on domestic subsidiaries suggest that the creation of business groups is focused on foreign countries, consistent with more profit shifting activity. Further, the increase of on average almost 1 percentage points in tax differential suggests that most of these subsidiaries are likely not founded (or acquired) in some of the largest European economies, such as Germany, France, Italy, or Spain, as all these countries have high corporate income tax rates. Therefore, we conclude that private equity firms do not just use but also create profit shifting opportunities in their targets.

## 4.2 Leverage

One important feature of private equity deals, which are often labeled as leveraged buyouts, is the increase in financial leverage (Kaplan and Strömberg, 2009). Higher corporate debt increases the value of a firm's tax shield because interest payments are tax deductible (Miller, 1977). These effects do not show up in the effective tax rate because the interest

**Figure 3: Target Firm and Parent Leverage around the Event**




**(a)** This figure shows the development of the net interest paying leverage ratio (%) from event year $t = -3$ to event year $t = 3$ for both the treated target firms and their direct parent firms.

**(b)** This figure shows the development of the net interest paying leverage ratio (%) from event year $t = -3$ to event year $t = 3$ for both the matched control firms and their direct parent firms.

payments are deducted from the income tax base. Therefore, this sub-section investigates the effect that private equity transactions have on the leverage of target companies. Most transactions in our sample (roughly 80%) occur in a country that allows for domestic group taxation (or fiscal consolidation). This regulation allows firms to accumulate debt in financial vehicles and settle interest payments with operating profits of other affiliates of the business group for tax purposes. Such strategies counteract any direct leverage effect at the target firm-level. Therefore, we also analyze the leverage of a firm's direct parent defined as the corporation directly owning more than 50% of the target company. Such parent holding companies often take on debt which, for tax purposes, is netted with operating profits of the target firm through so-called "debt-pushdowns" (Lamon, 2005). Since we are interested in the tax-deductible portion of debt, we analyze net interest paying leverage as our main dependent variable on the target as well as the direct parent level.

Figure 3 presents our graphical analysis and contains two graphs. In these graphs, we

show the average development of both the target's and the direct parent's net interest paying leverage over the event horizon for the treated as well as the control group. The darker blue and red colors depict the values for the target and its direct parent, respectively. Figure 3a presents the development of the two variables for the treated firms and Figure 3b for the control firms.

The pre-trend from $t = -3$ to $t = -1$, in which we should not see any effect, does not indicate any different development of the treated and control groups for both leverage variables. Whereas the control firms' and parents' leverage remains relatively constant over all years, we see that the event at $t = 0$ induces an immediate effect on the treated firms. Leverage declines at treated firms (and their parents) by about 1 (2.5) percentage points in $t = 0$ before increasing to values roughly 5 (9) percentage points higher than pre-treatment levels in $t = 3$. This initial decline can be explained with a financial restructuring taking place at the targets during the event year. The later rise is in line with our expectation that private equity firms establish higher leverage ratios after the buyout.

Table 8 shows our regression results. The four models present the difference-in-differences coefficients for the years prior to and after the acquisition. We choose $t = -1$ as the base year and, therefore, omit the coefficients. Models (1) and (2) show the results with *Net Interest Paying Leverage* as dependent variable. We present two different specifications, one baseline model without control variables and another one including controls. In Models (3) and (4), *Parent Net Interest Paying Leverage* is used as outcome with the same two specifications. Control variables comprise the share of intangible and tangible assets, ROA, GDP per capita, GDP, and long- as well as short-term interest rates. The dependent variables are winsorized at the 1 and 99% level. Standard errors are clustered at the firm-level throughout all models.

Models (1) and (2) present our results for *Net Interest Paying Leverage*. Our esti-

**Table 8: Leverage around Private Equity Deals**

This table presents estimation results for four different models using a matched-sample difference-in-differences framework. The dependent variables in Models (1) and (2) as well as (3) and (4) are *Net Interest Paying Leverage* and *Parent Net Interest Paying Leverage*, respectively. Controls refer to the share of intangible and tangible assets, profitability (ROA), GDP per capita, GDP, and long- as well as short-term interest rates. Standard errors are clustered at the firm-level and t-statistics are presented in parentheses.

| | Net Int. Paying Lev. | | P. Net Int. Paying Lev. | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Event (t=-3) * Treated | 0.24 | -0.32 | 0.32 | -0.15 |
| | (0.68) | (-0.96) | (0.50) | (-0.23) |
| Event (t=-2) * Treated | 0.20 | -0.17 | 0.12 | -0.17 |
| | (0.73) | (-0.62) | (0.24) | (-0.35) |
| Event (t=-2) * Treated | . | . | . | . |
| Event (t=0) * Treated | -1.12*** | -0.99*** | -2.64*** | -2.56*** |
| | (-3.55) | (-3.27) | (-4.67) | (-4.53) |
| Event (t=1) * Treated | 2.23*** | 1.93*** | 1.09 | 1.02 |
| | (5.64) | (5.01) | (1.51) | (1.41) |
| Event (t=2) * Treated | 4.45*** | 3.98*** | 6.89*** | 6.95*** |
| | (9.76) | (8.87) | (8.47) | (8.38) |
| Event (t=3) * Treated | 5.03*** | 4.79*** | 8.60*** | 8.92*** |
| | (9.87) | (9.52) | (9.75) | (9.94) |
| Winsorization | 1, 99 | 1, 99 | 1, 99 | 1, 99 |
| Standard Errors | Cluster | Cluster | Cluster | Cluster |
| Firm Fixed Effects | Y | Y | Y | Y |
| Year Fixed Effects | | Y | | Y |
| Controls | | Y | | Y |
| adj. R2 | 0.01 | 0.08 | 0.01 | 0.03 |
| Observations | 120,141 | 115,275 | 58,560 | 56,068 |

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

mates indicate no statistically significant pre-trend. Treatment effects are -1.12 and -0.99 percentage points in the year of the acquisition and 4.79 to 5.03 three years after. All coefficients are highly statistically significant. From the consistency of our estimates, we conclude that our findings are robust to the inclusion of control variables. In Models (3) and (4), we use *Parent Net Interest Paying Leverage* as dependent variable. These models exhibit fewer observations because ownership and parent financial information are not always available. Estimates are roughly two times larger than in the two previous models. In the year of the acquisition, treatment effects amount to -2.64 and -2.56

percentage points. Three years later, these effects increase to highly significant 8.60 and 8.92 percentage points. Given the consistency of our results, we again conclude that the inclusion of control variables does not alter our results.

