Intra-Industry Diffusion of Profit Shifting Activities

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Abstract: Does tax planning knowledge spill over across firms? Using a unique database on US-listed firms and an event study, I provide systematic evidence that profit shifting strategies spread across companies within sectors. The average probability that an enterprise owns a subsidiary in a specific tax haven is 10 percent higher if another enterprise operating in the same sector also does. Several robustness checks support the results while a battery of three-way fixed effects and the non-existence of pre-trends tackle endogeneity concerns. These findings suggest that firms somehow replicate the tax avoidance schemes of their peers and carry policy implications.

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

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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 towards those located in low-tax jurisdictions to decrease their average effective tax rate. They use many techniques, nowadays relatively well-identified and documented in the literature (Beer, de Mooij, and Liu, 2020). However, less is known on the factors prompting MNE to engage in profit shifting. Tax rate differentials across countries naturally play a key role. A perhaps more challenging question is whether an MNE affects 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 strategies.

In this paper, I dig into this question and focus on intra-industry spillovers and profit shifting. The approach can be decomposed into two steps. In the first step, I build a database informing on the worldwide network of subsidiaries of US-listed firms. I capitalize on the fact that these companies are required, by the Securities and Exchange Commission (SEC), 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, which indicates 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 another 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 actually doubles after five 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. Besides, I find consistent results when excluding the largest tax havens. The motive for doing so is that FDI in large 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 reinforces the view that the estimates reflect a causal effect. Last but not least, I investigate the existence of heterogeneous effects. More specifically, I investigate whether this pattern equally holds in financial/service sectors and manufacturing. The reason for this distinction lies in the fact that profit shifting seems exacerbated in finance and services (Gumpert, Hines, and Schnitzer, 2016; Merz and Overesch, 2016). Interestingly, the results do not outline such a discrepancy between these two classes of sectors.

These findings are new in the literature insofar as they uncover the existence of intra-industry spillovers of profit shifting with a systematic approach. 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 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 within manufacturing suggests that policy makers should maybe not necessarily concentrate all their efforts in services.

The remainder of the paper is organized as follows. First, section 2 introduces the data used to conduct the analysis. Next, section 3 lays out the econometric exercise, the results, and the robustness checks. Section 4 briefly 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). Besides, it is worth noting they are the most likely to engage in FDI and profit shifting. Earlier work points towards 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

FIGURE 1 – Non-exhaustive list of 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

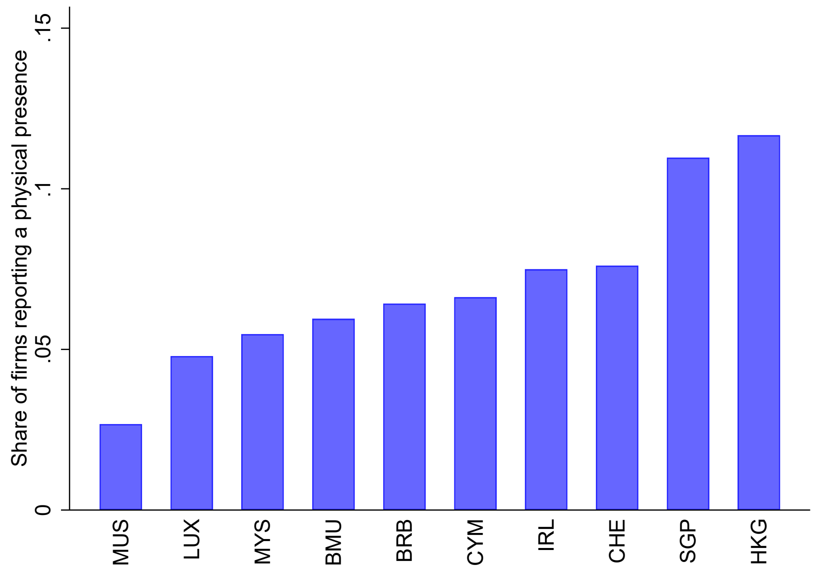
legal technicalities to book their income in tax-friendly jurisdictions (US Senate Permanent Subcommittee on Investigations, 2014; Jones, Temouri, and Cobham, 2018). For these reasons, not having a representative sample of the universe of firms is not a source of concern for this paper.[1]

