Tax Planning and Multinational Behavior*

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Abstract

We study the adoption and use of complex tax planning by US multinational corporations (MNCs). Using IRS data, we identify hybrid tax planning structures (HTPs) which avoid corporate income taxes by targeting mismatches with Irish, Dutch, and Luxembourg tax law. By 2016, more than 35% of the foreign profits of US MNCs were linked to HTPs. Difference-in-differences models comparing adopting and non-adopting MNCs reveal that, after adoption, MNCs intensify behaviors related to profit shifting, significantly increasing related-party loans, foreign intangible assets, and profits held abroad. These changes result in stark reductions in foreign effective tax rates. Adopting MNCs also experience larger increases in foreign tangible assets and in domestic R&D, payroll, and investment. Finally, we develop and estimate a model that rationalizes the selection of MNCs into HTPs and their changes in economic activity.

Keywords: international taxation, profit shifting, Double Irish, reverse hybrid mismatch
JEL Codes: D22, H25, H32, J23

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1 Introduction

The last quarter century has seen a remarkable increase in the complexity of tax planning by multinational corporations (MNCs). Document leaks and special government reports have revealed the existence of tax planning strategies that are designed to avoid corporate income taxes in multiple jurisdictions by exploiting mismatches in tax laws. While media attention following these revelations and dissatisfaction with the current system has motivated important international tax policy changes and multilateral projects, little is known about the importance of these tax planning strategies.[1] How prevalent are these strategies among MNCs? Do they facilitate profit shifting and lower foreign effective tax rates (ETRs)? Does tax planning influence the real economic activity of MNCs?

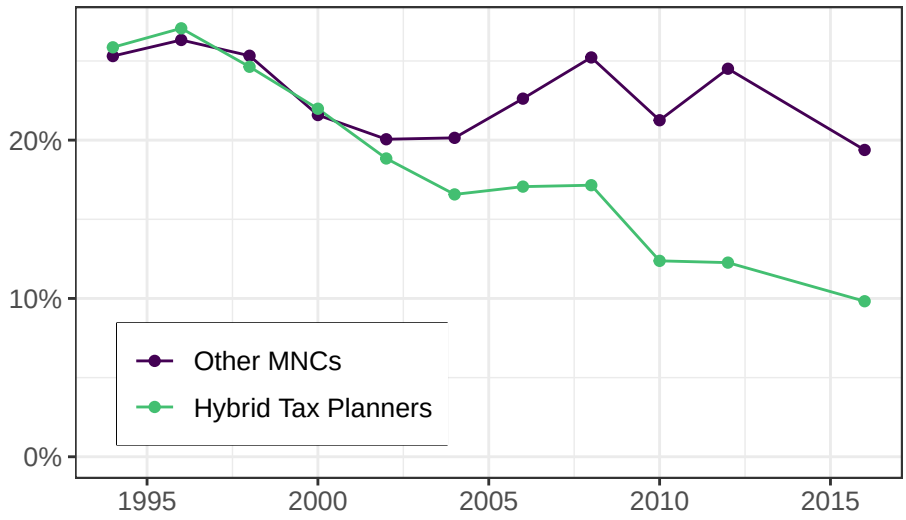
This paper uses IRS tax data to answer these questions by analyzing the adoption and use of a set of complex tax planning strategies that target mismatches in Irish, Dutch, and Luxembourg tax law. We first use data from multiple IRS tax forms to reconstruct the ownership networks of the foreign affiliates of US MNCs. We then identify when a US MNC creates an ownership structure that can exploit mismatches in tax laws across these countries. Data from the tax returns of US MNCs is crucial to identifying the adoption of these tax planning structures and how MNCs use them to shift profits across countries. This paper is the first to systematically uncover these tax planning structures.

We use these administrative data to document the growth and prevalence of these tax planning strategies. Although these strategies were extremely rare in the early 1990s, they were gradually adopted by MNCs following the 1997 regulations known as "Check the Box" (CTB), which facilitated this form of tax planning. By 2016, 16% of US MNCs in our sample had adopted at least one of the structures we identify, and these companies were responsible for more than 60% of foreign profits. Data on the foreign operations of adopting MNCs show that more than 50% of their foreign profits flow through one of these structures and that more than 35% of the foreign profits of MNCs in our sample are linked to these structures. MNCs that use these strategies are also responsible for significant shares of domestic economic activity, including 25% of domestic corporate payroll and 15% of capital investment.

Relative to MNCs that never adopt these structures, those that do engage more intensely

[1] These changes and projects include important aspects of the recent Tax Cuts and Jobs Act of 2017 as well as the OECD's Base Erosion and Profit Shifting project.

Figure 1: Comparison of Foreign Effective Tax Rates



Notes: This figure compares the aggregate annual foreign effective tax rate (ETR) for two groups of US multinationals (MNCs). The light green line shows the ETR for a group of MNCs that eventually adopt at least one of the hybrid tax structures described in Section 2. The dark blue line shows the ETR for MNCs that did not adopt any of these structures during the sample window. The combined sample includes most large US C corporations as described in Section 3.

in the kinds of financial transactions that could be used to shift profits to low tax countries: they increase their foreign holdings of intangible capital, they have larger loan balances between related foreign affiliates, and they collect more royalty income and accumulate more cash abroad. Most strikingly, as shown in Figure 1, over the period during which these structures are gradually put in place between 2002 and 2016, the foreign ETRs of adopting MNCs experience a dramatic decline. By 2010, the foreign ETR of adopters was roughly half that of other MNCs.

We use difference-in-differences event-study regressions to conduct more formal comparisons. These models measure changes in firm outcomes surrounding the adoption of these structures, relative to non-adopting firms. These models confirm that the marked increase in behaviors related to profit shifting coincides with the adoption of these structures. We then estimate that foreign ETRs see a relative decline of 18.4% ($p < 0.01$) six years after adopting one of these strategies. Concurrent with declining foreign ETRs, we estimate that adopting US MNCs have larger increases in foreign investment and accumulate 18% ($p < 0.01$) more depreciable capital in foreign affiliates than MNCs that do not adopt one of these structures. We also estimate that the adoption of these tax planning structures is followed by a 17% ($p < 0.01$) increase in domestic payroll and a 40% ($p < 0.01$) increase in R&D tax credits.

We integrate these results by developing and estimating a model of MNC behavior under tax

planning. In the model, firms deliver services in each destination country based on a shared, group-level productivity. MNCs can improve their global productivity by engaging in R&D. MNCs can also pay a fixed cost to engage in tax planning, which allows their foreign profits to be taxed at a lower rate. MNCs decide whether to adopt a tax planning strategy based on their profitability, their potential for R&D growth, and other determinants of tax aggressiveness. The model integrates our reduced-form results by allowing for both the selection of MNCs into tax planning and the reductions in foreign tax costs to impact their domestic and foreign activities. Our model estimates suggest that domestic outcomes are more likely to be driven by selection, while a significant share of foreign investment is the result of the lower taxes generated by tax planning. These results indicate that tax planning has small effects on the US economy and that limiting tax planning may reduce foreign investment with little impact on tax revenue.

We develop our results in four steps. First, we reconstruct the foreign ownership structures of US MNCs using information from three key tax forms contained in the IRS data files. Parent-level data from Form 1120 and related tax forms provide information on domestic activity, including assets, payroll, domestic investment, and R&D tax credits. Parents also file an information form (Form 5471) for each of their controlled foreign corporations (CFC), which includes data on foreign assets, taxes, earnings and profits (E&P), as well as related transactions between CFCs. With the advent of CTB, US MNCs could elect to "disregard" their foreign affiliates. These foreign disregarded entities (FDEs) are hybrid structures that are corporations in the host country but pass-through entities from the US perspective, making them transparent to the US Treasury. The IRS collects information about these entities in a separate information return, Form 8858. A novel aspect of this paper is the integration of FDE data with their CFC owners.

Second, with this information in hand, we flag MNCs that adopt tax planning structures that have previously only been revealed in leaks and special government reports. These planning structures used entities that facilitated tax planning by creating mismatches in their tax treatment between the United States and foreign countries. The first structure we identify, known as the Double Irish, used FDEs to exploit aspects of Irish and US tax law to shift profits out of high tax foreign countries into tax havens. The second and third structures use a strategy known as a reverse hybrid mismatch to accumulate untaxed foreign profits in a foreign affiliate. We identify usage of reverse hybrid mismatches for foreign affiliates located in the Netherlands and in Luxembourg. These three hybrid tax planning structures are well known and have been

targeted by European countries through legal investigations. They have also motivated policy agendas such as Action 2 of the OECD BEPS project, which aims to close down hybrid mismatch arrangements.[2]

Using these unique indicators of tax planning, we measure the growth, prevalence, and importance of these hybrid tax planning structures relative to aggregate economic activity of US MNCs. As mentioned above, the three structures we identify are connected to large shares of aggregate foreign activity by US MNCs by 2016, the end of our sample period. Although there have been numerous investigations and case studies that reveal how these arrangements work, this paper is the first attempt to systematically measure their importance for foreign and domestic economic activity.

In our third step, we compare the foreign and domestic operations of US MNCs that ever adopted one of these strategies to MNCs that did not. In the early 1990s, these two groups of firms have nearly identical patterns of ETRs and domestic and foreign activity. After the 1997 CTB regulations are put in place, foreign affiliates of MNCs that engage in hybrid tax planning (HTP) experience significantly larger declines in ETRs as well as markedly larger increases in intangible assets, royalty income, and cash held abroad, all of which is consistent with profit shifting and tax deferral.

To ensure that these results are tied to the adoption of HTPs, we estimate staggered difference-in-differences models around the first year that a given MNC adopts an HTP. Estimates from these models provide convincing evidence that these structures were put in place for tax avoidance purposes. Specifically, we show that adopting MNCs engage in more financial transactions that can be used to shift profits and reduce foreign ETRs following the adoption of an HTP. We also find that adopting MNCs experience larger increases in foreign capital, domestic payroll, and R&D than non-adopting MNCs in the years surrounding the adoption of an HTP. One potential concern is that these complex tax structures are adopted by specific types of firms that were also subject to other macroeconomic shocks over this time period. We address this concern by showing that we obtain similar results when we include industry-by-year fixed effects, when we flexibly control for firm size bins interacted with year fixed effects, and when we flexibly control

[2]Companies such as Google (Drucker, 2010) and Apple (Duhigg and Kocieniewski, 2012) have been reported to have used a Double Irish structure, while companies such as Nike (Guardian, 2019), Amazon (Guardian, 2018), and Starbucks (Kleinbard, 2013) have been reported to have used reverse hybrid mismatch arrangements through the Netherlands or Luxembourg.

for differences in intangible assets across firms. We also obtain similar results when we use a two-way fixed effects specification and when we use the estimator of Sun and Abraham (2021) that is robust to potential contamination bias resulting from staggered adoption.

Estimates of our staggered difference-in-differences models have a causal interpretation under the assumption that the outcomes of MNCs that adopt an HTP would have trended similarly to those that did not adopt such a structure. Event study results generally show that important outcomes of adopting MNCs, such as growth in payroll, foreign assets, R&D, and foreign ETRs follow similar patterns to those of non-adopting MNCs prior to the adoption of these structures. These results suggest that MNCs do not select into HTPs based on prior trends in economic outcomes. However, it is possible that MNCs select into HTPs based on the gains from adopting an HTP, such that adopting MNCs would have different post-period trends absent an HTP.

The fourth and final step of the paper develops and estimates a model of tax planning and multinational behavior that incorporates selection on gains into tax planning. In the model, firms trade off heterogeneous costs and benefits of setting up tax planning structures against the potential benefits from lower foreign ETRs. The model relates the difference-in-differences estimates to model parameters and a selection term. The model parameters measure how foreign ETRs impact foreign investment and how R&D investment impacts productivity. The selection term captures differences in the underlying productivity of the firms that adopt hybrid tax planning structures. By separating these forces, the model quantifies the degree to which investment by hybrid tax planning firms is inframarginal, in the sense that some of their increased investment would have occurred in the absence of tax planning. Through the lens of our model, the changes in domestic economic activity are more likely to be driven by the selection of firms with potential to increase their R&D investment. This result would imply that there are smaller benefits to the US economy from foreign tax planning of US MNCs than the difference-in-differences estimates would suggest. At the same time, the model also shows that increases in foreign capital are more likely to be driven by tax differentials, such that efforts to limit tax planning may significantly limit investment abroad.