Our estimates clearly show an event-induced increase in financial leverage at the target firms. The overall increase in target firms' net interest paying leverage amounts to about 4.8 percentage points. This rise from the sample mean of roughly 9.5 to 14.3% translates into a relative increase of about 50% to pre-treatment levels. For the target firms' parents, leverage rises from about 14.3 to 22.2%, representing a relative increase of 63%. With a combined post-deal leverage of roughly 36.5%, our results are far off from the leverage ratios of 60-90% stipulated in Kaplan and Strömberg (2009). Our findings are more in line with the target leverage ratio of 55% surveyed in a later study by Gompers et al. (2016). It is possible that more recent private equity transactions are less focused on the use of debt. Besides, we look at net interest-bearing debt instead of overall leverage, which lowers our estimates in comparison. Adding the average cash ratio of 13.7% already provides an estimate of 50.2%, which is more in line with the previous literature. Our results further represent a lower bound since some of the leverage might be taken on by other firms in the business group, such as sister companies or minority parents. Summarizing, target firms increase their financial leverage after the buyout and governments are, therefore, likely to lose tax revenues through the increase in corporate debt. However, from these results we cannot unambiguously infer that private equity firms implement this leverage with the primary purpose of avoiding taxes.

Several theories on capital structure explain the use of financial leverage. Traditional trade-off theory (Miller, 1977) only offers one possible explanation next to alternatives, such as the pecking order theory (Myers and Majluf, 1984) or the free cash flow hypothesis (Jensen, 1986). While Heider and Ljungqvist (2015) and Faulkender and Smith (2016) confirm trade-off theory for stand-alone firms, Axelson et al. (2013) argue that credit

conditions are the main driver of private equity buyout leverage. We use our European setting and the cross-country heterogeneity to analyze whether tax considerations are a major motive for leveraged buyouts. We argue that leverage increases after the acquisition should be higher whenever the tax-benefit of debt is greater. To that end, we look at three country-level variables that should affect the value of interest tax shields: the corporate income tax rate, the availability of cross-border group taxation, and thin capitalization rules. Higher corporate taxes increase the appeal of the interest deductibility because the benefit of shielding income from taxation is larger. Cross-border group taxation regimes allow the deduction of interest payments not only from the levered firm's profits but also from its subsidiaries' profits, either located in the same or in other countries. Thin capitalization rules limit the amount of interest that can be deducted from pre-tax earnings and thereby reduce the value of the tax shield of debt. We, therefore, hypothesize that leverage should be higher in high-tax countries and those that allow for cross-border group taxation, while it should be lower in countries that implement interest limitations.

Table 9 presents the results of our triple differences regressions. We extend our baseline results from Table 8 in accordance with Equation 2. Panel A shows the results for the dependent variable *Net Interest Paying Leverage* and Panel B for *Parent Net Interest Paying Leverage*. We report the baseline coefficient of interest *Event * Treated* in year $t = 3$ and the corresponding triple-interaction effects of the tax regulation variables *Tax Rate*, *Cross-border Group Tax*, and *Interest Limitations* in Models (1), (2), and (3), respectively. Control variables, winsorization levels, and standard error clustering are the same as in the previous leverage models.

Model (1) presents triple differences coefficients for the corporate income *Tax Rate*. The estimates show that a 1 percentage point increase in the corporate tax rate decreases a target firm's (parent's) leverage by 0.09 (0.27) percentage points. Of these estimates, only the second one is marginally significant at the 10% level. In Model (2), the treated

**Table 9: Determinants of Leverage around Private Equity Deals**

This table presents estimation results for three different models using a triple differences framework. In Panel A and B, the dependent variables are the target firm's (parent's) *(Parent) Net Interest Paying Leverage* The triple interaction variables are *Target Tax Rate*, *Target Cross-border Group Tax*, and *Target Interest Limitations* in Panel A and *Parent Tax Rate*, *Parent Cross-border Group Tax*, and *Parent Interest Limitations* in Panel B. Only the coefficients of *Event * Treated* and the interactions in $t = 3$ are shown to conserve space. Controls are the same as in the leverage Models (2) and (4) from Table 8. Standard errors are clustered at the firm-level and t-statistics are presented in parentheses.

| *Panel A* | Net Int. Paying Lev. | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| Event (t=3) * Treated | 7.34*** | 3.97*** | 4.66*** |
| | (2.68) | (7.20) | (7.26) |
| * T. Tax Rate | -0.09 | | |
| | (-0.98) | | |
| * T. Cross-b. Group Tax | | 2.90** | |
| | | (2.44) | |
| * T. Interest Lim. | | | 0.34 |
| | | | (0.39) |
| adj. R2 | 0.08 | 0.08 | 0.08 |
| Observations | 115,275 | 115,269 | 115,264 |
| *Panel B* | P. Net Int. Paying Lev. | | |
| | (1) | (2) | (3) |
| Event (t=3) * Treated | 16.86*** | 6.37*** | 10.49*** |
| | (3.46) | (6.49) | (9.25) |
| * P. Tax Rate | -0.27* | | |
| | (-1.71) | | |
| * P. Cross-b. Group Tax | | 8.61*** | |
| | | (4.18) | |
| * P. Interest Lim. | | | -4.05*** |
| | | | (-2.74) |
| adj. R2 | 0.03 | 0.03 | 0.03 |
| Observations | 56,068 | 56,068 | 56,068 |
| Winsorization | 1, 99 | 1, 99 | 1, 99 |
| Standard Errors | Cluster | Cluster | Cluster |
| Firm Fixed Effects | Y | Y | Y |
| Year Fixed Effects | Y | Y | Y |
| Controls | Y | Y | Y |

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

firms' (parents') leverage increase is interacted with the availability to engage in *Cross-border Group Taxation*. Both coefficients are statistically significant and amount to 2.90

and 8.61 percentage points. Model (3) shows the results for *Interest Limitations*. Target firms' leverage is 0.34 percentage points higher and parents' leverage is -4.05 percentage points lower in countries limiting the deductibility of interest. Only the second coefficient is statistically significant.