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

1. Small firms are more prone to *evade* taxes, the main difference between evasion and avoidance being that the former is illegal. Small firms have a lower probability to be audited and undertake more informal activities as well (Dabla-Norris, Gradstein, and Inchauste, 2008; Hanlon, Hoopes, and Shroff, 2014; Ulyssea, 2018).

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

Figure 2 – US-listed firms in tax havens



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 enable to observe 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 electronically 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 subsidiary 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 that 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 one of the two lists, so 52 foreign countries are viewed as tax havens. [3] Among these 14,070 companies, 10,220 of them (73 percent) never declared a 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. 11.7 percent of these firms disclosed at least one subsidiary in this jurisdiction. Singapore (11.0 percent), Switzerland (7.6 percent), Ireland (7.5 percent), and the Cayman Islands (6.6 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 between firms 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

3. The list is composed of Andorra, Anguilla, Antigua, Aruba, Bahamas, Bahrain, Barbados, Barbuda, Belize, 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 excluded in this paper due to data limitations.

Table 1 – Baseline results

	(1) LPM	(2) Logit
	$FDI_{i,c,t}$	$FDI_{i,c,t}$
$TREAT_{i,c,t}$	1.32e-3^a	0.127^b
	(2.75e-4)	(0.063)
Firm-year FEs	Yes	Yes
Country-year FEs	Yes	Yes
Firm-country FEs	Yes	Yes
(Pseudo) R^2	0.69	0.645
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. $^dp < 0.15$, $^cp < 0.10$, $^bp < 0.05$, $^ap < 0.01$. See section 3 for more details.

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 foreign direct investments 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 in the likes of 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 probability to own a subsidiary in tax haven c in year t increases by 10 percent if another firm in the same sector does too.

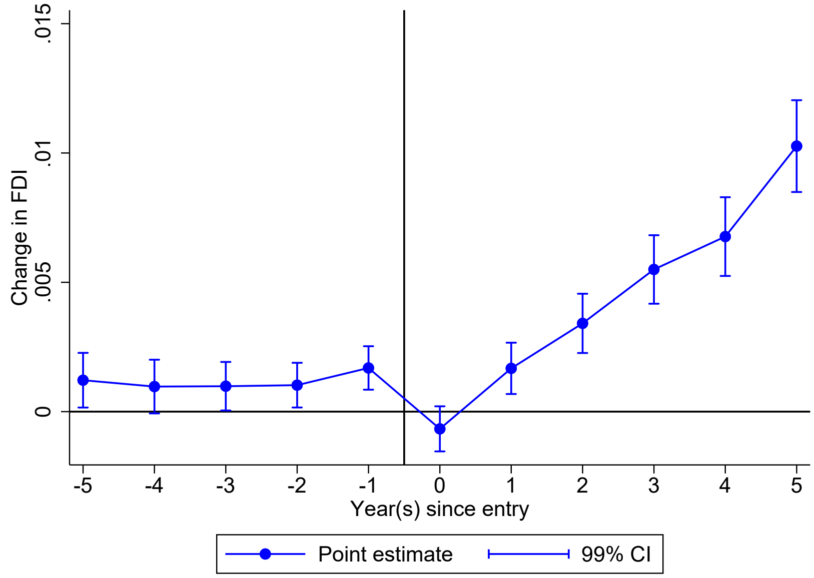
Robustness I now evaluate the robustness of this finding. In the other column of the same table, I demonstrate that it is not ascribable to the estimation technique. There is no consensus in the econometrics literature on the estimator one should use when the dependent variable is binary (Horrace and 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, the former 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. 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.

