Intra-Industry Diffusion of Profit Shifting Strategies

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Abstract: Does tax knowledge spill over across firms? Using data on US-listed firms and an event study approach, I provide systematic evidence that profit shifting strategies spread across companies within sectors. The probability that an enterprise owns a subsidiary in a specific tax haven increases if another enterprise operating in the same sector also does. A battery of three-way fixed effects and the non-existence of pre-trends allow a causal interpretation of the results. These findings suggest that firms replicate the tax avoidance schemes of their peers and carry policy implications.

Keywords: Multinational enterprises, profit shifting, tax havens, foreign direct investments, spillovers.

JEL codes: F14, F23, H26, L25, M21.

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1 Introduction

In light of the recent tax scandals, multinational enterprises (MNE) are frequently accused of large-scale tax avoidance. Some MNE artificially shift profits from their affiliates implanted in high-tax countries toward those located in low-tax countries to decrease their average effective tax rate. The techniques used to this end are nowadays relatively well-identified and documented in the literature (Beer, de Mooij, and Liu, 2020). However, less is known about the factors prompting MNE to engage in profit shifting. Tax rate differentials across jurisdictions naturally play a key role. A perhaps more challenging question is whether an MNE affects the income shifting activities of other MNE. The corporate tax avoidance literature points in this direction. Lim, Shevlin, Wang, and Xu (2018), Barrios and Gallemore (2019), and Gallemore, Gipper, and Maydew (2019) show that firms connected to low-tax firms via auditor, employee, and bank ties have lower effective tax rates. Cen, Maydew, Zhang, and Zuo (2017) demonstrate that the behavior of companies along the supply chain is determinant. Bauckloh, Hardeck, Wittenstein, and Zwergel (2021) observe that news about tax avoidance of an MNE entails a negative stock price reaction among its peers. This response, according to the authors, stems from the fact that investors expect similar firms to employ similar practices.

In this paper, I dig into this question and focus on intra-industry spillovers and profit shifting. The paper can be decomposed into two steps. In the first step, I build a database on the worldwide network of subsidiaries of US-listed firms between 1993 and 2013. I capitalize on the fact that the Securities and Exchange Commission (SEC) requires these companies to declare every year a list of their subsidiaries, be it inside or outside the US. On this basis, I construct a database at the firm-country-year level indicating the number of subsidiaries each US-listed enterprise discloses in each tax haven and each year. In the second step, I proceed with an event study and a difference-in-differences (DiD) exercise. I explore whether the probability to report a physical presence in a given tax haven varies when at least one other company operating in the same 4-digit SIC sector also does. The effect is estimated while controlling for a wide set of confounding factors via three-way fixed effects, thereby mitigating a number of endogeneity concerns.

The benchmark results reveal that the average probability to report a subsidiary in a specific tax haven increases by 10 percent when a peer is present in this tax haven. The effect is progressive and the average probability doubles after 5 years. This finding is corroborated by diverse sensitivity tests. I show that the estimate is robust across classifications of tax havens. In the baseline equation, I follow the lists of tax havens established by Hines and Rice (1994) and Dyreng and Lindsey (2009), both standard in the literature. Nonetheless, adopting one or the intersection of the two lists delivers the same results. Furthermore, I find consistent results when excluding the largest tax havens. The motive for doing so is that foreign direct investments (FDI) in large and well-connected tax havens like Ireland and Switzerland might have nothing to do with tax avoidance in the first place. It is on the contrary reasonable to consider that FDI in small and remote islands like Seychelles are purely attributable to profit shifting. Moreover, the findings are not driven by the estimation methodology (linear probability model versus binary model) and are validated by a falsification test. I randomly assign each 4-digit SIC industry to another 4-digit SIC industry and examine whether profit shifting activities in this random industry affects firms' presence in tax havens. As expected, this is not the case. In the same vein, I find no pre-existing trends, which supports the view that the estimates reflect a causal effect.