Our findings provide novel evidence on the relationship between leverage in private equity buyouts and tax incentives. Inconsistent with our hypotheses, we do not find that higher tax rates are related to more post-buyout leverage at the target firms. However, our findings on cross-border group taxation indicate that private equity firms exploit local tax regulation in their capital structure decision. This is in line with our hypotheses and the survey results of Gompers et al. (2016), in which roughly two-thirds of private equity investors say that they consider tax benefits when deciding on optimal leverage. In particular, the strong results on parent leverage hint at the use of debt-pushdown strategies for international buyouts. Further, our results suggest that interest limitation rules help regulators to cap the use of debt in private equity deals. The negative effect on parent leverage is again in line with our hypotheses. Summarizing, our results show that some country-specific tax regulations are relevant for the private equity firm's optimal capital structure decision. However, in light of the mixed results, we conclude that tax considerations are not the primary driver of buyout leverage.

# 5 Real Effects

In this section, we use a two-step methodology to split target firms based on their predicted tax savings and then investigate the asset and employment growth as well as firm-level productivity within the resulting sub-samples. At first, we run a predictive Ordinary Least Squares (OLS) regression to identify which transactions are likely to be tax deals (i.e., high tax avoidance deals). We use only ex-ante variables and make no causal

claims about the relation of these predictor variables to the outcome of interest. Since we only care about predictive power, we include many potential predictors amounting to a total of 21 firm-level and macroeconomic variables. These variables are the ETR, ROA, cash ratio, 3-year log. asset growth, log. total assets, leverage and (in)tangible asset ratios, tax potential, cross-border group taxation, institutional vendor, and public target as well as their squared term when meaningful. The regression model takes the following form

$$\begin{aligned} Y_{it} = \alpha_i + \gamma * After_{it} + \beta * Treated_i * After_{it} \\ + \sum_f \delta^f * Char_i^f * Treated_i + \sum_f \theta^f * Char_i^f * Treated_i * After_{it} + \epsilon_{it} \end{aligned} \quad (3)$$

where $Y_{it}$ denotes the effective tax rate and $\alpha_i$ firm fixed effects. $After_{it}$ is a dummy variable equaling 1 if event time $t \geq 0$ and $Treated$ is a time-invariant indicator variable for target firms. Pre-deal firm characteristics are included via $Char_i^f$. Subscript $i$ is unique for each firm. In total, $f$ different characteristics are included in the regression. We then calculate a score for each firm based on our prediction, $S_i = \sum_f \hat{\theta}^f * Char_i^f$. This score summarizes the predicted level of tax avoidance based on the observable characteristics and later serves as our splitting variable for tax and no tax deals.

In the second step, we use the splitting variable $S_i$ to analyze different sub-samples. The regression model of Equation 3 simplifies to

$$Y_{it} = \alpha_i + \gamma * After_{it} + \beta * Treated_i * After_{it} + \epsilon_{it} \quad (4)$$

with $Y_{it}$ now denoting the outcome measures effective tax rate, log. asset growth, log. employment growth, and total factor productivity (TFP).[22] The coefficient of interest is

[22]In untabulated tests, we use a different definition of total factor productivity computed via an index approach where productivity is the logarithm of sales less the logarithm of total assets and the logarithm of the number of employees or employee expenses (see, e.g., Syverson, 2011). We obtain almost identical

$\beta$. We analyze regression models for sub-samples that are split according to the median as well as the lowest and highest quartiles of $S_i$.

Table 10 presents the results for eight regression models in a difference-in-differences framework. The eight models present the *Post * Treated* difference-in-differences coefficient for the collapsed event years $t = 0$ to $t = 3$. The dependent variables are *ETR*, *Log. Asset Growth*, *Log. Employment Growth*, and *TFP*. Models (1), (3), (5), and (7) present the results for the sub-sample of no tax deals and Models (2), (4), (6), and (8) the results for tax deals. We report the differences in our coefficient of interest below the sample splits based on untabulated auxiliary regressions to test the sample differences for statistical significance. Panel A shows the estimates for a median split on $S_i$ and Panel B for the lowest and highest quartiles. While the effective tax rate is winsorized at the 5 and 95% level, the other three dependent variables are winsorized at the 1 and 99% level. All models include firm and year fixed effects and standard errors are clustered at the firm-level.

Models (1) and (2) show the treatment effect on the *ETR* for target firms split according to the median and quartile cutoffs of their expected tax avoidance. Unsurprisingly, high (low) tax deals exhibit coefficients of -3.14 (-0.20) and -4.12 (0.49) percentage points for median and quartile cutoffs, respectively. The highly significant difference estimates of -2.93 and -4.61 show that the sample split fulfills its purpose and that our OLS prediction is successful. We also considered using a machine learning approach, such as lasso regularization, for prediction. However, given our sample with $n >> p$ and clearly defined predictors from the literature, we refrained from using more complicated models. In Models (3) and (4), we see that *Log. Asset Growth* is significantly lower in tax deals with coefficients of -2.56 (-3.85) percentage points for median (quartile) cutoffs. Models (5) and (6) show differences in *Log. Employment Growth* that are less pronounced and

results.