Next, I enrich equation (1) with lagged and leading values of $TREAT_{i,c,t}$, denoted $TREAT_{i,c,t}^{t-k}$ and $TREAT_{i,c,t}^{t+k}$ 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:

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

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 five years. Second, there is little

Figure 3 – Dynamics



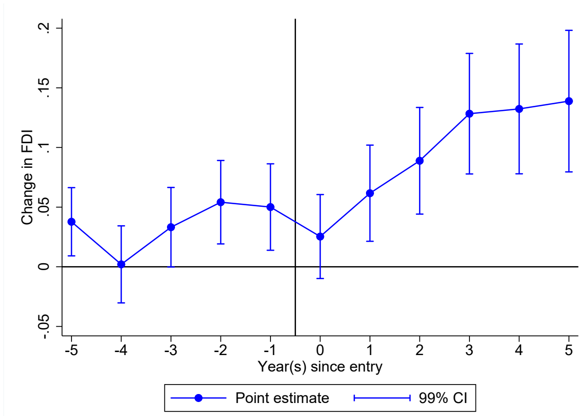
Notes. This figure outlines how $FDI_{i,c,t}$ varies before and after the treatment. Standard errors are clustered at the firm-year level. See section 3 for more details.

evidence of pre-existing trends. The probability to report a subsidiary in tax haven c does not clearly vary before the treatment, as expected, thereby corroborating the common trend assumption. Note, by the same token, that the non-existence of pre-trends implies that the treatment variable is unlikely to be correlated with past unobserved firm-country-year shocks and alleviates reverse causality concerns.

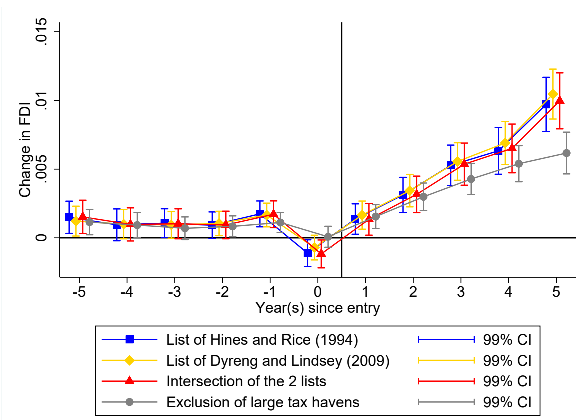
I further gauge the robustness of the results in figure 4. In figure 4a, I reproduce figure 3 but replace $TREAT_{i,c,t}$ by another variable $SHARE_{i,c,t}$ measuring the share of firms in the same sector reporting at least one subsidiary in tax haven c and year t. As can be seen, equation (2) with $SHARE$ delivers analogous conclusions. 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 re-run the regression by using them separately or by forming an even more restricted list composed of the countries found in the two lists. Several classifications coexist because having a low statutory corporate