Lastly, I investigate the existence of heterogeneous effects along two dimensions: over time and across sectors. Profit shifting is growing over time (Grubert, 2012; Klassen and Laplante, 2012) and exacerbated in finance and services (Gumpert, Hines, and Schnitzer, 2016; Merz and Overesch, 2016). Hence, I conjecture that spillovers (i) are more pronounced in the 2004-2013 period than in the 1993-2003 period and (ii) do not equally hold in financial/service sectors and manufacturing. Interestingly, the results are mixed. They certify that the size of spillovers does increase over time, but they do not outline a discrepancy between the aforementioned sectors.

These findings are new in the literature insofar as they uncover the existence of intra-industry spillovers of profit shifting. In addition, they have policy implications. They emphasize that firms tend to reproduce the tax schemes of their peers. When a firm is found to carry on activities in tax havens exclusively for tax purposes, public authorities could thus pay particular attention to other corporations operating in the same sector. In this regard, the fact that there is no significant difference between intra-industry spillovers within services and manufacturing suggests that policy makers should maybe not necessarily concentrate all their efforts on services.

The remainder of the paper is organized as follows. First, section 2 introduces the data used to conduct the analysis and presents descriptive statistics. Next, section 3 lays out the econometric exercise, the results, and the robustness checks. Finally, section 4 concludes and discusses fruitful avenues for future research.

2 Data

The data come from two complementary sources: Compustat and Exhibit 21 filings. Compustat is a large database providing extensive information on balance sheets, income statements, and cash flows of all publicly listed firms in North America since 1950. These firms, despite being few in number, concentrate a significant share of overall sales, profits, and employment (Asker, Farre-Mensa, and Ljungqvist, 2014). It is worth noting they are the most likely to engage in FDI and profit shifting. Earlier work points toward the existence of fixed costs for FDI (Helpman, Melitz, and Yeaple, 2004). Some of these costs derive from the establishment of facilities overseas, and merely the largest and most productive firms can afford and find profitable to pay these costs. The same logic applies to profit shifting (Bilicka, Devereux, and Guceri, 2020). Avoiding taxes necessitates an excellent knowledge of the tax code. Firms must recruit tax experts to exploit loopholes, mismatches between tax systems, and other legal technicalities to book their income in tax-friendly jurisdictions (US Senate Permanent Subcommittee on Investigations, 2014; Jones, Temouri, and Cobham, 2018). For these reasons, not having a representative sample of the universe of firms is not a problem for this paper. [1]

The Compustat data are merged with data extracted from Exhibit 21 filings. The SEC requires US-listed firms to disclose, each year, a list of their significant subsidiaries in Exhibit 21 of Form 10-K. [2] A subsidiary is qualified as significant if its assets (or revenues) represent at least 10 percent of consolidated assets (or revenues). Moreover, any subsidiary is treated as significant if by combining all undisclosed subsidiaries into one fictive affiliate, this composite accounts for at least 10 percent of global assets (or revenues). Therefore, Exhibit 21 filings reflect where more than 90 percent of US-listed firms' assets and revenues are recorded. They allow observing where most of the subsidiaries of US-listed firms are incorporated and how these networks evolve over time. An interesting feature of Exhibit 21 filings is that firms elec-

1. Small firms are more prone to *evade* taxes. The central distinction between tax evasion and tax avoidance is that tax evasion is undoubtedly illegal. The strategies used are therefore not the same in both cases.

2. Note that companies are not obliged to uncover financial information concerning each of these subsidiaries.

Figure 1 – Non-exhaustive list of the significant subsidiaries reported by Johnson & Johnson in Exhibit 21 filings in 2011