## Table 10: Real Effects of Private Equity Deals

This table presents estimation results for eight models using a matched-sample difference-in-differences and triple differences framework. The dependent variables are *Effective Tax Rate (ETR)* for Models (1) and (2), *Log. Asset Growth* for Models (3) and (4), *Log. Employment Growth* for Models (5) and (6), and *TFP* for Models (7) and (8). Regression estimates are calculated for different sub-samples with splits according to the median and quartile cutoffs of the predicted score variable $S_i$. The differences across the sub-samples and their statistical significances are then computed in auxiliary regressions. Panels A and B present the results for the median and quartile cutoffs, respectively. Standard errors are clustered at the firm-level and t-statistics are presented in parentheses.

| | ETR | | Log. Asset Growth | | Log. Employment Growth | | TFP | |
|---|---|---|---|---|---|---|---|---|
| | Increase in Tax Efficiency after Deal | | | | | | | |
| | Low | High | Low | High | Low | High | Low | High |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *Panel A: Median Cutoff* | | | | | | | | |
| Post * Treated | -0.20 | -3.14*** | 6.02*** | 3.46*** | 0.33 | -0.01 | -1.41 | -7.05*** |
| | (-0.56) | (-10.03) | (11.18) | (6.89) | (0.70) | (-0.03) | (-0.91) | (-5.36) |
| Difference | -2.93*** | | -2.56*** | | -0.34 | | -5.65*** | |
| | (-6.11) | | (-3.48) | | (-0.56) | | (-2.79) | |
| adj. R2 | 0.00 | 0.04 | 0.03 | 0.06 | 0.03 | 0.03 | 0.00 | 0.01 |
| Observations | 64,911 | 65,463 | 66,509 | 66,371 | 53,026 | 57,489 | 52,422 | 55,721 |

**Table 10: Real Effects of Private Equity Deals** (continued)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| *Panel B: Quartile Cutoff* | | | | | | | | |
| Post * Treated | 0.49 | -4.12*** | 7.23*** | 3.38*** | 1.44** | -0.24 | 0.06 | -8.63*** |
| | (0.93) | (-9.31) | (8.90) | (4.53) | (1.98) | (-0.43) | (0.02) | (-4.84) |
| Difference | -4.61*** | | -3.85*** | | -1.68* | | -8.69*** | |
| | (-6.69) | | (-3.49) | | (-1.83) | | (-2.87) | |
| adj. R2 | 0.01 | 0.05 | 0.03 | 0.07 | 0.03 | 0.03 | 0.00 | 0.02 |
| Observations | 32,229 | 32,651 | 33,247 | 33,085 | 25,603 | 28,969 | 25,399 | 27,788 |
| Winsorization | 5, 95 | 5, 95 | 1, 99 | 1, 99 | 1, 99 | 1, 99 | 1, 99 | 1, 99 |
| Standard Errors | Cluster | Cluster | Cluster | Cluster | Cluster | Cluster | Cluster | Cluster |
| Firm Fixed Effects | Y | Y | Y | Y | Y | Y | Y | Y |
| Year Fixed Effects | Y | Y | Y | Y | Y | Y | Y | Y |

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

amount to -0.34 (-1.68) percentage points for both cutoffs. Only the coefficient from the quartile cutoff turns out statistically significant at the 10% level. Results from Models (7) and (8) for *TFP* are again significantly lower for high tax deals with difference coefficients of -5.65 (-8.69) percentage points for the median (quartile) cutoffs.

Our results show that private equity transactions are generally followed by higher asset growth, flat employment growth, and a decline in productivity. These findings are in line with the previous empirical literature on growth (Boucly et al., 2011) and employment (Davis et al., 2014). We add to this literature by showing that these effects depend on the operational and financial strategies implemented by the private equity firm after the deal. In particular, we show that deals followed by high tax avoidance are associated with lower asset and productivity growth compared to low tax avoidance deals. We acknowledge that these associations might not be causal relationships. In particular, unobservable deal characteristics might introduce a systematic correlation between higher tax avoidance and lower investment opportunities. We believe that our evidence can best be interpreted as different motives in private equity transactions leading to divergent economic outcomes. Deals inducing higher tax efficiency seem to fall under the general private equity strategy of cost-cutting and financial engineering, while growth-oriented private equity investors seem to focus less on tax avoidance.

# 6 Robustness

This section covers additional robustness tests for our main analysis on tax efficiency. We have already verified that our results satisfy a common pre-trend and are robust to the inclusion of control variables as well as to the use of alternative outcome measures. Now, we discuss the possibility that our results are driven by a non-representative sample, country-industry trends, or subject to a survivorship bias. We further employ alternative

samples and matching approaches to show that our treatment effects are not driven by our sample of control firms. Last, we employ a falsification test by analyzing a placebo event four years before the actual acquisition.

We first propose some alternative models that underline the *robustness of the results* from our sample. Models (1) to (5) in Table A-4 in the Appendix represent slightly modified versions of our previous ETR regressions in Table 4. In Model (1), we weight each observation with its deal share in the Zephyr database relative to the share in our final sample. A graphical depiction of this approach is presented in Figure 1. One example is the following: Say that 10% of all deals in Europe have a German target. However, due to data unavailability, German targets represent only 5% of all observations in our sample. In this case, German transactions would receive a weight of 2 (10% / 5%). Our results are almost identical to the findings without country weights. Next, in Model (2), we include a full set of country-industry-year fixed effects in our regression. Again, results remain unchanged. Last, Models (3) to (5) show results in which we only consider firm-years that come in pairs, i.e. have both a treated and a control observation. In these three models, we look at survivor firm-year observations, positive EBT firms, and positive tax expenses firms. Our results clearly show that neither a survivorship bias nor loss-making firms with potential loss carryforward positions affect our results.

We then analyze alternative samples to make sure our results are not driven by our *sample selection*. In Models (6) to (8) in Table A-4 in the Appendix, we thus make use of different control samples. Model (6) shows the results excluding all control firms. Therefore, the model is equivalent to an event study as recommended by Atanasov and Black (2016). The consistency of our estimates shows that they are not induced by our sample of control firms. In Model (7), we use a randomly selected control sample from the matching cells. Again, the coefficients remain robust. Last, in Model (8), we use a Mahanalobis distance matching instead of our preferred Euclidean distance. Results are

slightly stronger, but remain qualitatively the same. Taken together, we conclude that our results are not driven by our choice of control firms.