Overall, our results provide the first systematic documentation of the prevalence of hybrid tax planning structures. By 2016, these structures accounted for about a third of foreign profits of US MNCs and these corporations play an important role in the domestic economy. We estimate that adoption of these strategies is followed by large increases in financial transactions that can

be used to shift profits to low tax countries and by declines in foreign ETRs. We also estimate significant relative changes in domestic and foreign economic activity following the adoption of an HTP and develop a model to conduct counterfactual policy analyses that incorporate the tax effects along with potential selection on gains.

This paper contributes to studies that quantify the importance of profit shifting. In a seminal contribution, Hines and Rice (1994) describe and measure the importance of tax havens to the operations of US multinationals. Clausing (2016) uses the sensitivity of reported profits to tax rate differentials to estimate the magnitude of profit shifting of US MNCs. Tørsløv, Wier and Zucman (2018) use macroeconomic data and differences in the profitability of different affiliates to estimate the magnitude of profits shifted to tax havens. Bilicka (2019) uses tax data from the UK to argue that the large differences in the profitability between domestic UK firms and the affiliates of foreign MNCs (in the UK) are driven by profit shifting. In a recent survey, Dyreng and Hanlon (2021) highlight the cross-sectional variation in tax avoidance and conclude that a large portion of the variation in tax avoidance remains unexplained. Our focus on HTPs contributes to our understanding of the importance of specific tax planning strategies.

While several papers document the existence of profit shifting, the magnitude of this problem has been hard to pin down. Using tax data from US firms, Dowd, Landefeld and Moore (2017) argue that the sensitivity of reported profits to tax differentials can be non-linear and that accounting for non-linearities increases estimates of profits shifted to low tax countries. In contrast, Blouin and Robinson (2020) argue that prior estimates using tax and survey data can be plagued by double counting of profits and that accounting for direct investment income between affiliates can significantly lower estimates of profit shifting. Following their suggestions, we subtract dividend income from related foreign corporations when computing aggregate foreign earnings for US MNCs. Rather than provide estimates of profit shifting, we document the prevalence of widely used tax planning structures, show that MNCs use them in transactions that are likely related to profit shifting, and find that close to one third of the foreign profits of US MNCs in our sample flow through these structures by 2016.

We also contribute to our understanding of CTB regulations by directly examining the adoption and consequences of complex tax structures facilitated by the policy. Using tax return data from US MNCs, Altshuler and Grubert (2006) find reductions in foreign effective tax rates after the enactment of CTB in 1997 that are consistent with the use of the tax planning strategies we

examine. Mutti and Grubert (2009) use multiple data sources to show that, after the implementation of CTB, MNCs increased profit shares in low-tax jurisdictions and conducted transfers of intangible assets abroad. Blouin and Krull (2014) show that MNCs had more tax haven affiliates and longer ownership chains after the enactment of CTB.[3] Faulkender, Hankins and Petersen (2019) study the 440 percent increase in cash held abroad by US MNCs between 1998 and 2008 and argue that this rise is driven by tax factors, including CTB. While prior research assumed that MNCs disregarded foreign affiliates following the CTB regulations, ours is the first paper to use tax information to confirm when an affiliate is disregarded and to systematically identify MNCs that use a specific set of tax planning structures. In a contemporaneous paper, Samarakoon (2022) uses tax data to identify firms that use a Double Irish structure and examines how the closure of this structure impacts repatriation of deferred earnings by MNCs.[4] Our results show that the bulk of the decrease in foreign ETRs and the increase in cash held abroad was driven by MNCs that adopted a particular set of tax planning structures.

Finally, our paper contributes to the literature on how profit shifting impacts real behavior. Grubert and Slemrod (1998) study profit shifting opportunities through Puerto Rico and argue that US MNCs changed their investment decisions in response to these opportunities. Suárez Serrato (2018) studies the reduction in profit shifting opportunities through Puerto Rico and shows US MNCs decrease their domestic investment in response.[5] Albertus (2019) uses Bureau of Economic Analysis data to compare US MNCs with different average foreign tax rates prior to the implementation of CTB. He finds that MNCs with higher initial tax rates experience a larger decline in average rates and increase their R&D intensity after 1996. By using tax data to identify specific tax planning structures and to demonstrate how they were used for profit shifting, we reveal substantial heterogeneity regarding which firms benefitted from CTB and shed light on the mechanisms through which CTB lowered foreign ETRs and affected real economic activity.

The remainder of the paper is organized as follows. Section 2 describes the three hybrid tax planning structures and discusses how CTB facilitated their adoption by making it easy to create

[3] Grubert (2012) finds that foreign ETRs of US MNCs declined by 5 percentage points between 1996 and 2004 using tax return data. By examining CFCs that indicate that they have a disregarded entity he is able to determine that 1 to 2 percentage points of this decline is due to CTB.

[4] Hardeck and Wittenstein (2018) use data from the Luxembourg Leaks to identify firms with hybrid tax structures and find that hybrid tax structures reduce MNC tax rates, as measured by financial statements data.

[5] de Mooij and Liu (2018) study the impact of transfer pricing regulations and show that these policies can reduce investment. Bilicka, Qi and Xing (2019) shows that a world-wide debt cap that limited interest stripping as a form of profit shifting also impact the investment decisions of UK MNCs.

foreign disregarded entities. Section 3 provides an overview of the data. Section 4 discusses how the creation of foreign disregarded entities and hybrid tax planning structures has grown over time. Section 5 estimates the effects of adopting tax planning strategies on foreign tax rates and economic activity of US MNCs. Section 6 provides a model of international MNC investment in which firms select into tax planning by trading off heterogeneous setup costs that vary based on levels of IP. Section 7 concludes.

2 Hybrid Tax Planning Structures and Check The Box

This section describes the hybrid tax planning structures that we study. We first describe the "Check the Box" (CTB) regulations that facilitated their adoption and then describe the structures in detail.

2.1 Check The Box Regulations

During the period we study, the United States imposed corporate tax on the worldwide income of US corporations with a credit for foreign taxes paid to avoid double taxation. The credit was limited to what US tax would have been on the foreign income. Taxes were not due on active foreign business income until it was repatriated to the parent corporation. This deferral feature of the US tax code made it attractive to hold income generated abroad in tax havens.

To prevent profit shifting, deferral was not extended to certain types of "tainted income" under what is generally referred to as Controlled Foreign Corporations (CFC) rules. These rules are contained in Subpart F of the tax code and foreign income that is subject to current US tax is referred to as "Subpart F" income. Tainted income includes passive portfolio income and the payment of interest, dividends, and royalties from one CFC to a CFC in another jurisdiction.

In 1996, Treasury promulgated regulations effective on January 1, 1997 that made it easier for US corporations to change the entity classification (e.g., pass-through or corporate) of domestic and foreign affiliates. This policy change became known as Check the Box (CTB), referring to the ease with which US corporations could change entity classifications. CTB was originally intended to simplify tax filing for domestic firms. However, it also facilitated certain types of international tax planning strategies that exploit mismatches in tax laws across countries. These strategies make use of foreign affiliates referred to as "hybrid entities" that are treated differently for tax purposes at home and in host countries.

Below we discuss how tax planning structures that use hybrid entities allowed US companies to avoid US tax levied on intercompany payments such as dividends, interest, and royalties, and how these structures exploit mismatches in tax laws across countries to lower foreign tax bills.

2.2 Hybrid Tax Planning Strategies

To understand how CTB facilitates tax planning it is necessary to explain the concept of a hybrid entity. A hybrid entity is a business operation that is incorporated from the foreign country point of view and a pass-through (unincorporated branch of another corporation) from the US point of view (or vice-versa, in which case it is referred to as a "reverse" hybrid). Since 1997, an MNC can simply check a box on a tax form to create a pass-through entity. Importantly, the check the box regulations allowed the use of pass-through entities as "foreign disregarded entities" (FDEs). If a pass-through entity like a branch or partnership is disregarded, the transactions with their entity parent and with other disregarded entities owned by the same parent are disregarded. As a result, they become invisible to the U.S. Treasury as they are all part of one consolidated corporation.[6]

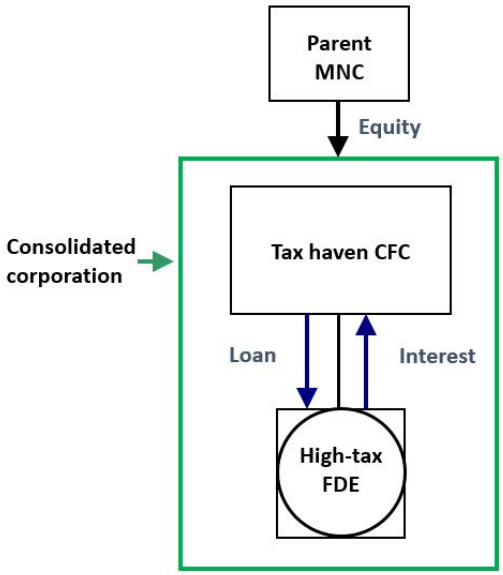
The simplest hybrid tax planning structure allows MNCs to take large deductions for interest in high-tax jurisdictions through the use of tax haven finance affiliates. Consider the following planning structure to finance a subsidiary in a high-tax country. Instead of funding the high-tax subsidiary directly, the parent injects equity into a tax haven affiliate which lends to the high-tax subsidiary. The high-tax subsidiary then pays interest to the tax haven affiliate. This profit shifting strategy is commonly known as "interest stripping." While the interest is deductible abroad against taxable income, it is subject to immediate US tax under the CFC rules.

Prior to 1997, CFC rules made the use of a tax haven financing affiliate unattractive for tax purposes. After 1997, the parent can check the box on the high-tax affiliate making it a hybrid FDE. From the US point of view, the high-tax affiliate is an unincorporated branch of the tax haven affiliate and the interest payment is invisible to the US Treasury, which regards the combined tax haven-high tax operation as one consolidated corporation. The interest payment therefore escapes Subpart F taxes and the company can defer US income tax in the tax haven.

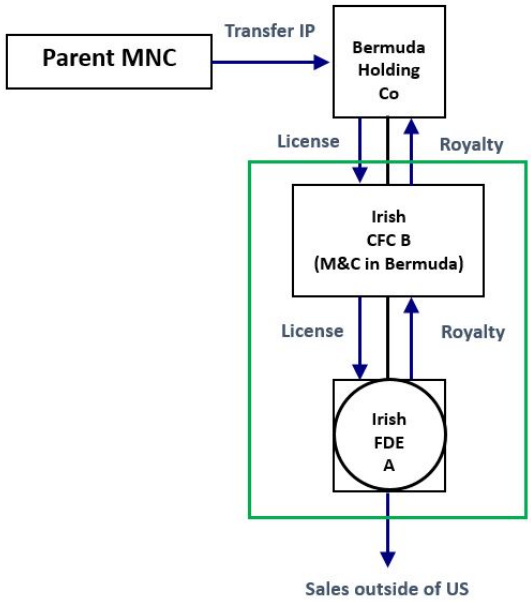
[6]Prior to 1997, although it was possible for MNCs to create foreign disregarded entities, there were strict rules regarding what types of entities could be declared as such. In particular, such entities had to demonstrate that they possessed at least three of four characteristics associated with partnerships. In practice, we observe very few of these entities prior to the implementation of CTB in 1997.