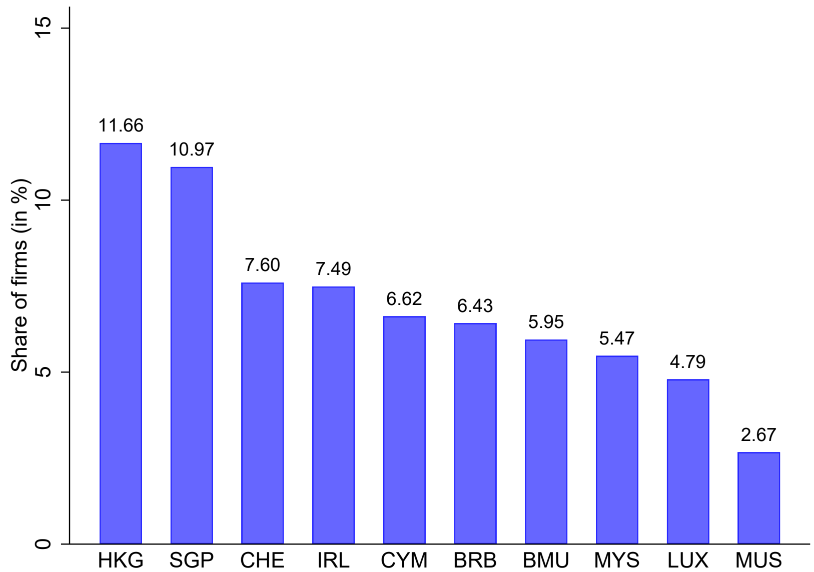
Name of Subsidiary	Jurisdiction of Organization
U.S. Subsidiaries:	
Acclarent, Inc.	Delaware
ALZA Corporation	Delaware
Alza Development Corporation	California
Alza Land Management, Inc.	Delaware
Animas Corporation	Delaware
Biosense Webster, Inc.	California
Centocor Biologics, LLC	Pennsylvania
Centocor Research & Development, Inc.	Pennsylvania
CNA Development LLC	Delaware
Codman & Shurtleff, Inc.	New Jersey
Cordis Corporation	Florida
Cordis International Corporation	Delaware
Cordis LLC	Delaware
Cougar Biotechnology, Inc.	Delaware
Crescendo Pharmaceuticals Corporation	Delaware
Crucell Holdings Inc.	Delaware
DePuy, Inc.	Delaware
DePuy Mitek, Inc.	Massachusetts
DePuy Orthopaedics, Inc.	Indiana
International Subsidiaries:	
Apsis	France
Beijing Dabao Cosmetics Co., Ltd.	China
Berna Biotech Korea Corporation	Korea
Berna Rhein B.V.	Netherlands
Biosense Webster (Israel) Ltd.	Israel
Cilag Advanced Technologies GmbH	Switzerland
Cilag AG	Switzerland

tronically file the reports since 1993 and these reports are publicly available on the Electronic Data Gathering, Analysis, and Retrieval (EDGAR) platform. I give an example in figure 1, which displays (a part of) the list of subsidiaries reported by the firm Johnson & Johnson in 2011. One potential caveat is that firms might have incentives to under-estimate the number of subsidiaries in tax havens. Dyreng, Hoopes, Langetieg, and Wilde (2020) argue, however, that most disclosures are accurate, even when it comes to tax havens. In this study, I exploit an updated version of the database constructed by Dyreng and Lindsey (2009) covering the 1993-2013 period.

The final sample consists of 14,070 firms, all of which reported one or several subsidiaries at some point, inside or outside the US. The database is compiled at the firm-tax haven-year level. The list of tax havens follows those of Hines and Rice (1994) and Dyreng and Lindsey (2009), both standard in the corporate tax avoidance literature. A country is assumed to be a tax haven if it figures in at least one of the two lists. In total, 52 foreign countries are viewed as tax havens. [3] Among these 14,070 companies, 10,220 of them (73 percent) never declared a

3. The list is composed of Andorra, Anguilla, Antigua, Aruba, Bahamas, Bahrain, Barbados, Barbuda, Be-

FIGURE 2 – Presence of US-listed firms in tax havens



subsidiary in a tax haven while 2,753 of them (19 percent) entered a tax haven between 1993 and 2013. The 1,097 remaining firms (8 percent) always reported at least one subsidiary in a tax haven. It means that beyond data availability, 1993-2013 is convenient for the analysis since a significant part of firms started operating in tax havens during this period. According to figure 2, Hong Kong is the most popular tax haven among US-listed firms. 11.66 percent of these firms disclosed at least one subsidiary in this jurisdiction. Singapore (10.97 percent), Switzerland (7.60 percent), Ireland (7.49 percent), and the Cayman Islands (6.62 percent) complete the top 5.