Last, we analyze a *placebo event*. It is conceivable that private equity firms acquire targets because they follow a firm-specific trend. If this trend is related to the effective tax rate, we will find a spurious treatment effect. Therefore, we investigate a placebo event four years prior to the actual acquisition. The graphical depiction of this finding can be found in Figure A-2 in the Appendix. According to our hypothesis, we should not find a significant treatment effect around this pseudo treatment. Our results show that target firms do not exhibit a reaction to the placebo event.

# 7 Conclusion

In this paper, we study the effect of private equity buyouts on corporate tax avoidance. Lowering corporate tax payments at the target firm-level creates shareholder value at the expense of the government. Our data comprises 10,776 European private equity transactions. To address the endogeneity of private equity acquisitions, we employ a matched sample difference-in-differences estimation. We analyze post-deal effective tax rates, earnings, and leverage to investigate different channels of tax avoidance. In addition, we compute heterogeneous treatment effects to look at asset growth, employment growth, and differences in productivity in high tax avoidance deals.

We find a significant increase in tax efficiency at the level of the target firm after the buyout. Target firms do not pay less taxes in absolute terms after being acquired by a private equity firm but they pay less taxes on each additional euro of pre-tax earnings. We further investigate two channels of tax base erosion. Our findings suggest that private equity firms use and create profit shifting opportunities at their target firms. In addition, we find that target firms increase their leverage ratio, although we argue that this increase

is not primarily driven by tax motivations. Finally, we show that those target firms which reduce their relative tax bill the most invest significantly less in assets and exhibit lower productivity. Concluding, our results show that some private equity firms create value for their shareholders by extracting value from the government through relatively lower tax payments and that buyouts with high tax savings are accompanied with lower growth and less improvements in operational efficiency.

# Appendix

### Table A-1: Potential Controls Sample Construction

This table presents the construction of the potential control dataset. Seven steps are described. The number of observations that remains after each step is provided and so is the relative loss when compared to the original sample.

| Description | Observations | Loss |
|---|---|---|
| (1) All observations provided by the Bureau van Dijk July 2018 flat files on company financial data | 216,868,946 | |
| (2) Remove duplicates and observations with missing values for turnover, number of employees, and total assets | 212,670,770 | 1.94% |
| (3) Remove all firms with negative values for total assets, number of employees, sales, or tangible assets in any given firm-year | 211,829,691 | 0.39% |
| (4) Fill the time-series of firm-year observations and interpolate variables | 227,979,417 | -7.45% |
| (5) Remove all firm-year observations outside of the period 2000-2015 and firm-year duplicates | 186,117,159 | 19.30% |
| (6) Remove observations without values filled for all discrete and continuous matching variables | 52,039,151 | 61.82% |
| (7) Remove all firms that were at least once targeted by a private equity firm between 2001 and 2016 | 51,943,428 | 0.04% |

## Table A-2: Distribution of Discrete Matching Variables

This table presents the distribution of the discrete matching variables in $t = -1$, excluding country and year, for all treated firms. Given the one-to-one matching, the distribution of the variables is identical for control firms.

| | N | % |
|---|---|---|
| **Industry section** | | |
| A - Agriculture, forestry and fishing | 24 | 0.2 |
| B - Mining and quarrying | 40 | 0.4 |
| C - Manufacturing | 3,132 | 29.1 |
| D - Electricity, gas, steam and air conditioning supply | 101 | 0.9 |
| E - Water supply, sewerage, waste management and remediation activities | 68 | 0.6 |
| F - Construction | 338 | 3.1 |
| G - Wholesale and retails trade, repair of motor vehicles and motorcycles | 1,559 | 14.5 |
| H - Transportation and storage | 280 | 2.6 |
| I - Accommodation and food service activities | 199 | 1.8 |
| J - Information and communication | 1,609 | 14.9 |
| K - Financial and insurance activities | 866 | 8.0 |
| L - Real estate activities | 137 | 1.3 |
| M - Professional, scientific and technical activities | 1,344 | 12.5 |
| N - Administrative and support service activities | 626 | 5.8 |
| O - Public administration and defence, compulsory social security | 1 | 0.0 |
| P - Education | 71 | 0.7 |
| Q - Human health and social work activities | 200 | 1.9 |
| R - Arts, entertainment and recreation | 97 | 0.9 |
| S - Other service activities | 84 | 0.8 |
| **Positive EBT Dummy** | | |
| Negative EBT | 2,970 | 27.6 |
| Positive EBT | 7,806 | 72.4 |
| **Positive Tax Expenses Dummy** | | |
| Negative Tax Expenses | 2,198 | 20.4 |
| Positive Tax Expenses | 8,578 | 79.6 |
| **Business Group Dummy** | | |
| No Subsidiary | 6,524 | 60.5 |
| Owns Subsidiary | 4,252 | 39.5 |
| **Foreign Business Group Dummy** | | |
| No Foreign Subsidiary | 8,912 | 82.7 |
| Owns Foreign Subsidiary | 1,864 | 17.3 |
| **Tax Haven Dummy** | | |
| No Tax Haven Subsidiary | 10,373 | 96.3 |
| Owns Tax Haven Subsidiary | 403 | 3.7 |

## Table A-3: Variable Description

This table presents the description of all variables used throughout the analysis. Variables are grouped into firm-level and country-level variables as well as variables used in the matching process. The data source as well as the definition are provided for each variable. *Orbis Financials* refers to data obtained from Bureau van Dijk's Orbis flatfile as of July 2018. *Orbis Ownership* and *Status* refers to data obtained from Bureau van Dijk's Orbis annual historical updates (2005-2017). *Zephyr* refers to Bureau van Dijk's deal database as of October 2018. *KPMG* refers to the international accounting firm KPMG. *IBFD* refers to the International Bureau of Fiscal Documentation.