Figure 2: Diagrams of Hybrid Tax Planning Structures

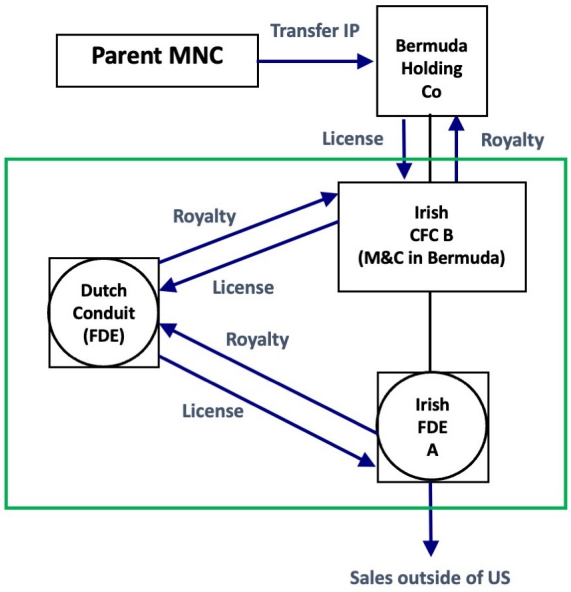
(A) Simple CTB Structure



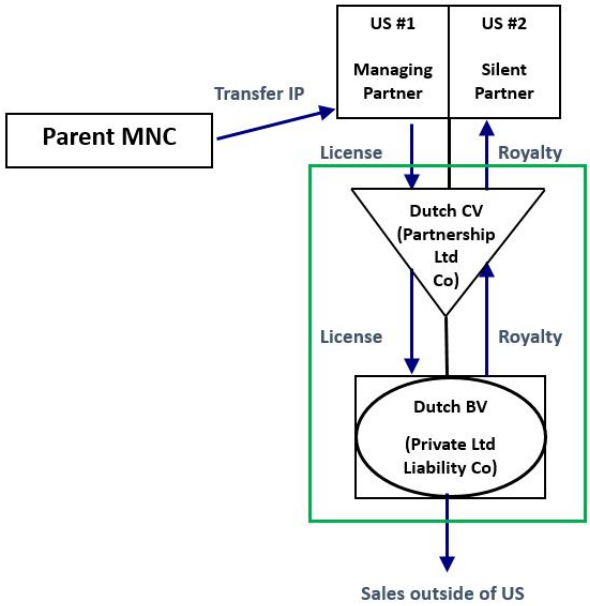
(B) Double Irish



(C) Double Irish with Dutch Sandwich



(D) Reverse Hybrid Mismatch



Notes: Panel A of Figure 2 depicts a hypothetical financing CTB structure; Panel B describes a Double Irish structure; Panel C adds a Dutch sandwich; and Panel D describes a reverse hybrid mismatch structure, otherwise known as a CV-BV. In each of these diagrams, the green rectangles depict the combined structures as perceived by the IRS, corporations are denoted by squares, and disregarded entities are denoted by circles. Hybrid entities—which are corporation in the local country but are disregarded for US purposes—are denoted as squares with circles inside. In Panel D, the CV is shown as a triangle to denote that it is a reverse hybrid: is it a partnership for Dutch purposes but a corporation for US purposes.

Panel A in Figure 2 depicts this simple hybrid tax planning structure using a tax haven affiliate. Squares in Figure 2 denote CFCs and circles within squares denote hybrids that are disregarded entities (FDEs). The green box around the two entities (the tax haven CFC and the high-tax FDE) indicates that the structure is consolidated from the US point of view. This simple structure allows the parent to capitalize a foreign affiliate through a haven while avoiding any current US tax on interest by making intercompany payments invisible.

While this structure avoids Subpart F taxes and defers US income taxes, the MNC would still be subject to corporate income taxes in the tax haven (if they exist) and potentially to foreign withholding taxes on the interest payments between affiliates.[7] Moreover, to combat interest stripping, many countries have adopted "thin-capitalization rules" that limit the tax deductibility of interest payments, reducing the attractiveness of this option.

2.2.1 CTB and Cost Sharing Agreements

Another form of income shifting is available to MNCs with intellectual property (IP). This method uses cost sharing agreements to develop IP that can be licensed abroad. These agreements are particularly tax advantageous when combined with CTB.

Under a cost sharing agreement, the tax haven affiliate makes a "buy-in payment" that funds a part of the parent's R&D project. This gives the affiliate the right to license resulting IP to other foreign subsidiaries in exchange for royalty payments. Royalty payments are not subject to current tax under Subpart F if the parent checks the box on the affiliate making the payment.[8] The key is that with CTB, any payments for the use of the IP abroad are contained within one consolidated company from the view of the US Treasury.

It is important to note that determining the right arm's length payment for the buy-in is usually quite difficult. Typically the IP is not fully developed at the time the buy-in payment is made so there is risk regarding future profits. While the US has rules under which buy-in payments would be adjusted if the profits associated with the IP are too high relative to payments, it is possible for MNCs to underprice the IP. This allows US MNCs to shift income from IP to low-tax affiliates. MNCs are then able to use hybrid tax planning structures to

[7] After the adoption of "look-through" rules passed as part of the Tax Increase Prevention and Reconciliation Act (TIPRA) of 2005, MNCs could avoid Subpart F taxation on distributions of interest, rents and royalties across CFCs without relying on FDEs.

[8] Profits could be further accumulated in a tax haven if MNCs overprice the royalty. The absence of comparable transactions makes it hard for tax authorities to value intellectual property and correctly price royalty payments.

minimize tax on the foreign profits generated from their IP.

As with interest stripping, royalty payments may still be subject to corporate income taxes in a tax haven and to withholding taxes that are meant to prevent profit shifting between countries. We now describe complex tax planning strategies that aim to circumvent all income and withholding taxes.

2.2.2 CTB, Ireland, and Intellectual Property

The first tax planning strategy we study is known as the Double Irish and involves setting up a network of affiliates in Ireland and tax havens. Consider a parent MNC that develops IP in the US that it wants to sell around the world through Ireland, for example. The parent can transfer the IP to a tax haven CFC using a cost sharing arrangement. The tax haven CFC could then license the IP to an Irish CFC which we show as CFC A in Panel B of Figure 2. The Irish CFC pays royalties to the tax haven CFC from the sales revenue it receives from selling the IP abroad.

The cost sharing structure described above creates three tax problems for the parent. First, the parent will be subject to Subpart F taxes (current US tax) on the royalties paid from Ireland CFC A to the haven. Second, taxes will be due in Ireland on any profits that remain in CFC A after royalties are paid to the haven affiliate. Finally, the parent will owe Irish withholding taxes on the royalty transfers to the haven.

These tax problems can be solved in two steps. In step one, the parent creates a second CFC, "CFC B" in Panel B of Figure 2, which is legally incorporated in Ireland but managed and controlled in Bermuda. Under Irish tax law, CFC B is a Bermuda company and therefore not subject to Irish tax. The parent can check the box on CFC A to avoid current US tax on the royalties. CFC A becomes a FDE and is fiscally transparent to the US Treasury. While step one eliminates Irish tax on any profits remaining in Ireland after royalties are paid as well as current US taxes on the royalties, the transfer to the CFC B generates Irish withholding taxes.

The second step eliminates the withholding taxes by putting a Dutch conduit—a "Dutch Sandwich"—between the Irish affiliates. Panel C of Figure 2 shows this augmented structure. With the Dutch conduit in place, the parent owes no withholding tax on payments between the conduit and the Irish affiliate (FDE A) since no withholding taxes are due between European Union companies. Further, no withholding taxes will accrue on the royalties between the Dutch conduit and the Irish CFC B since no withholding tax is imposed on these transfers under Dutch

law. To avoid Subpart F taxes on the royalty payments, the Dutch conduit is also an FDE. The "Double Irish with a Dutch Sandwich" hybrid tax planning structure solves all three tax problems we identified above.

2.2.3 Reverse Hybrid Mismatch

The second tax planning structure we examine uses a structure known as a reverse hybrid mismatch. While these strategies can be employed using affiliates in different countries, we first describe a common structure using Dutch companies. To set up this structure, a US MNC creates two US-based affiliates to act as managing/silent partners in a Dutch closed limited partnership called a CV (*commanditaire vennootschap* in Dutch). The partnership is a reverse hybrid entity—it is treated as a pass-through company by the Netherlands and as a corporation by the US. The Dutch CV owns a private limited liability company, called a BV (*besloten vennootschap* in Dutch), which acts as a holding company. The BV owns foreign (non-US) subsidiaries (e.g., in Europe). The BV holds the license for the US IP, sells it to foreign companies, and pays royalties to the CV. Panel D of Figure 2 depicts this structure.

The reverse hybrid mismatch allows the MNC to avoid taxes on foreign income by solving three tax problems. First, taxes may be due in the Netherlands. By Dutch tax law, the CV is a pass-through entity and, as a result, corporate taxes are not paid in the Netherlands. The CV is a reverse hybrid since the CV is a corporation from the US perspective. The BV is a hybrid and the US MNC disregards it by "checking the box." Second, payments from BV to CV can generate Subpart F taxes. Since the US sees a consolidated operation, no Subpart F tax will be due on the royalties. Finally, payments from the BV to the CV could trigger Dutch withholding tax. However, a 2005 decree by the Dutch Finance Ministry exempted US-based CV-BVs from withholding taxes. With this tax planning structure in place, profits from US-developed IP sold abroad are not subject to corporate tax in the Netherlands and enjoy indefinite deferral from US tax (under pre-TCJA law). The CV-BV structure is effectively a "sink" for foreign profits.

A similar structure can be set up through other countries. In particular, a combination of two types of Luxembourg companies, known as SCS and SARL yields a reverse hybrid mismatch structure.[9]

While the description of these structures emphasizes the potential to minimize tax obligations,

[9]SCS and SARL are short for *société en commandite simple* and *société à responsabilité limitée*, respectively. In this case, the SCS is the reverse hybrid company and the SARL is disregarded from the US perspective.

it is important to note that tax planning is also costly. MNCs have to pay for accounting and legal advice and engage in transactions to form the structures. In addition, company executives differ in their perceived cost of adopting tax aggressive positions. Our model incorporates these fixed costs of tax planning into the decision to adopt an HTP. To the extent that MNCs incur these costs to avoid paying taxes, tax planning is distortionary from an economic perspective.

3 Data and Sample Construction

3.1 IRS Business Tax Data

We rely primarily on several IRS datasets for our analysis. These administrative datasets provide parent and CFC-level information disclosed in tax returns that allows us to measure domestic and foreign activity of US corporations for a large sample of US corporations, both private and public.

The first dataset, commonly referred to as the Statistics of Income (SOI) corporate sample, is an annual stratified sample of US corporations that SOI uses to produce publicly available aggregated business income statistics.[10] The SOI corporate sample contains information from unaudited tax returns for approximately 100,000 US corporations annually and has been widely used in the business tax literature to study the behavior of domestic firms (e.g., as in Yagan, 2015; Zwick and Mahon, 2017). Our data focuses on C-corporations that were sampled between 1992 and 2016. The data primarily contains information from Form 1120, the US Corporate Income Tax Return, as well as some information from related forms. In our analysis, we also use information from Form 6765, which is used to claim the R&D tax credit, as well as Form 4562, which is used to calculate tax deductions for depreciation on capital assets.

The second dataset, which reports information related to foreign affiliates of US corporations, is used by SOI to publish aggregate statistics for international business taxes (IRS, 2022*a*). This dataset provides information from filings of Form 5471, an information return that provides financial information and activity of CFCs, as well as Form 8858, which provides similar information for foreign disregarded entities (FDEs), the entity type created by CTB. Unlike the SOI corporate sample, which is provided annually, CFC data is collected only in even years. FDE data is collected for four of the years in our sample period (2006, 2008, 2012, and 2016). Prior to 2004, SOI only collected information related to CFCs for large MNCs with greater than $500

[10]Statistics are available at IRS (2022*b*), and the sampling procedure is described in IRS (2011).

Table 1: IRS Forms and Selected Outcomes

SOI Corporate Sample

Form	Description	Selected Outcomes
1120	Corporate Income Tax Return	Domestic Assets Domestic Wages
6765	R&D Tax Credit	Domestic R&D Expenses Domestic R&D Wages R&D Tax Credit
4562	Depreciation and Amortization	Capital Investment

SOI International Business Tax Sample

Form	Description	Selected Outcomes
5471	CFC Information Return	Foreign E&P Foreign Taxes Foreign Assets Country of Incorporation Transactions Between CFCs Transactions Between US Parent and CFCs
8858	FDE Information Return	Foreign E&P Foreign Assets Country of Incorporation Date Disregarded Passthrough Owners Tax Owner

million in assets. Starting in 2004, the sampling procedure became much broader, and covers a superset of the SOI corporate sample.

Table 1 summarizes the tax forms described above along with selected outcomes that we use in our analysis.

3.2 Sample Construction

Table 2 shows the size of several different samples of MNCs, along with their foreign affiliates (CFCs and FDEs). We consider a firm to be a MNC if it files Form 5471 for at least one CFC. Column (1) reports the number of MNCs that have coverage in our data from the SOI international business tax studies. Column (2) shows the number of MNCs from Column (1) that also appear in the SOI corporate sample. As mentioned above, there was a sampling change

Table 2: Sample Sizes

	(1) Int'l. Business Sample	(2) SOI Corp. Sample	(3) Stable Sample	(4) Balanced
MNE Count	21411	17491	3638	460
CFC Count	247686	230874	40836	22648
FDE Count	53094	51579	46039	23278

Notes: This table provides the size of four different samples of US MNCs, along with their related controlled foreign corporations (CFCs) and related foreign disregarded entities (FDEs). Column (1) provides sample sizes using all MNCs in the SOI International Business Tax Sample. Column (2) provides sample sizes after removing MNCs that are not included in the IRS Statistics of Income (SOI) corporate sample. Column (3) applies a size filter that removes smaller MNCs from the sample so that the sample composition is similar in earlier and later years. Column (4) provides samples sizes for MNCs included in Column (3) that are also observed prior to the implementation of CTB in 1997 and that remain in the sample until at least 2002.

in the international business tax study starting in 2004 that resulted in a large increase in the sample, especially for smaller MNCs. To stabilize the firm sampling distribution between earlier and later years, we remove MNCs that did not have at least one CFC with $50 million in foreign assets as well as those with fewer than $500 million in domestic assets. Column (3) shows sample sizes after applying this filter. Column (4) shows sample sizes for a balanced panel of MNCs that appear in the data in 1996, the first period prior to the implementation of CTB, and that remain in the sample until at least 2002. To study firm-level outcomes, our analysis primarily uses the samples shown in Columns (3) and (4).