3 Econometric analysis

Identification strategy Armed with this database, I run the following linear probability model (LPM) with ordinary least squares to see whether tax dodging schemes propagate

lize, Bermuda, British Virgin Islands, Cayman Islands, Cook Islands, Costa Rica, Cyprus, Dominica, Gibraltar, Grenada, Guernsey, Hong Kong, Ireland, Isle of Man, Jersey, Jordan, Lebanon, Liberia, Liechtenstein, Luxembourg, Macau, Malaysia, Maldives, Malta, Marshall Islands, Mauritius, Monaco, Montserrat, Nauru, Netherlands Antilles, Niue, Panama, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Saint Martin, Samoa, San Marino, Seychelles, Singapore, Switzerland, Turks and Caicos Islands, and Vanuatu. Although Channel Islands and UK Caribbean Islands appear in Hines and Rice (1994), they are left aside in this paper due to data limitations.

Table 1 – Baseline results

	(1) LPM	(2) Logit
$TREAT_{i,c,t}$	1.32e-3^{a}	0.13^{b}
	(2.75e-4)	(0.06)
Firm-year FEs	Yes	Yes
Country-year FEs	Yes	Yes
Firm-country FEs	Yes	Yes
(Pseudo) R^2	0.69	0.65
Nb. of obs.	5,514,400	83,385

Notes. This table reports the baseline regression results of equation (1). Standard errors, in parentheses, are clustered at the firm-year level. $^{d}p < 0.15$, $^{c}p < 0.10$, $^{b}p < 0.05$, $^{a}p < 0.01$. See section 3 for more details.

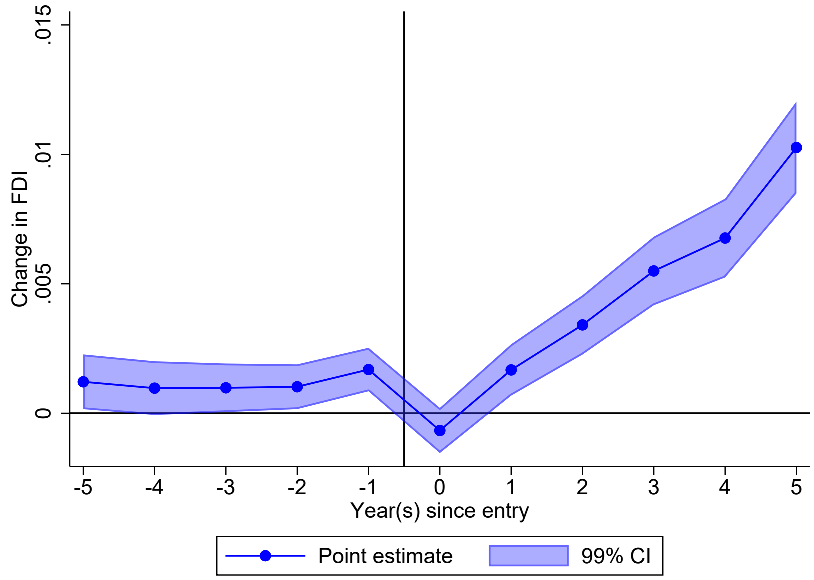
within sectors:

$$FDI_{i,c,t} = \alpha TREAT_{i,c,t} + \mu_{i,t} + \upsilon_{c,t} + \gamma_{i,c} + \epsilon_{i,c,t} \tag{1}$$

The dependent variable $FDI_{i,c,t}$ is a dummy variable equal to 1 if firm i has at least one subsidiary in tax haven c in year t. On the right-hand side, $TREAT_{i,c,t}$ is another dichotomous variable equal to 1 if another firm operating in the same 4-digit SIC sector discloses in year t a subsidiary in tax haven c. To mitigate endogeneity issues, I introduce a battery of three-way fixed effects: firm-year fixed effects $\mu_{i,t}$, country-year fixed effects $\upsilon_{c,t}$, and firm-country fixed effects $\gamma_{i,c}$. The first set of fixed effects absorb all firm-year determinants of FDI and tax avoidance. They incorporate, among other things, determinants already highlighted in the literature such as firm productivity and intangible assets. The country-year fixed effects, in the same vein, capture country-year factors influencing foreign countries' inward FDI from US-listed firms. These factors include (but are not limited to) geographical and cultural distance with respect to the US as well as corporate tax rates. The third and last set of fixed effects, firm-country specific, finally ensures to capture firm-country time-invariant causes of FDI like firm-country specific knowledge.