FIGURE 4 – Sensitivity checks

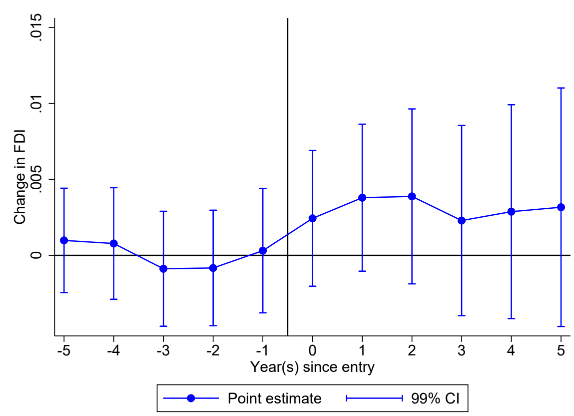
(a) Use of $SHARE$



(b) Alternative classifications of tax havens



(c) Falsification test

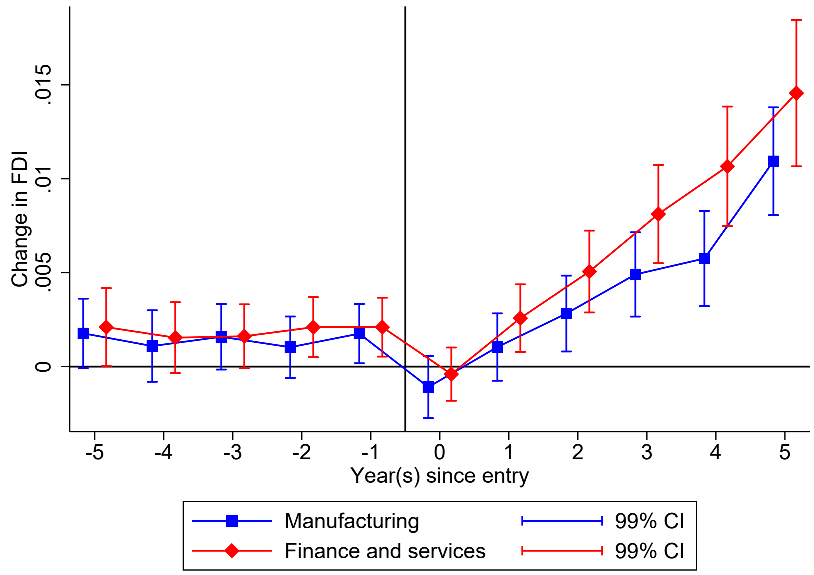


Notes. These figures evaluate the robustness of the regressions results outlined in figure 3. Standard errors are clustered at the firm-year level. See section 3 for more details.

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 weight associated with those sometimes differs. [4] 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

4. 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: manufacturing *versus* financial sectors and services



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

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 sole scope of profit shifting. In all four cases, the results are in line with the 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 so 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 points in this direction and, therefore, reinforces the previous results.

Heterogeneous effects Before concluding, I explore the existence of heterogeneous effects. A stream of research emphasizes substantial industry-specific heterogeneity in profit shifting. In particular, the latter is more intense in services and financial sectors compared to manufacturing (Gumpert et al., 2016; Merz and Overesch, 2016). Drawing on this line of research, I study whether spillover effects are larger in services and financial sectors (SIC 60-67, SIC 70-88) than in manufacturing (SIC 20-39). To do so, I augment equation (2). 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:

$$\begin{aligned} FDI_{i,c,t} &= \alpha TREAT_{i,c,t} + \alpha^{SF} TREAT^{SF}_{i,c,t} + \sum_{k=1}^{5} \beta_k TREAT^{t+k}_{i,c,t} + \sum_{k=1}^{5} \beta^{SF}_k TREAT^{SF,t+k}_{i,c,t} \\ &+ \sum_{k=1}^{5} \zeta_k TREAT^{t-k}_{i,c,t} + \sum_{k=1}^{5} \zeta^{SF}_k TREAT^{SF,t-k}_{i,c,t} + \mu_{i,t} + \upsilon_{c,t} + \gamma_{i,c} + \epsilon_{i,c,t} \end{aligned} \tag{3}$$

Figure 5 graphically depicts the regression results. Surprisingly, intra-industry spillovers do not differ across the two classes. The pattern holds in both groups and its magnitude is quite similar.

4 Concluding remarks

Using a rich dataset containing 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 average probability that a firm owns a subsidiary in a tax haven augments when at least one another firm of the same industry establishes a physical presence in this tax haven. The probability grows over time and doubles after five years. Causality relies on the inclusion of a wide array of fixed effects and a placebo test, the results pass several robustness checks, and spillovers do not appear more intense in services than in manufacturing. All in all, the findings suggest that firms tend to duplicate the tax dodging schemes of their peers. From a policy point of view, this implies that redirecting resources to audit peers of firms accused of profit shifting could help public authorities better detect profit shifting. This paper leaves a number of questions for future research. More work is needed to identify precisely the channels whereby profit shifting diffuses across firms and quantify their contribution.

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