3.3 Measuring Foreign Effective Tax Rates

One possible concern when measuring the income of foreign affiliates of corporations relates to the measurement of foreign E&P. Blouin and Robinson (2020) suggest that IRS statistics may inadvertently double count foreign E&P. This is due to accounting quirks of MNCs. Consider a hypothetical US firm with two CFCs (A and B). Suppose that CFC A is a holding company that holds a 100% stake in CFC B and has no economic purpose other than to collect dividends from its subsidiaries, and further suppose that CFC B discloses E&P of $100 million, which is then issued as a dividend to CFC A. CFC B will then also report E&P of $100 million. A simple aggregation of the firm's foreign profits will result in an estimate of $200 million in foreign E&P even though the true figure is $100 million. If firms with hybrid structures tend to issue more dividends between their foreign affiliates, then this exercise would overestimate their E&P and

in turn underestimate the ETR. However, each CFC must also file an attachment to Form 5471 that discloses transactions between the focal CFC and related CFCs, including any dividends that the CFCs may transfer to each other.

To ensure that there is no double-counting of foreign profits, we subtract these related dividends from our calculations. Specifically, we compute the firm-level foreign ETRs as

$$ETR = \frac{\text{Foreign Taxes}}{\text{Foreign Taxes} + \text{Foreign Earnings and Profits}},$$

where total foreign tax payments are taken from Form 5471, Schedule E.[11] To calculate pre-tax earnings and profits we obtain pre-tax E&P for each affiliated CFC (using Schedules H and E from Form 5471). Following the suggestion of Blouin and Robinson (2020), we remove dividends received from related CFCs from E&P (using Schedule M from Form 5471).

3.4 Measuring Changes in International Corporate Structures

Both the SOI corporate sample and the CFC sample have been used to study domestic and international business taxation. Relatively little work, however, has utilized the wealth of information contained in the FDE sample.[12] Although data from Form 8858 is collected less frequently than other samples, it allows us to observe two important features of US MNC structures. First, it reveals the date when an entity was first disregarded by a MNC, which allows us to measure adoption of CTB among MNCs. Second, it allows us to observe the tax ownership structure of each CFC along with its FDEs. These ownership structures reveal important cross-national linkages within MNCs and, most importantly, allow us to identify CFCs that have particular structures associated with the tax planning strategies described in Section 2.

3.4.1 Detecting the Double Irish

As described previously, the Double Irish involves two Irish entities—a top-level entity that is incorporated in Ireland, but managed and controlled in another low-tax foreign country, and a lower-level Irish entity that merchandises the IP and pays a royalty. Typically, the lower-level entity is "checked" and is classified as an FDE for US tax purposes. Alternatively, the MNC may "check" both types of entities which are then classified as FDEs under the "tax ownership"

[11] There does not appear to be any such double-counting concern related to the payment of foreign taxes. We exclude unprofitable firm-years from this calculation.

[12] A notable exception is a recent working paper, Samarakoon (2022), that examines the impact of the closure of the Double Irish tax structure in Ireland.

of a separate CFC. As a result, we flag two types of CFCs that could be used in a Double Irish arrangement. First, we flag any CFC that is incorporated in Ireland and that checks the box on an Irish FDE. Second, we flag any CFC that checks the box on two separate Irish FDEs. Note that this classification method flags "simple" Double Irish arrangements that involve a direct link between two Irish entities, but also more complex arrangements, such as the Double Irish with a Dutch Sandwich, that might involve intermediary affiliates through which profits are routed.

3.4.2 Detecting Reverse Hybrids

The other type of structures we consider are reverse hybrid arrangements common in the Netherlands and Luxembourg. This arrangement, also described in Section 2, involves a top-level entity that is classified as a partnership and a bottom-level entity that is classified as an private limited company (PLC) in the associated country of incorporation. SOI data typically provide the acronym that is associated with the management form of foreign affiliates on Form 5471 and 8858. In the Netherlands, for example, partnerships are associated with the acronym CV and the equivalent form of a PLC is associated with the acronym BV. The equivalent acronyms in Luxembourg are SCS (for a partnership) and SARL (for a PLC). To classify potential reverse hybrid structures, we flag any CFC classified as a CV (incorporated in the Netherlands) or SCS (incorporated in Luxembourg) that check the box on an FDE classified as a BV (Netherlands) or SARL (Luxembourg). We also flag any CFC that checks the box on a CV-BV or SCS-SARL pair of FDEs.

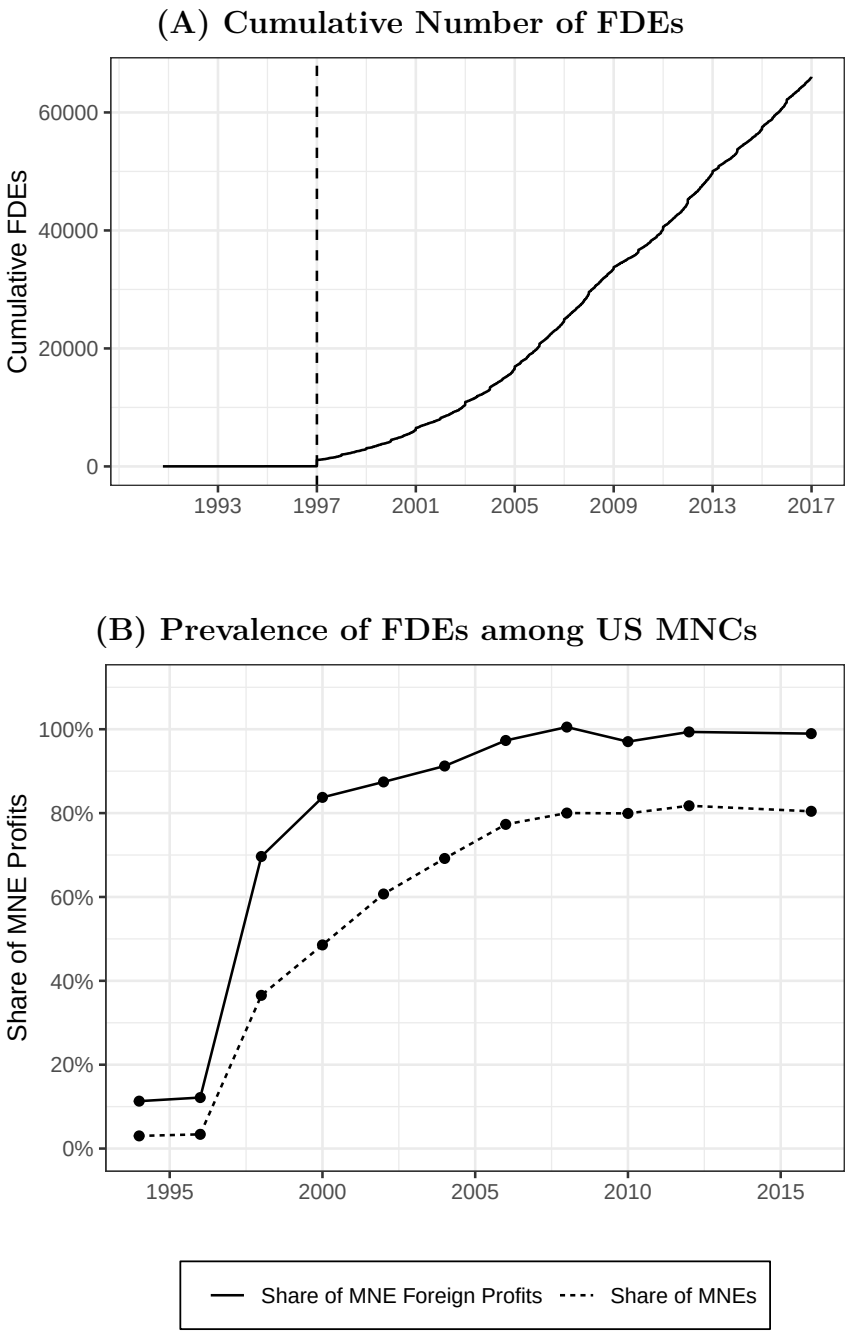
For both the Double Irish and Reverse Hybrid Mismatch arrangements, we use the first date that all flagged FDEs were disregarded to measure the year that a MNC first adopted a particular structure.

4 Adoption and Prevalence of CTB and Hybrid Tax Planning Structures

In this section, we start by describing how US MNCs used CTB after its implementation in 1997. We show that after its implementation, usage of tax-transparent FDEs quickly became widespread among US MNCs. A large share of these entities are connected to well known tax havens.

Next, we focus on the tax planning structures described in Section 2. We show that MNCs

Figure 3: Adoption of Foreign Disregarded Entities



Notes: Panels A of Figure 3 plots the cumulative number of foreign disregarded entities (FDEs). There were fewer than 50 FDEs prior to 1997 and this number grew rapidly following the adoption of CTB regulations. Panel B plots the fraction of US MNCs with an FDE as well as the share of foreign profits that accrue to US MNCs with FDEs. By 2008, close to 80% of US MNCs have a FDE and these MNCs account for close to 100% of foreign profits.

Table 3: Disregarded Entities by Country of Incorporation

Country Name	Adj. E&P (billions)	Num. FDEs
Netherlands	69	12236
Ireland	67	4834
United Kingdom	66	26979
Cayman Islands	51	5276
Bermuda	46	2124
Singapore	38	3458
Switzerland	33	2134
Canada	28	7427
Australia	26	6780
China	22	6558

Notes: This table shows the largest ten countries by total foreign earnings generated by foreign disregarded entities (FDEs). Column (2) provides aggregate E&P, adjusted to remove related dividends, generated by FDEs in the the country listed in column (1). This includes E&P for all years that we observe Form 8858 filings (2006, 2008, 2012, and 2016). Column (3) shows the number of unique entities across all years of this sample.

gradually adopted these structures in the decade after the implementation of CTB. By the 2010s, MNCs that adopted at least one of these structures were generating a majority of E&P among firms in our sample and for these MNCs, a majority of foreign profits were connected to these structures. We show that these MNCs also represent a large share of domestic activity, with 20% of domestic payroll and 15% of domestic capital assets by 2016.

4.1 Adoption of Check the Box

Panel A of Figure 3 shows the cumulative number of FDEs created between 1992 and 2016. Prior to 1997, usage of these transparent entities was relatively rare—the IRS had used a resource-intensive system that required firms to show that their affiliates possessed a set of characteristics that were more consistent with a partnership classification (transparent) or corporations (non-transparent). Starting in 1997, the Treasury relaxed these restrictions, as described in Section 2. As a result, usage of FDEs became widespread over the next two decades, with over 60,000 foreign affiliates classified as FDEs by the end of 2016. Panel B shows that by 2008, about 80% of MNCs used CTB, and that these MNCs generated nearly all of foreign E&P.