Main results The benchmark result is outlined in table 1 column (1). The coefficient of interest $\hat{\alpha}$ is both positive and statistically significant at the 1 percent level. Given that the average predicted value of $FDI_{i,c,t}$ is equal to 1.33e-2, the regression result indicates that the average probability to own a subsidiary in a given tax haven increases by 10 percent if another

Figure 3 – Dynamics



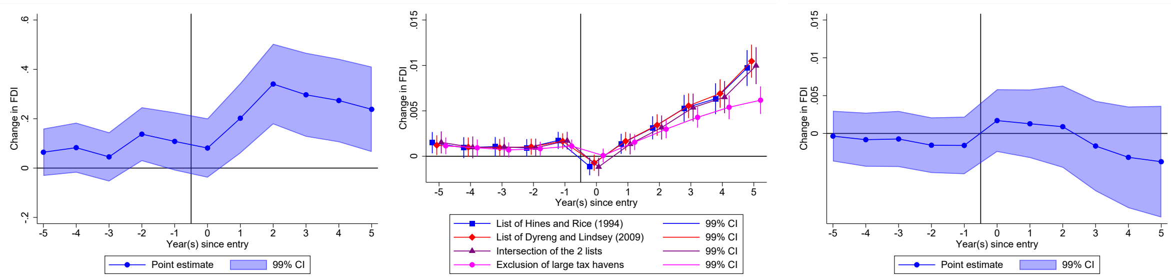
Notes. This figure outlines how $FDI_{i,c,t}$ varies before and after the treatment. Standard errors are clustered at the firm-year level. See section 3 for more details.

firm in the same sector does too.

Robustness I now evaluate the robustness of this finding. In the other column of the same table, I demonstrate that it is not ascribable to the estimation technique. There is no consensus in the econometrics literature on the estimator one should use when the dependent variable is binary (Horrace and Oaxaca, 2006; Angrist and Pischke, 2009; Battey, Cox, and Jackson, 2019; Gomila, 2020). LPM and binary models have their own advantages and drawbacks. For instance, LPM are easier to interpret and more transparent, but they might yield inconsistent estimates under some conditions. On the other hand, binary models guarantee that the predicted probabilities lie on the unit interval, but they may suffer from the incidental parameters problem. An important point, indeed, is that estimating binary models with high dimensional fixed effects is not trivial. Groups for which the dependent variable does not vary should be excluded. This omission leads to the so-called incidental parameters problem. The estimates are biased and need to be corrected accordingly. In column (2), I estimate a logit model building on Hinz, Stammann, and Wanner (2020). They design a correction procedure for binary models with three-way fixed effects akin to mine. Reassuringly, $\hat{\alpha}$ remains positive and statistically significant, in line with the benchmark result.

Figure 4 – Sensitivity checks

(a) Use of $SHARE$ (b) Alternative classifications (c) Falsification test



Notes. These figures evaluate the robustness of the regressions results outlined in figure 3. Standard errors are clustered at the firm-year level. See section 3 for more details.