| Firm-level Variables | Source | Definition |
|---|---|---|
| - *Dependent Variables* | | |
| Effective Tax Rate (ETR) | Orbis Financials | Tax Expenses / Earnings before Taxes (EBT) |
| 3(5)-year long-run ETR | Orbis Financials | Sum of Tax Expenses of current and one (two) past and future periods over the sum of EBT of the same period |
| Log. EBT | Orbis Financials | ln(1 + EBT) |
| Log. Tax Expenses | Orbis Financials | ln(1 + Tax Expenses) |
| T. Tax Diff. | Orbis Ownership / OECD / KPMG | The maximum corporate income tax rate differential between the target firm and its subsidiaries |
| T. Foreign Sub. | Orbis Ownership | Dummy variable equal to 1 if the target firm has a subsidiary in a foreign country |
| T. Dom. Sub. | Orbis Ownership | Dummy variable equal to 1 if the target firm has a domestic but no foreign subsidiary |
| T. Haven EU | Orbis Ownership | Dummy variable equal to 1 if the target firm has a subsidiary in a European tax haven country based on the blacklist of www.datafortaxjustice.net/paradiselost/ |
| T. Haven | Orbis Ownership | Dummy variable equal to 1 if the target firm has a subsidiary in any tax haven country based on the lists in Bennedsen and Zeume (2018) |
| (P.) Net Int. Paying Lev. | Orbis Financials / Ownership | (Parent firm) (Loans + Long-term Debt - Cash) / Total Assets |
| Log. Asset Growth | Orbis Financials | ln(Total Assets[t] / Total Assets[t-1]) |
| Log. Employment Growth | Orbis Financials | ln(Number of Employees[t] / Number of Employees[t-1]) |
| TFP | Orbis Financials | Total factor productivity: regression residuals (log.) of Cobb Douglas production function estimated per industry section-country-year with sales as output and total assets and the number of employees as inputs |

**Table A-3: Variable Description** (continued)

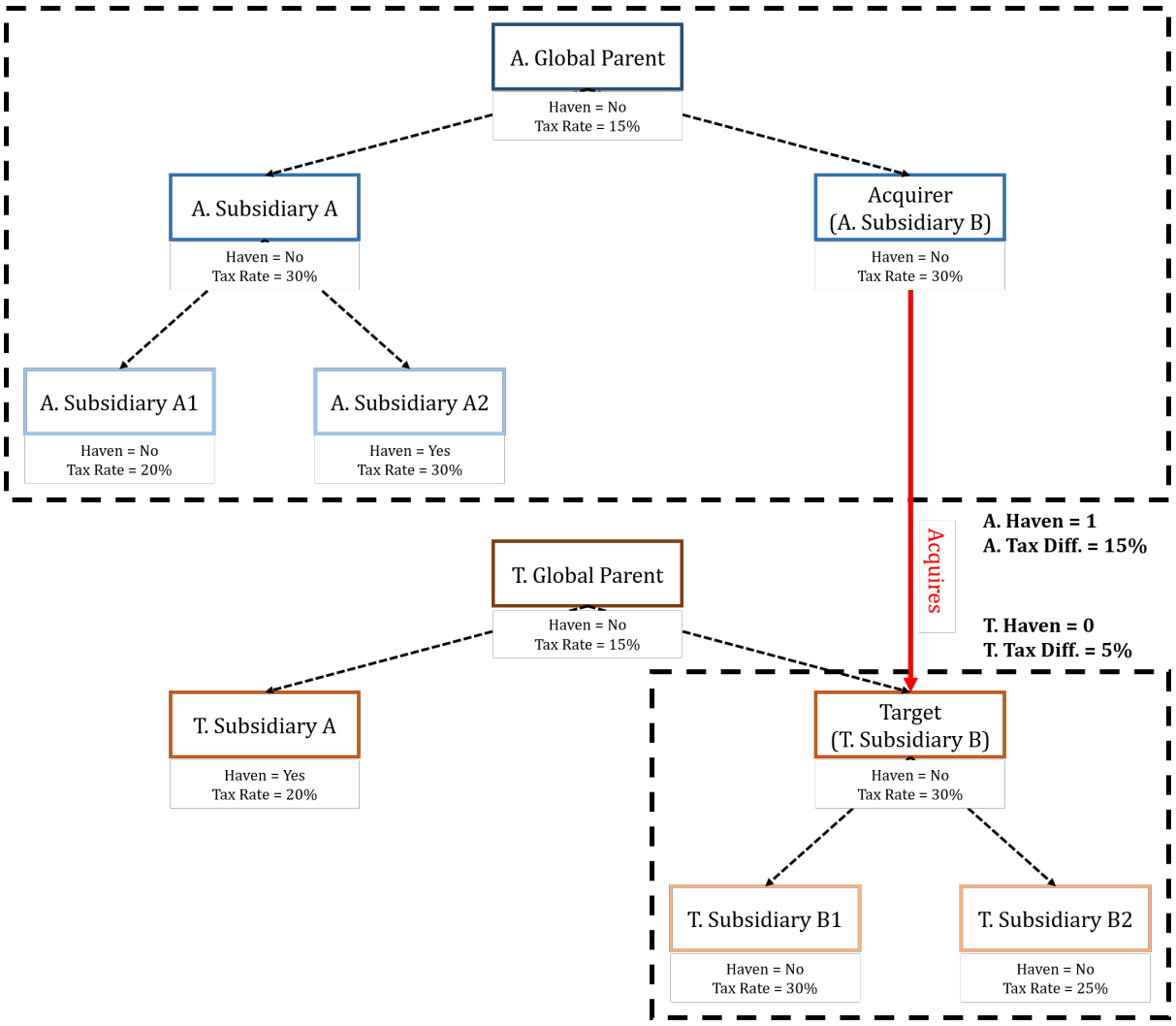
| Firm-level Variables | | |
|---|---|---|
| *- Interaction Variables* | | |
| Tax Potential, t=-1 | Orbis Financials / OECD / KPMG | Dummy variable equal to 1 for target firms with an above median difference between their ETR and the applicable statutory corporate income tax rate in the year prior to the deal |
| Inst. Vendor, t=-1 | Zephyr | Dummy variable equal to 1 if the target firm was sold by private vendors identified as not having a company ID and being identified as "shareholders" or without a specific name in the Zephyr database |
| Public Target, t=-1 | Orbis Status | Dummy variable equal to 1 if the target firm was publicly traded indicated by ever having been assigned an ISIN |
| T. (A.) Tax Diff., t=-1 | Orbis Ownership / OECD / KPMG | The maximum corporate income tax rate differential between the target firm and its subsidiaries (across the acquirer's affiliated firms ultimately owned by the same corporate owner) in the year prior to the deal |
| T. (A.) Foreign Sub., t=-1 | Orbis Ownership | Dummy variable equal to 1 if the target firm (acquirer's group) has a subsidiary in a foreign country in the year prior to the deal |
| T. (A.) Dom. Sub., t=-1 | Orbis Ownership | Dummy variable equal to 1 if the target firm (acquirer's group) has a domestic but no foreign subsidiary in the year prior to the deal |
| T. (A.) Haven EU, t=-1 | Orbis Ownership | Dummy variable equal to 1 if the target firm (acquirer's group) has a subsidiary in a European tax haven country based on the blacklist on www.datafortaxjustice.net/paradiselost/ |
| T. (A.) Haven, t=-1 | Orbis Ownership | Dummy variable equal to 1 if the target (acquirer's group) has a subsidiary in any tax haven country based on the lists in Bennedsen and Zeume (2018) in the year prior to the deal |
| *- Control Variables* | | |
| Log. Total Assets | Orbis Financials | ln(1 + Total Assets) |
| EBIT over Assets (ROA) | Orbis Financials | Earnings before Interest and Taxes (EBIT) / Total Assets (Return on Assets) |
| Cash Ratio | Orbis Financials | Cash and Cash Equivalents / Total Assets |
| Intan. Fixed Assets Ratio | Orbis Financials | Intangible Fixed Assets / Total Assets |
| Tan. Fixed Assets Ratio | Orbis Financials | Tangible Fixed Assets / Total Assets |
| Leverage Ratio | Orbis Financials | Total Liablities / Total Assets |