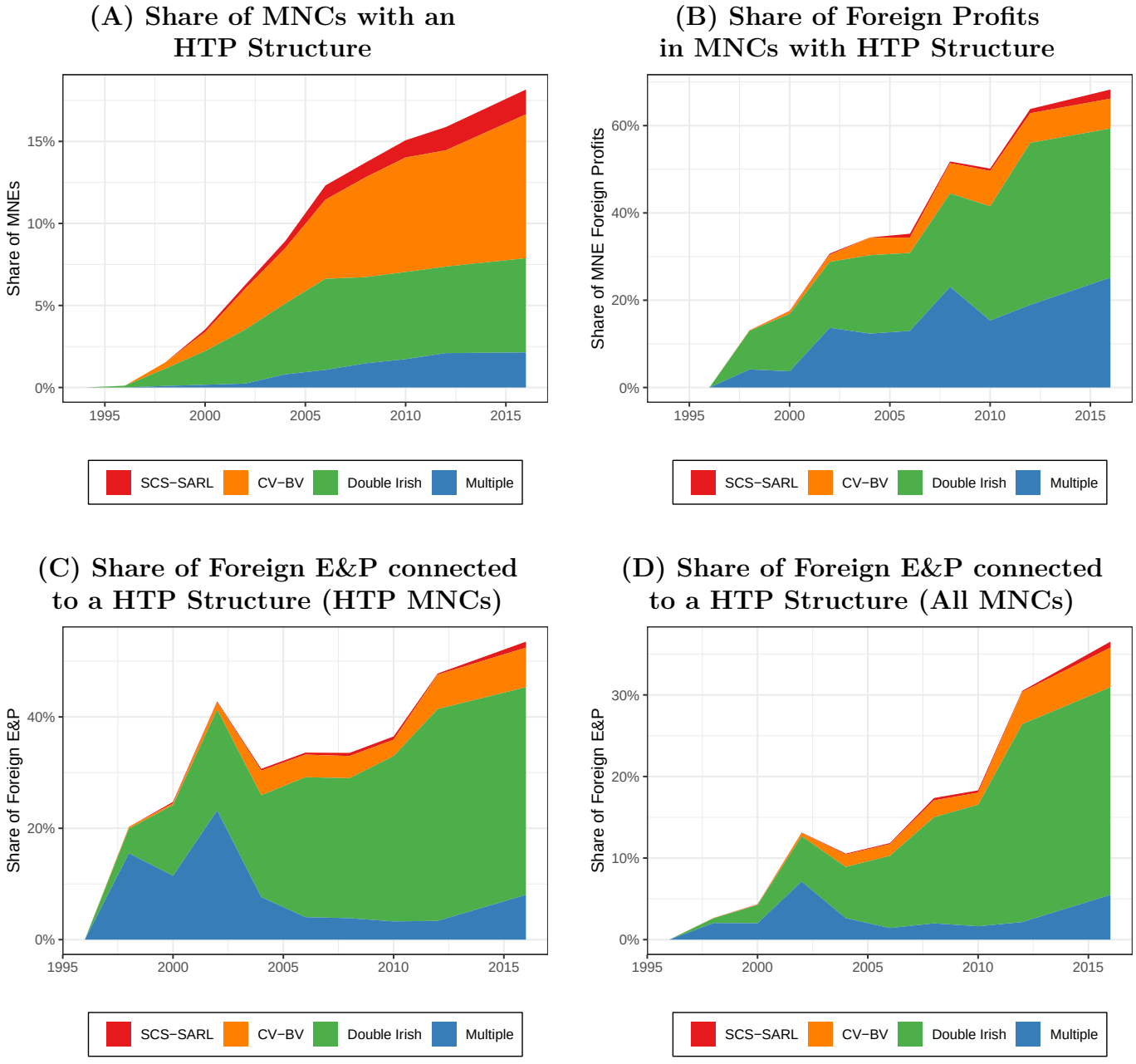
Table 3 shows the largest ten countries according to total earnings generated by FDEs. The Netherlands and Ireland are the largest domiciles for these types of foreign affiliates. FDEs also generate large amounts of earnings in well known tax havens, such as the Cayman Islands and

Bermuda.

4.2 Adoption of Hybrid Tax Planning Structures

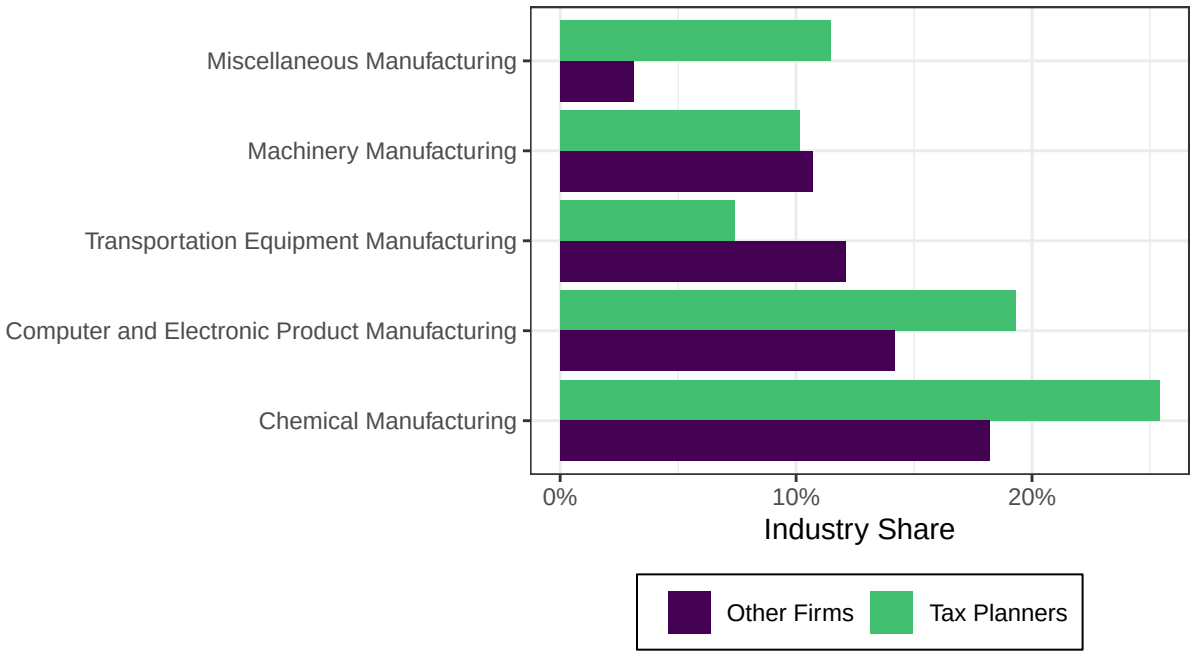
Panel A of Figure 4 shows the evolution of the share of MNCs in our sample that adopted particular tax planning structures. After the implementation of CTB, there was steady adoption of these structures, with more than 16% of MNCs adopting at least one by 2016. Panel B demonstrates that by 2008, these MNCs generated a majority of foreign E&P. Panel C shows that the CFCs linked to HTPs generate the majority of profits within MNCs that use them. Panel D shows the share of foreign E&P that is linked to HTP structures relative to all the foreign E&P of the MNCs in our sample. This figure shows that, by 2016, close to 35% of all foreign E&P of US MNCs was routed through an HTP.

Figure 4: Adoption of Hybrid Tax Planning (HTP) Structures



Notes: These figures show that a growing share of US multinationals (MNCs) have adopted hybrid tax structures over time (Panel A) and that these MNCs are responsible for a large share of the overall foreign E&P of US MNCs (Panel B). Panel C shows that a large share of foreign E&P within adopting MNCs is connected to HTPs. Panel D shows the share of foreign E&P that is connected to an HTP relative to all the MNCs in our sample. In each panel, the blue area comprises MNCs that have adopted more than one structure.

Figure 5: Comparison of Industry Shares by MNC Group



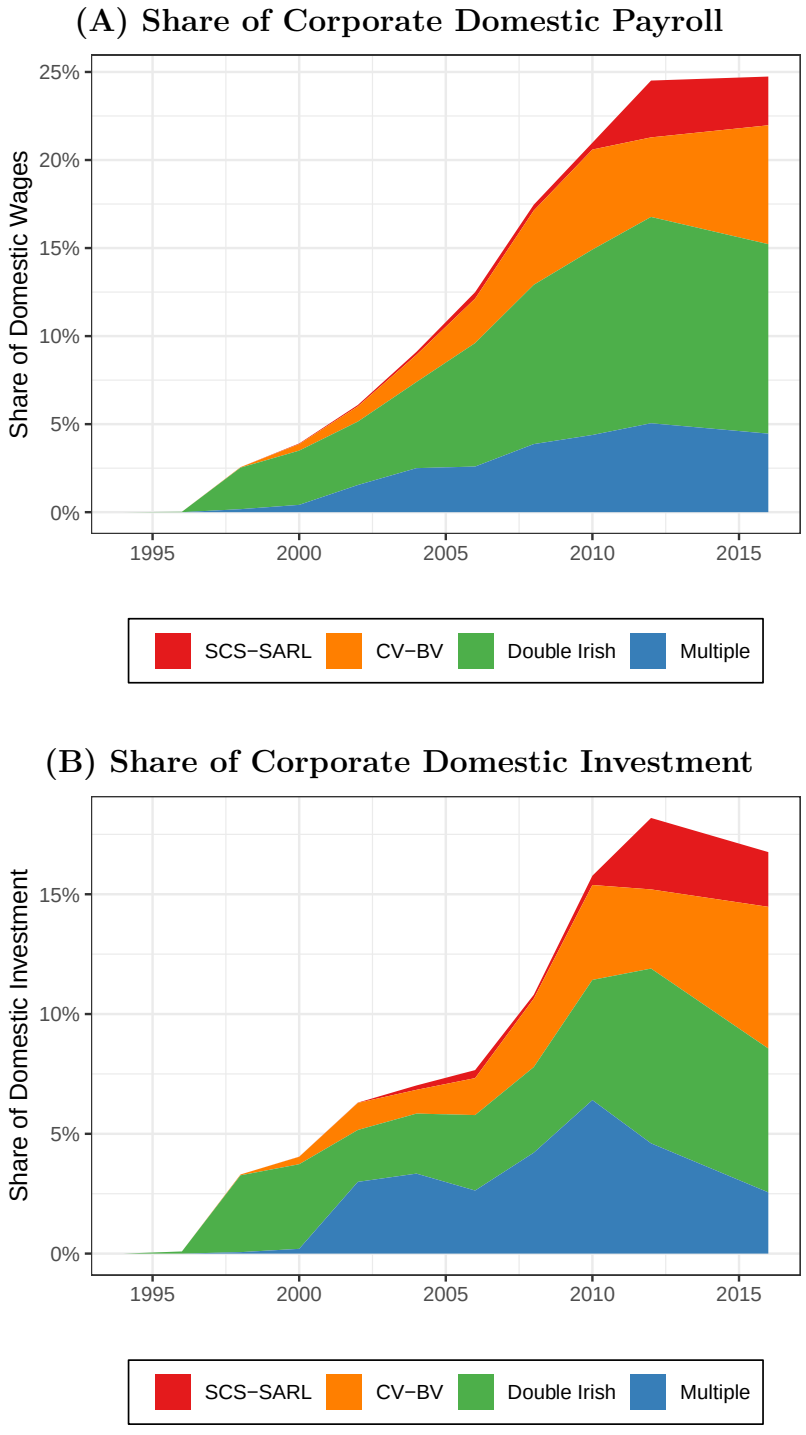
Notes: This figure compares manufacturing subindustry shares across two groups of US multinationals (MNCs) for the five largest manufacturing subindustries. The light green bars show the subindustry share for a group of MNCs that eventually adopt at least one of the hybrid tax structures described in Section 2. The dark blue bars shows the subindustry share for MNCs that did not adopt any of these structures during the sample window.

The bulk of our sample is concentrated in manufacturing. Figure 5 compares manufacturing subindustry shares among MNCs with tax planning structures to MNCs without these structures. MNCs with tax planning structures have noticeably larger industry shares within Chemical Manufacturing and Computer and Electronic Product Manufacturing. These subindustries include pharmaceutical and tech firms, IP-intensive businesses that are able to use intangible assets to relocate foreign earnings.

Figure 6 shows that MNCs with tax planning structures comprise a large share of domestic economic activity. As a share of all C corporations in the SOI corporate sample, which includes domestic corporations as well as MNCs, MNCs with tax planning structures paid more than 20% of domestic wages and account for about 15% of domestic investment by 2010.

The results in this section demonstrate that several hybrid tax planning structures became widely adopted by US MNCs after the implementation of CTB, with large shares of foreign profits flowing through these structures in the decade after adoption.

Figure 6: Hybrid Tax Planning Structures and Domestic Economic Activity



Notes: These figures show the share of domestic wages (Panel A) and domestic capital investment (Panel B) paid by US multinationals (MNCs) that adopt one of the hybrid tax structures described in Section 2. This share is computed as a fraction of all domestic wages and capital investment among C corporations in the IRS Statistics of Income corporate sample. See Section 3 and Table 2, Column 2 for a description of the sample.

5 Hybrid Tax Planning Structures and Multinational Activity

In this section, we examine changes in domestic and foreign economic activity of adopting MNCs. We start with a set of descriptive facts that compare select outcomes for MNCs that utilized HTPs, relative to other MNCs that do not rely on these arrangements. We then estimate staggered difference-in-differences models that control for firm characteristics to compare outcomes of MNCs that do and do not adopt hybrid tax structures post adoption.