Next, I enrich equation (1) with lagged and leading values of $TREAT_{i,c,t}$, denoted $TREAT^{t-k}_{i,c,t}$ and $TREAT^{t+k}_{i,c,t}$ respectively, to investigate the existence of pre-existing trends and see how the effect evolves post entry. More precisely, I observe how the probability of a firm to disclose a subsidiary in tax haven c fluctuates before and after at least one other firm reports a subsidiary in this specific tax haven. I select a 10-year window around the treatment and estimate equation (2) below:

$$\begin{aligned} FDI_{i,c,t} &= \alpha TREAT_{i,c,t} + \sum_{k=1}^{5} \beta_k TREAT^{t+k}_{i,c,t} + \sum_{k=1}^{5} \zeta_k TREAT^{t-k}_{i,c,t} \\ &\quad + \mu_{i,t} + \upsilon_{c,t} + \gamma_{i,c} + \epsilon_{i,c,t} \end{aligned} \tag{2}$$

The results can be visualized in figure 3. Two comments are in order. First, the effect is progressive and almost equal to +100 percent after 5 years. Second, there is little evidence of pre-existing trends. The probability to report a subsidiary in a given tax haven does not clearly vary before the treatment as expected, thereby corroborating the common trend assumption. Note that the non-existence of pre-trends (i) implies that the treatment variable is unlikely to be correlated with past unobserved firm-country-year shocks and (ii) alleviates reverse causality concerns.

I further gauge the robustness of the results in figure 4. In figure 4a, I reproduce figure 3 but replace $TREAT_{i,c,t}$ by another variable $SHARE_{i,c,t}$ measuring the share of firms in the same sector reporting at least one subsidiary in tax haven c and year t. Estimating equation

(2) with $SHARE$ delivers analogous conclusions.[4] In figure 4b, I modify this time the set of tax havens. Instead of combining the classifications of Hines and Rice (1994) and Dyreng and Lindsey (2009), I rerun the regression by using them separately or by forming a more restricted list composed of the countries found in the two lists. Several classifications coexist because having a low statutory corporate income tax rate is not a sufficient condition to be seen as a tax haven. Other criteria are determinant (e.g., secrecy and self-promotion as an offshore financial center), and the weights associated with those sometimes differ.[5] In the same spirit, a fourth regression puts six tax havens aside: Hong-Kong, Ireland, Luxembourg, Malaysia, Singapore, and Switzerland. Because these countries are relatively large and well-connected with the rest of the world, FDI of US-listed firms in these countries could be unrelated to tax avoidance. FDI in remote and small jurisdictions like Jersey and Nauru, for their part, certainly fall within the scope of profit shifting. In all four cases, the results coincide with baseline ones. Lastly, in figure 4c, I randomly assign each 4-digit SIC industry to another 4-digit SIC industry as a placebo test. The rationale is as follows: if the estimates exposed thus far reflect intra-industry spillovers, then we should observe no reaction of firms' FDI in a given tax haven when another company from another sector enters this tax haven. The figure validates this and, therefore, reinforces the previous results.

Heterogeneous effects Before concluding, I explore the existence of heterogeneous effects. Grubert (2012) and Klassen and Laplante (2012) find that profit shifting of US MNE increases over time. Another stream of research emphasizes substantial industry-specific heterogeneity in profit shifting. In particular, Gumpert et al. (2016) and Merz and Overesch (2016) show that profit shifting is more intense in services and financial sectors compared to manufacturing. Drawing on these contributions, I study whether spillover effects are larger (i) between 2004 and 2013 and (ii) in services and financial sectors (SIC 60-67, SIC 70-88) than in manufacturing (SIC 20-39). To do so, I run two separate regressions. First, I augment equation (1) with a supplementary variable $TREAT^{2004-2013}$ equal to 0 before 2004 and to $TREAT$ from 2004 onward:

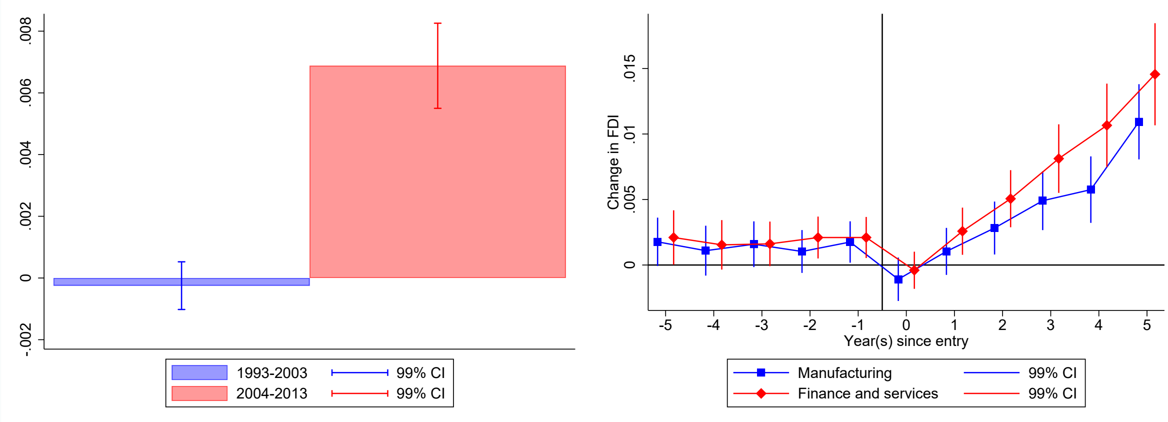
$$FDI_{i,c,t} = \alpha TREAT_{i,c,t} + \alpha^{2004-2013} TREAT^{2004-2013}_{i,c,t} + \mu_{i,t} + \upsilon_{c,t} + \gamma_{i,c} + \epsilon_{i,c,t} \tag{3}$$

4. Similarly, keeping sectors composed of at least 25 or 50 distinct firms generates results comparable to figure 3.

5. The two lists share 35 tax havens. Nonetheless, the classification of Dyreng and Lindsey (2009) is the only one to enumerate Aruba, Costa Rica, Guernsey, Jersey, Malaysia, Mauritius, Nauru, Niue, Samoa, San Marino, and Seychelles. On the other hand, Hines and Rice (1994), as opposed to Dyreng and Lindsey (2009), retain the British Virgin Islands, Jordan, Maldives, Saint Martin, Channel Islands, and UK Caribbean Islands.

FIGURE 5 – Heterogeneous effects

(a) 1993-2003 versus 2004-2013 (b) Manufacturing versus finance and services



Notes. These graphs depict the regressions results of equations (3) and (4). Standard errors are clustered at the firm-year level. See section 3 for more details.

Then, I augment equation (2).[6] I add a group of variables $TREAT^{SF}$ that interacts $TREAT$ with a variable equal to 1 if the firm mainly operates in finance or services:

$$FDI_{i,c,t} = \alpha TREAT_{i,c,t} + \alpha^{SF} TREAT^{SF}_{i,c,t} + \sum_{k=1}^{5} \beta_k TREAT^{t+k}_{i,c,t} + \sum_{k=1}^{5} \beta^{SF}_k TREAT^{SF,t+k}_{i,c,t} \quad (4)$$
$$+ \sum_{k=1}^{5} \zeta_k TREAT^{t-k}_{i,c,t} + \sum_{k=1}^{5} \zeta^{SF}_k TREAT^{SF,t-k}_{i,c,t} + \mu_{i,t} + \upsilon_{c,t} + \gamma_{i,c} + \epsilon_{i,c,t}$$

Figure 5 graphically depicts the regression results. Figure 5a lends credence to the first hypothesis. Surprisingly, figure 5b exhibits no clear difference between sectors. The pattern holds in both classes of sectors and is of the same order of magnitude.

4 Conclusion

Using information on subsidiaries of US-listed companies in tax havens and a DiD methodology, I unveil in this paper the existence of intra-industry spillovers of profit shifting. I estimate that the probability that a firm owns a subsidiary in a tax haven augments when at least one other firm in the same industry establishes a physical presence in this tax haven.

6. I introduce neither lagged nor leading values in equation (3) in order to maintain a sufficiently high number of observations.

This probability grows over time and doubles after 5 years. The results pass several robustness checks, and causality relies on the inclusion of a wide array of fixed effects and a placebo test. All in all, the findings suggest that firms tend to duplicate the tax dodging schemes of their peers. From a policy point of view, it means that auditing peers of firms accused of profit shifting could help public authorities deter profit shifting. This paper leaves a number of questions for future research. More work is needed to identify the exact channels whereby profit shifting diffuses across firms and to quantify their relative contribution.

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