**Table A-3: Variable Description** (continued)

| | | |
|---|---|---|
| Country-level Variables | | |
| *- Interaction Variables* | | |
| T. (P.) Tax Rate | Orbis Ownership / OECD / KPMG | Statutory corporate income tax rate in the target (its direct parent) firm's country |
| T. (P.) Cross-b. Group Tax | Orbis Ownership / IBFD | Dummy variable equal to 1 if the target (its direct parent) firm's country allows for cross-border group tax consolidation |
| T. (P.) Interest Lim. | Orbis Ownership / IBFD | Dummy variable equal to 1 if the target (its direct parent) firm's country restricts the deductibility of interest payments from pre-tax income |
| *- Control Variables* | | |
| GDP / Capita (th) | OECD | GDP per capita of the target firm's country (in thousand EUR) |
| GDP (tn) | OECD | Total GDP of the target firm's country (in trillion EUR) |
| Long-Term Interest Rate | OECD | Long-term interest rate in the target firm's country |
| Short-Term Interest Rate | OECD | Short-term interest rate in the target firm's country |
| Matching Variables | | |
| *- Continuous Variables* | | |
| Log. Asset Growth (3-year) | Orbis Financials | ln(Total Assets[t] / Total Assets[t-3]) |
| *- Categorical Variables* | | |
| Country | Orbis Financials | Country where the firm is incorporated |
| Year | Orbis Financials | Publication year of the firm's financial statements (usually 31st December) |
| Industry section | Orbis Financials | Section code of the European classification of economic activities (NACE Rev. 2) |
| *- Dummy Variables* | | |
| Positive EBT | Orbis Financials | Indicator variable equal to 1 if the target firm has positive EBT |
| Positive Tax Expenses | Orbis Financials | Indicator variable equal to 1 if the target firm has positive Tax Expenses |
| Business Group | Orbis Ownership | Indicator variable equal to 1 if the target firm has a subsidiary |
| Foreign Business Group | Orbis Ownership | Indicator variable equal to 1 if the target firm has a foreign subsidiary |
| Tax Haven | Orbis Ownership | Indicator variable equal to 1 if the target firm has a subsidiary in any tax haven country based on the lists in Bennedsen and Zeume (2018) |

**Figure A-1: Target and Acquirer's Business Group Structures for the Construction of Tax Planning Opportunities**

This figure illustrates the computation of firm-level variables from the business group structures of target and acquirer firms. We construct target (*T.*) and acquier (*A.*) proxies for tax planning opportunities allowing to engage in profit shifting. The figure shows two hypothetical group structures, in which the *Acquirer* (*A. Subsidiary B*) acquirers the *Target* (*T. Subsidiary B*). Both the target and acquirer firm belong to a business group with one or more subsidiaries. Based on the locations of each business group's subsidiary, we obtain information on their countries' tax haven status and corporate tax rates, which are exemplatoryly illustrated in the figure. Given this information, we construct tax rate differentials (*A. Tax Differential* and *T. Tax Differential*) and tax haven indicators (*A. Haven* and *T. Haven*) for each business group (identified by the dashed line). Since pre-acquisition profit-shifting opportunities outside the target's chain of ownership control, such as *T. Subsidiary A* in a tax haven country, are no longer valuable after the deal, we only consider the direct and indirect subsidiaries of the target for the computation of the variables. For the acquirer, we consider all affiliated subsidiaries in the business group as these profit shifting opportunities remain after the deal.