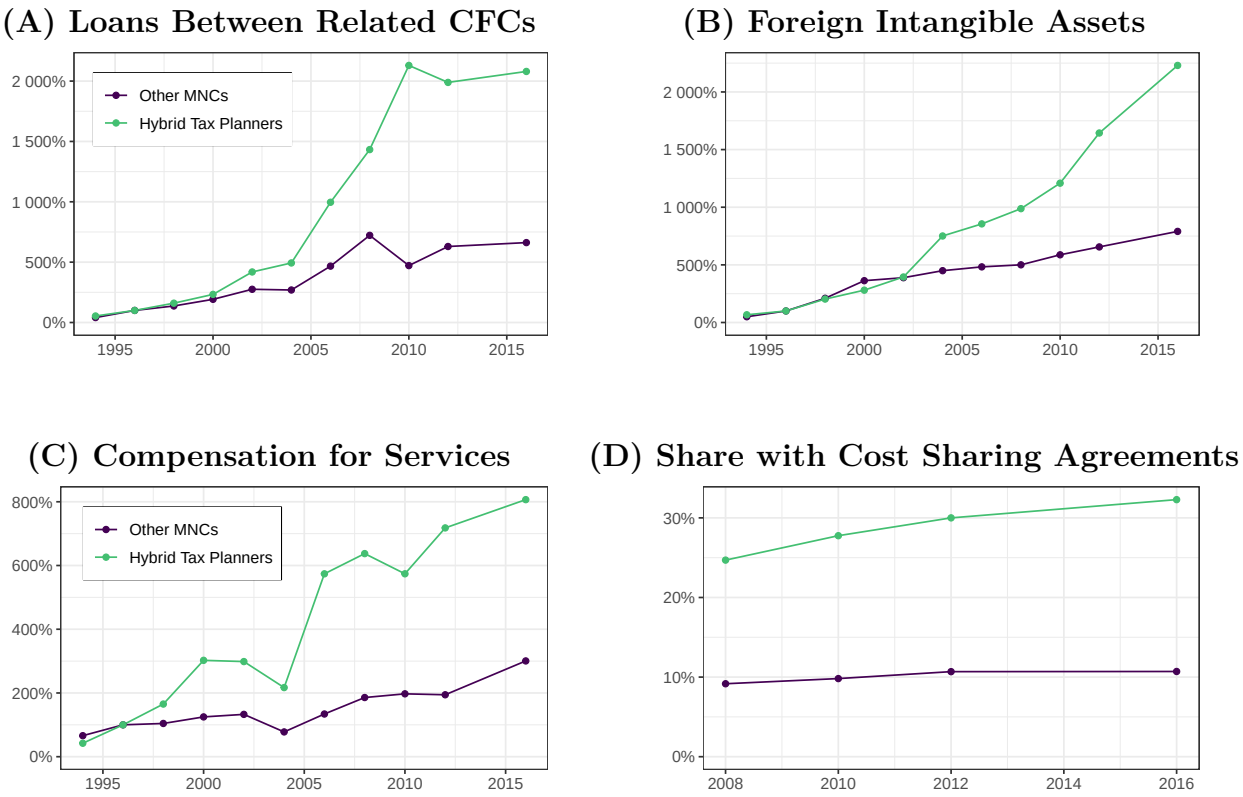
5.1 Comparison of Aggregate Trends

While the structures we study had been suspected of being used for profit shifting, lack of tax data had prevented prior researchers from confirming their role in profit shifting. We thus start by examining whether the hybrid tax planning firms engage in the kinds of transactions that are associated with profit shifting. Figure 7 compares hybrid tax planners to other multinationals along a number of these dimensions. In Panel A we first document that hybrid tax planning firms see a much larger growth in the balance of loans between related CFCs than other MNCs. These transactions may be related to interest stripping strategies, as discussed in Panel A of Figure 2.

Panel B of Figure 7 shows that hybrid tax planning firms experience a much faster rise in the value of their intangible assets held abroad. This is consistent with using hybrid tax planning structures to exploit intangibles abroad. Panel C of Figure 7 shows that hybrid tax planning firms also had larger increases in compensation for services from CFCs to parents—which include cost sharing payments. Starting in 2008, we also observe whether a parent had any cost sharing agreements with one of its CFCs; Panel D shows that hybrid tax planning firms are also more likely to engage in these agreements.

Figure 1 compares the average foreign ETRs of hybrid tax planners with other US MNCs in our sample. At the beginning of the sample period, both types of MNCs paid taxes on foreign E&P at similar rates. Starting in 2002, however, there is a striking divergence in the evolution of each group's ETR. By 2016, hybrid tax planners faced a foreign ETR that was about half of the ETR incurred by other MNCs. Figure 7 provides important context for the decline in foreign ETRs. While one may suppose that declining statutory rates around the world may be responsible for this decline, Figure 7 shows that it was the use of hybrid tax planning structures

Figure 7: Mechanisms for Profit Shifting

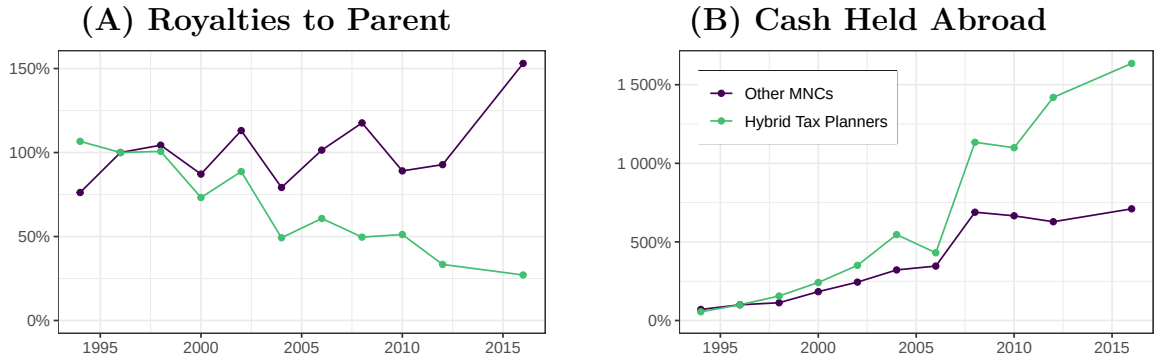


Notes: These figures show the evolution of aggregate loans between related CFCs (Panel A), foreign intangible assets (Panel B), payments from CFCs to US parent companies for technical services (Panel C), and the share of MNCs in each group with active cost sharing agreements with a CFC. For comparability, aggregate values for both groups are normalized to 100% as of 1996 for Panels A through C. The light green line shows values for a group of MNCs that eventually adopt at least one of the hybrid tax structures described in Section 2. The dark blue line shows aggregate values for MNCs that did not adopt any of these structures during the sample window.

that allowed these MNCs to obtain lower ETRs abroad. Indeed, as we see in Figure 1, non-HTP firms experienced a very small decline in foreign ETRs during our sample period.

Having shown that hybrid tax planning structures are likely used for profit shifting, we now examine whether hybrid tax planning firms also deferred more income abroad. Panel A of Figure 8 shows that, relative to foreign E&P, hybrid tax planning firms saw faster declines in royalty payments from CFCs to parents. This result is consistent with parents retaining royalty income from intangibles abroad. Consistent with this interpretation, Panel B also shows that hybrid tax planning firms saw significant larger increases in cash held abroad. While the fact that MNCs accumulated cash abroad during the last two decades is well known, this figure shows that the bulk of the increase in cash held abroad occurred in the just over 300 firms that engaged in hybrid tax planning agreements through Ireland, Netherlands, and Luxembourg.

Figure 8: Evidence of Deferral



Notes: These figures show the evolution of royalty payments from CFCs to domestic parent entities as a share of foreign E&P (Panel A) and aggregate foreign cash balances (Panel B) for two groups of US multinationals (MNCs). For comparability, aggregate values for both groups are normalized to 100% as of 1996 in Panel B. The light green line shows values for a group of MNCs that eventually adopt at least one of the hybrid tax structures described in Section 2. The dark blue line shows aggregate values for MNCs that did not adopt any of these structures during the sample window.

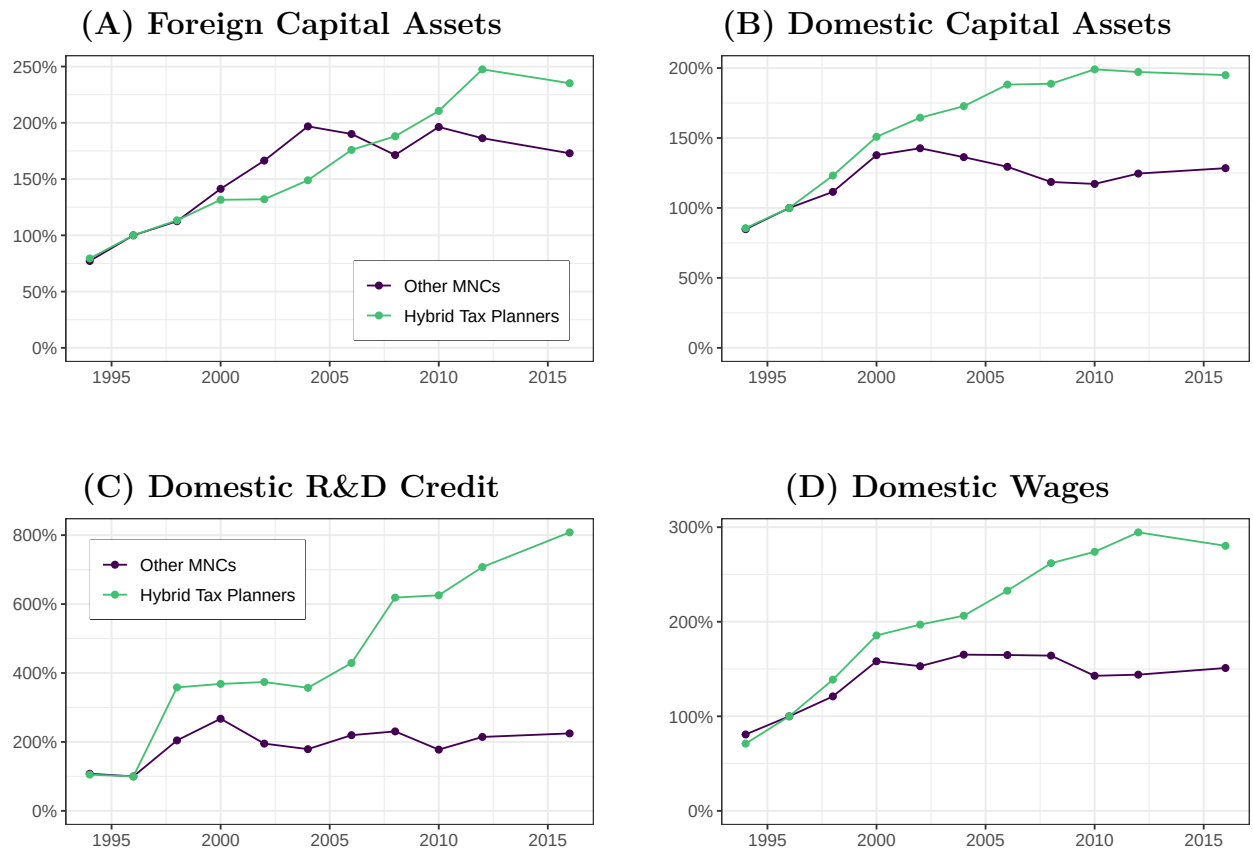
The results in Figures 7 and 8 provide prima-facie evidence of the specific mechanisms through which hybrid tax planning strategies operate. The ability to shift profits to lower tax countries allowed MNCs to avoid taxes abroad, while locating intangibles abroad allowed US MNCs to defer paying US income taxes. We now study whether hybrid tax planning firms experience a different evolution in their real operations.

Figure 9 shows that, while hybrid tax plannings firms and other MNCs had similar patterns of economic activity prior to 1997, their economic activities diverged over the same time period that hybrid tax plannings strategies were adopted. Panel A shows that hybrid tax planners had larger increases in foreign capital assets; Panel B shows that these firms also accumulated more domestic capital assets; Panel C shows larger increases in R&D conducted at home for hybrid tax planners; and Panel D shows larger increases in domestic wages. Across all of these measures, the declines in foreign ETRs were accompanied by increases in economic activity, both domestically and abroad.

5.2 Estimating Staggered Difference-in-Differences Models

The analysis in the preceding section demonstrates that, in aggregate, the foreign ETR among MNCs that adopted hybrid tax planning structures was nearly identical to the foreign ETR of other US MNCs prior to 2004. Furthermore, the aggregate trajectory of several foreign and domestic outcomes for both groups of MNCs were similar until the mid-2000s, at which point

Figure 9: Hybrid Tax Planning and Real Economic Activity



Notes: These figures show the evolution of aggregate foreign capital assets (Panel A), domestic capital assets (Panel B), claimed domestic R&D credits (Panel C), and domestic wages (Panel D) for two groups of US multinationals (MNCs). For comparability, aggregate values for both groups are normalized to 100% as of 1996. The light green line shows aggregate values for a group of MNCs that eventually adopt at least one of the hybrid tax structures described in Section 2. The dark blue line shows aggregate values for MNCs that did not adopt any of these structures during the sample window.

there appears to be substantial divergence. The timing of this divergence coincides with the period when foreign tax planning structures became widely adopted.

In this section, we examine whether this aggregate difference is present at the firm level and estimate relative changes in firm outcomes that adopt an HTP relative to those that do not. We estimate staggered difference-in-differences (DD) models that allow us to determine whether the timing of adoption of a hybrid tax structure aligns with changes in foreign and domestic outcomes.

5.2.1 Event Study Specification

Our main specification relies on a standard staggered differences-in-differences model,

$$Y_{i,t} = \alpha_i + \lambda_t + \sum_{\ell} \mu_\ell \mathbf{1}\left\{t - E_i = \ell\right\} + v_{i,t}, \tag{1}$$

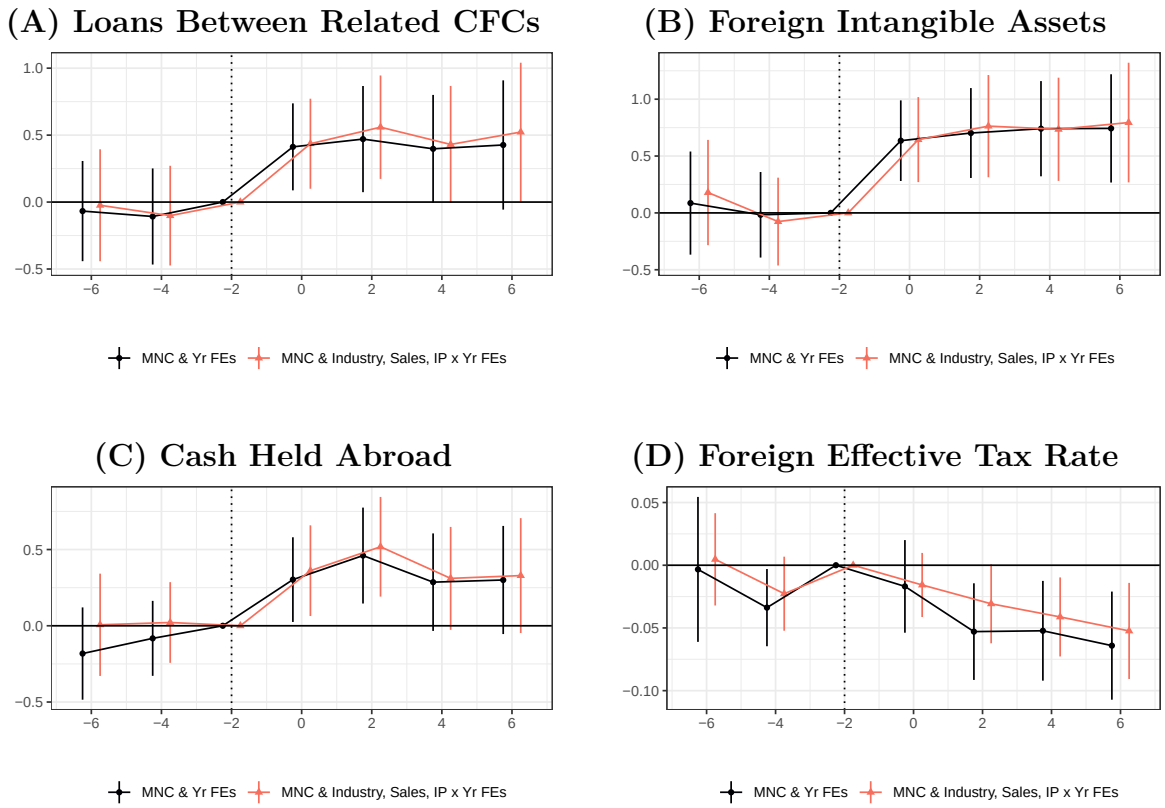
where $Y_{i,t}$ is the selected outcome for MNC i in year t, α_i and λ_t are MNC and year fixed effects, E_i is the time when MNC i initially receives treatment, and ℓ is an indicator for the relative number of periods after MNC i adopts a foreign tax planning structure. We focus on a 12-year relative period around the adoption of a foreign tax planning structure, i.e. we let ℓ vary between -6 and 6. In all specifications, we cluster standard errors at the MNC level.

We interpret results of Equation 1 as measuring dynamic changes in firm-level outcomes of adopting MNCs relative to non-adopting MNCs. Relative to the results in the prior section, these estimates help tie changes in firm outcomes to the timing of adoption. This approach also addresses the concern that firm outcomes are driven by concomitant shocks to firms with characteristics that are related to tax planning (e.g. larger firms, more IP-intensive firms, or firms in different industries). To do so, we estimate alternative specifications that interact year fixed effects with a set of pre-treatment covariates for MNCs to allow for time-varying heterogeneity across industries, across foreign and domestic firm sales bins, and across foreign and domestic bins for intangible assets.[13] Recent literature has pointed out the potential for contamination bias in the specification in Equation 1. As a robustness check, we also estimate effects using the methodology proposed by Sun and Abraham (2021).

While these firm-level comparisons are informative of the role of HTPs in driving the aggregate changes described in the previous section, a key question is whether the results of Equation

[13]To be precise, this implies an augmented version of Equation 1 where λ_t is replaced by $\sum_{g \in G} \lambda_{gt}$, where G is a set of groups for which we include group-by-year fixed effects.

Figure 10: Event Studies: Profit Shifting Mechanisms and Foreign ETRs



Notes: This figure provides estimates of μ_ℓ from Equation 1 for the corresponding foreign outcome listed in each panel. Specification 1 (in black) does not include additional controls. Specification 2 (in orange) includes year-by-industry fixed effects and year-by-group fixed effects, where groups include domestic and foreign sales quartiles and domestic and foreign intangible asset quartiles, and where quartiles are computed using pre-treatment values.

1 can be interpreted as causal effects of HTPs. The usual assumptions for a causal interpretation include parallel trends and no anticipatory behavior. The descriptive evidence provided in the previous section shows that the evolution of outcomes for adopting and non-adopting MNCs was strikingly similar prior to the bulk of adoptions in the mid-2000s. Additionally, pre-trend coefficients in the event study plots provided below are generally insignificant. Regarding anticipation, recall that our data only provides observations in even years, therefore MNCs would have to adjust behavior two years in advance for this form of bias to be present. Because the parallel trends assumption is inherently untestable, it is important to consider that firms may select into HTPs because they have more to gain from tax planning. Section 6 develops a model of selection on gains that interprets estimates from Equation 1 as arising from both selection into tax planning and from behavioral changes related to tax planning.

Table 4: Profit Shifting Mechanisms and Foreign ETRs

	1	2	3	4
Panel A. Loans Between Related CFCs				
ATT	0.288*	0.346*	0.260+	0.334*
	(0.134)	(0.138)	(0.142)	(0.146)
Num. Units	1755	1755	1755	1755
Num. Treated	285	285	285	285
Panel B. Foreign Intangible Assets				
ATT	0.476**	0.492**	0.485**	0.495**
	(0.150)	(0.158)	(0.158)	(0.166)
Num. Units	2290	2290	2290	2290
Num. Treated	308	308	308	308
Panel C. Cash Held Abroad				
ATT	0.295**	0.255*	0.287*	0.263*
	(0.111)	(0.112)	(0.116)	(0.116)
Num. Units	3226	3226	3226	3226
Num. Treated	321	321	321	321
Panel D. Foreign ETR				
ATT	−0.043**	−0.029*	−0.042**	−0.030*
	(0.014)	(0.012)	(0.014)	(0.012)
Num. Units	3302	3302	3302	3302
Num. Treated	321	321	321	321
Industry by Year FEs	No	Yes	No	Yes
Size by Year FEs	No	No	Yes	Yes

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Notes: This table provides ATT estimates for a staggered two-way fixed effects difference-in-differences model provided in equation 1 for the corresponding foreign outcome listed in each panel. Specification 1 does not include additional controls. Specification 2 includes year-by-industry fixed effects. Specification 3 includes year-by-group fixed effects, where groups include domestic and foreign sales quartiles and domestic and foreign intangible asset quartiles, and where quartiles are computed using pre-treatment values. The last specification includes all fixed effects used in specifications 2 and 3.

Table 5: Profit Shifting Mechanisms and Foreign ETRs (Sun & Abraham)

	1	2	3	4
Panel A. Loans Between Related CFCs				
ATT	0.448**	0.472***	0.421**	0.473**
	(0.147)	(0.143)	(0.156)	(0.153)
Num. Units	1755	1755	1755	1755
Num. Treated	285	285	285	285
Panel B. Foreign Intangible Assets				
ATT	0.602***	0.601***	0.599***	0.596***
	(0.148)	(0.151)	(0.155)	(0.159)
Num. Units	2290	2290	2290	2290
Num. Treated	308	308	308	308
Panel C. Cash Held Abroad				
ATT	0.402**	0.371**	0.386**	0.372**
	(0.126)	(0.131)	(0.130)	(0.134)
Num. Units	3226	3226	3226	3226
Num. Treated	321	321	321	321
Panel D. Foreign ETR				
ATT	−0.045***	−0.033**	−0.040***	−0.032**
	(0.011)	(0.011)	(0.012)	(0.011)
Num. Units	3302	3302	3302	3302
Num. Treated	321	321	321	321
Industry by Year FEs	No	Yes	No	Yes
Size by Year FEs	No	No	Yes	Yes

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Notes: This table provides ATT estimates for a staggered difference-in-differences model using the estimator proposed by Sun and Abraham (2021) for the corresponding foreign outcome listed in each panel. Specification 1 does not include additional controls. Specification 2 includes year-by-industry fixed effects. Specification 3 includes year-by-group fixed effects, where groups include domestic and foreign sales quartiles and domestic and foreign intangible asset quartiles, and where quartiles are computed using pre-treatment values. The last specification includes all fixed effects used in specifications 2 and 3.

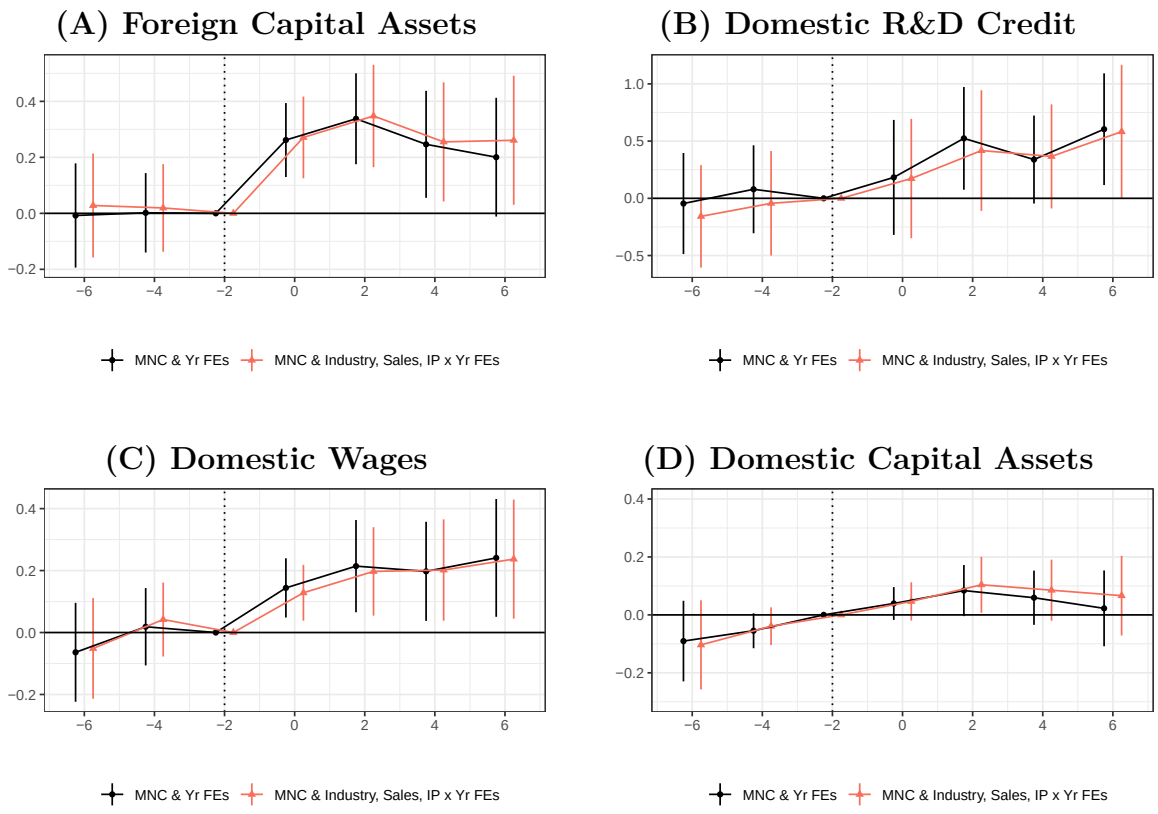
5.2.2 Estimates of Changes in Financial and Tax Outcomes

Figure 10 plots the results of estimating Equation 1 on a set of financial and tax outcomes. We report two specifications for each outcome. Specification 1 (in black) does not include additional controls. Specification 2 (in orange) includes year-by-industry fixed effects and year-by-group fixed effects, where groups include domestic and foreign sales quartiles and domestic and foreign intangible asset quartiles, and where quartiles are computed using pre-treatment values.