## Table A-4: Tax Efficiency around Private Equity Deals - Robustness

This table presents estimation results for eight different models using a matched-sample difference-in-differences framework. The dependent variable is the *Effective Tax Rate (ETR)* throughout all models. In Models (1) to (5), alternative models and sample selection procedures are presented. Models (6) to (8) show the same baseline results from Model (2) in Table 4 but with different samples. Controls refer to log. total assets, leverage and cash ratios, the share of intangible and tangible assets, profitability (ROA), GDP per capita, GDP, and long- as well as short-term interest rates. Standard errors are clustered at the firm-level and t-statistics are presented in parentheses.

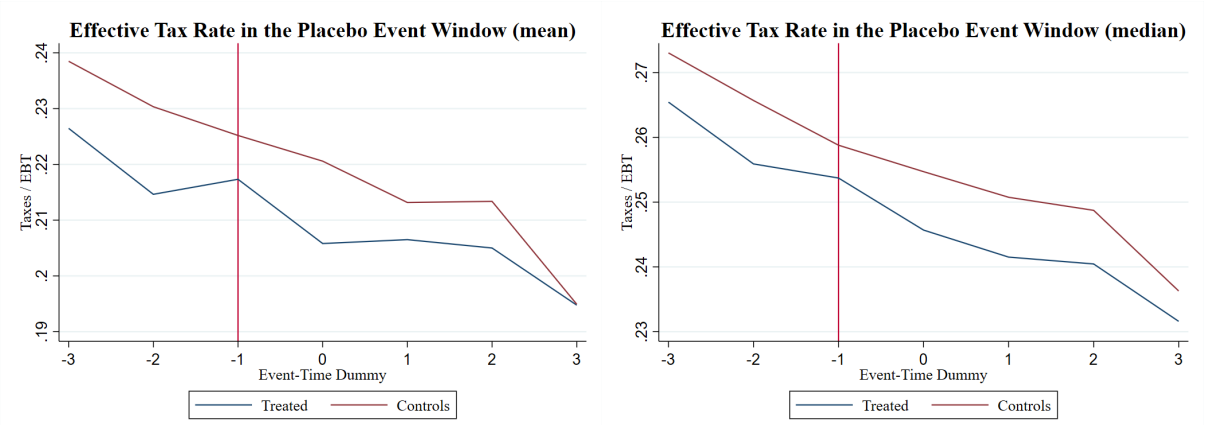
| | Effective Tax Rate (ETR) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Main Sample | | | | | Alternative Samples | | |
| | Country Weights | Ctry-Ind-Year FE | Balanced Controls | EBT>0 | Tax>0 | Event Study | Random Controls | Mahanalobis Distance |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Event (t=-3) * Treated | -0.93 | -0.43 | -0.39 | -0.39 | 0.51 | -0.44 | 0.47 | -0.78 |
| | (-1.24) | (-0.64) | (-0.59) | (-0.68) | (0.78) | (-0.67) | (0.69) | (-1.17) |
| Event (t=-2) * Treated | -0.77 | -0.73 | -0.70 | -0.22 | 0.19 | -0.07 | 0.73 | -0.46 |
| | (-1.09) | (-1.16) | (-1.11) | (-0.42) | (0.31) | (-0.11) | (1.11) | (-0.73) |
| Event (t=-1) * Treated | . | . | . | . | . | . | . | . |
| Event (t=0) * Treated | -1.91*** | -1.54** | -1.50** | -1.37** | -1.43** | -1.58** | -0.86 | -1.92*** |
| | (-2.60) | (-2.36) | (-2.25) | (-2.48) | (-2.24) | (-2.53) | (-1.27) | (-2.93) |
| Event (t=1) * Treated | -2.86*** | -2.37*** | -2.38*** | -1.79*** | -2.54*** | -2.31*** | -1.81** | -2.74*** |
| | (-3.59) | (-3.29) | (-3.21) | (-2.69) | (-3.53) | (-3.41) | (-2.42) | (-3.80) |
| Event (t=2) * Treated | -2.85*** | -2.54*** | -2.60*** | -2.60*** | -3.07*** | -3.55*** | -2.33*** | -3.25*** |
| | (-3.24) | (-3.26) | (-3.18) | (-3.47) | (-3.84) | (-5.00) | (-2.93) | (-4.17) |
| Event (t=3) * Treated | -2.50*** | -2.55*** | -2.24*** | -2.19*** | -2.00** | -2.93*** | -1.47* | -3.31*** |
| | (-2.81) | (-3.09) | (-2.60) | (-2.65) | (-2.38) | (-3.99) | (-1.74) | (-3.98) |

**Table A-4: Tax Efficiency around Private Equity Deals - Robustness** (continued)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Winsorization | 1, 99 | 1, 99 | 1, 99 | 1, 99 | 1, 99 | 1, 99 | 1, 99 | 1, 99 |
| Standard Errors | Cluster | Cluster | Cluster | Cluster | Cluster | Cluster | Cluster | Cluster |
| Firm Fixed Effects | Y | Y | Y | Y | Y | | Y | Y |
| Year Fixed Effects | Y | | Y | Y | Y | Y | Y | Y |
| Controls | Y | Y | Y | Y | Y | Y | Y | Y |
| Country x Industry x Year Fixed Effects | | Y | | | | | | |
| adj. R2 | 0.01 | 0.15 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 |
| Observations | 125,211 | 124,991 | 120,387 | 78,520 | 87,899 | 40,563 | 122,222 | 125,521 |

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

**Figure A-2: Effective Tax Rates around Placebo Event**




**(a)** This figure shows the development of the mean effective tax rate (%) from placebo event year $t = -3$ to placebo event year $t = 3$ for both treated firms and the control group. The placebo event takes place four years prior to the actual event for both treated and control firms. The red line at $t = -1$ indicates the time of the placebo event, which is four years prior to the actual acquisition.

**(b)** This figure shows the development of the median effective tax rate (%) from placebo event year $t = -3$ to placebo event year $t = 3$ for both treated firms and the control group. The placebo event takes place four years prior to the actual event for both treated and control firms. The red line at $t = -1$ indicates the time of the placebo event, which is four years prior to the actual acquisition.

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