Panel A of Figure 10 shows estimates for the log of the balance of loans between CFCs; Panel B shows results for the log of intangibles held abroad; and Panel C shows estimates for the log of cash held abroad. Across these three outcomes, we observe that these markers of profit shifting and deferral are similar between hybrid tax planning firms and other MNCs prior to the adoption of a hybrid structure. For all three outcomes, we observe significant relative increases for hybrid tax planning firms following the adoption of a hybrid tax planning strategy. Consistent with these mechanism and the result of Figure 1, Panel D shows that the foreign ETRs of hybrid tax planning firms saw a significant relative decline following the adoption of a hybrid tax planning structure. For the case of foreign ETRs, Panel D of Figure 10 demonstrates that there was a gradual phase in of the ETR reduction. Six years after adoption, MNCs experience a reduction in their foreign ETR of between 5 and 7 percentage points. For all of these outcomes, we find that inclusion of size-bin-by-year fixed effects and industry-by-year fixed effects does not impact the estimated effects of adopting a hybrid tax planning strategy.

Table 4 displays coefficients from a difference-in-differences specification that summarizes the average changes on these outcomes. We estimate that loans between CFCs increased by 29 percent; foreign intangible assets increased by 48 percent; and cash held abroad increased by 30 percent. We also estimate declines in foreign ETRs of between 3 and 4.3 percentage points. These estimates are remarkably stable across our specifications, suggesting that they are not driven by comparisons across firms in different industries, in different domestic and foreign size categories, or that are more or less dependent on intellectual property. Table 5 reports estimates using the estimator proposed by Sun and Abraham (2021); we obtain similar estimates using this method.

Figure 11: Event Studies: Hybrid Tax Planning and Real Economic Activity



Notes: This figure provides estimates of μ_ℓ from Equation 1 for the corresponding foreign outcome listed in each panel. Specification 1 (in black) does not include additional controls. Specification 2 (in orange) includes year-by-industry fixed effects and year-by-group fixed effects, where groups include domestic and foreign sales quartiles and domestic and foreign intangible asset quartiles, and where quartiles are computed using pre-treatment values.

5.2.3 Estimates of Changes in Real Economic Activity

To measure changes on domestic activity, we estimate Equation 1 on a set of real economic outcomes, including foreign assets, wages, capital investment, and R&D. Foreign assets are reported on Form 5471, wages are reported on Form 1120, capital investment is measured as the sum of reported assets placed into service on Form 4562, and we proxy for R&D with the claimed R&D tax credit reported on Form 6765. Figure 11 reports the results of the event study analyses for these outcomes. As with the financial and tax outcomes, we do not estimate significant pre-trends in any of the real outcomes. Following the adoption of a hybrid tax planning structure, we observe significant relative increases in the foreign and domestic capital assets, domestic R&D activity, and domestic wages.

Table 6 summarizes these estimates using a difference-in-differences specification. Panel A reports an average increase of 18 percent in foreign capital assets. Panel B shows that domestic R&D increased by 40 percent. Panel C reports a 17 percent increase in domestic wages, while Panel D reports a 9 percent increase in domestic capital assets. For all these outcomes, we find that including potential drivers of selection into a hybrid tax planning structure does not impact any of the estimates. Table 7 further shows that we obtain similar estimates when using the estimator of Sun and Abraham (2021).

To gauge the magnitude of these changes in real outcomes, it is useful to compare them to the estimated decrease in foreign ETRs. Specifically, we compute tax rate elasticities as the ratios of the percentages in each of these outcomes and the percentage change in foreign ETRs. Since Figure 7 showed that foreign ETRs declined more gradually, we compare the estimates on real outcome with the decline in foreign ETRs after six years of adoption. Relative to the average foreign ETR of close to 27 percent at the beginning of our sample period (Figure 1), we estimate that foreign ETRs declined by 18.4 percent. Compared to the impacts on real outcomes, we then estimate a foreign ETR elasticity of foreign capital of 0.98, a domestic payroll elasticity of 0.92, a domestic R&D elasticity of 2.2, and a domestic capital elasticity of 0.5.[14]

[14]These calculations use specification 4, where foreign ETRs declined by 5 percentage points. In specification 1, where foreign ETRs declined by 6.7 percentage points, we instead estimate a 37 percent decrease in foreign ETRs. This estimate corresponds to a foreign asset elasticity of 0.49, a domestic wage elasticity of 0.46, a domestic R&D elasticity of 1.09, and a domestic capital elasticity of 0.25.

Table 6: Estimates on Real Economic Activity

	1	2	3	4
Panel A. Foreign Capital Assets				
ATT	0.181**	0.177*	0.181*	0.189*
	(0.070)	(0.071)	(0.075)	(0.076)
Num. Units	2860	2860	2860	2860
Num. Treated	320	320	320	320
Panel B. Domestic R&D Credit				
ATT	0.395**	0.384**	0.388**	0.393**
	(0.143)	(0.147)	(0.143)	(0.151)
Num. Units	1744	1744	1744	1744
Num. Treated	262	262	262	262
Panel C. Domestic Wages				
ATT	0.169**	0.165**	0.161**	0.161**
	(0.059)	(0.061)	(0.060)	(0.061)
Num. Units	2823	2823	2823	2823
Num. Treated	311	311	311	311
Panel D. Domestic Capital Assets				
ATT	0.069	0.097*	0.062	0.092+
	(0.045)	(0.046)	(0.047)	(0.048)
Num. Units	2835	2835	2835	2835
Num. Treated	312	312	312	312
Industry by Year FEs	No	Yes	No	Yes
Size by Year FEs	No	No	Yes	Yes

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: This table provides ATT estimates for a staggered two-way fixed effects difference-in-differences model provided in equation 1 for the corresponding foreign outcome listed in each panel. Specification 1 does not include additional controls. Specification 2 includes year-by-industry fixed effects. Specification 3 includes year-by-group fixed effects, where groups include domestic and foreign sales quartiles and domestic and foreign intangible asset quartiles, and where quartiles are computed using pre-treatment values. The last specification includes all fixed effects used in specifications 2 and 3.

Table 7: Estimates on Real Economic Activity (Sun & Abraham)

	1	2	3	4
Panel A. Foreign Capital Assets				
ATT	0.263***	0.266***	0.248**	0.263***
	(0.073)	(0.075)	(0.077)	(0.079)
Num. Units	2860	2860	2860	2860
Num. Treated	320	320	320	320
Panel B. Domestic R&D Credit				
ATT	0.371*	0.400*	0.373*	0.392*
	(0.145)	(0.164)	(0.152)	(0.171)
Num. Units	1744	1744	1744	1744
Num. Treated	262	262	262	262
Panel C. Domestic Wages				
ATT	0.215***	0.203**	0.212***	0.202**
	(0.061)	(0.062)	(0.062)	(0.061)
Num. Units	2823	2823	2823	2823
Num. Treated	311	311	311	311
Panel D. Domestic Capital Assets				
ATT	0.088*	0.119**	0.083+	0.117*
	(0.042)	(0.044)	(0.044)	(0.046)
Num. Units	2835	2835	2835	2835
Num. Treated	312	312	312	312
Industry by Year FEs	No	Yes	No	Yes
Size by Year FEs	No	No	Yes	Yes

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: This table provides ATT estimates for a staggered difference-in-differences model using the estimator proposed by Sun and Abraham (2021) for the corresponding foreign outcome listed in each panel. Specification 1 does not include additional controls. Specification 2 includes year-by-industry fixed effects. Specification 3 includes year-by-group fixed effects, where groups include domestic and foreign sales quartiles and domestic and foreign intangible asset quartiles, and where quartiles are computed using pre-treatment values. The last specification includes all fixed effects used in specifications 2 and 3.

6 A Model of International Tax Planning

This section develops a model in which MNCs provide services in different countries, engage in hybrid tax planning, and develop intellectual property through R&D. The model highlights two key aspects of tax planning. First, tax planning can impact production and investment abroad by lowering the cost of capital. In the model, R&D investment is nonrival within the MNC and impacts production everywhere by increasing productivity across the MNC. By lowering the cost of capital abroad, tax planning also incentivizes the MNC to increase R&D. Separately, the model allows for the possibility that MNCs select into a hybrid tax planning strategy based on unobserved shocks to their IP. By modeling the selection behavior of MNCs, we can decompose the reduced-form difference-in-differences estimates from the previous section into a "treatment effect" and a "selection effect."

6.1 Model Setup

The model has three stages, which we describe in descending order. In stage 3, the MNC takes taxes and group-level productivity ϕ as given and produces output—which is sold locally in each country—using local capital K. In stage 2, the MNC decides how much to invest in R&D taking taxes as given. In stage 1, the multinational chooses whether to set up a hybrid tax planning structure, taking into account idiosyncratic costs of tax planning, as discussed in Section 2.[15]

Stage 3: Production

For simplicity, we consider two countries: d for domestic and f for foreign. The multinational sells quantities q_c of its product in each country c. The prices for its product in each country is $p_c = I_c(q_c)^{\frac{1}{\varepsilon}}$, where I_c is a demand shifter (e.g., income) and $\varepsilon < -1$ is the elasticity of product demand. The MNC produces output with technology: $q_c = \phi K_c$, where K_c has a global price ρ, which we assume is not tax deductible.[16]

We assume the MNC faces a worldwide tax on corporate income from its home country d. If the MNC sets up a hybrid tax planning structure, the MNC still pays a tax rate of t_d on domestic

[15] This model abstracts away from other behavior, such as the manipulation of transfer pricing in individual transactions (e.g., as in Hines and Rice, 1994). Such behavior can be analyzed by adding a fourth stage where MNCs optimally misreport the location of their profits.

[16] For simplicity, we assume the cost of capital is not tax deductible. In practice, the cost of capital may be partially tax deductible either because of a lack of expensing or from limits to the deductibilty of interest expense.

profits but pays a lower tax rate of t_h by shifting foreign profits to a tax haven, which it defers indefinitely. In this way, the hybrid structure can be seen as a "do it yourself territorial regime" combined with a profit shifting strategy to avoid foreign country taxes.

The MNC solves the production problem:

$$\max_{K_c,K_f} \ (1-t_d)I_d(\phi K_d)^{1+\frac{1}{\varepsilon}} - \rho K_d + (1-t_h)I_f(\phi K_f)^{1+\frac{1}{\varepsilon}} - \rho K_f.$$

Note that assuming that $t_d = t_h$ yields the special case where the MNC does not set up a hybrid tax planning structure and instead faces worldwide income regime in which the domestic country has a higher tax rate $t_d > t_f$ and a credit for foreign taxes.

The optimal capital use in each country is given by: $K_c = (\phi)^{-(1+\varepsilon)} \left[\frac{1+\varepsilon}{\varepsilon}\frac{I_c}{\rho/(1-t_c)}\right]^{-\varepsilon}$. Because capital costs are not tax deductible, higher tax rates increase the effective cost of capital $\frac{\rho}{(1-t_c)}$. The hybrid tax planning structure does not impact domestic capital through the tax rate, but it can increase foreign capital by lowering the tax rate faced by foreign production.

As is the case in models of monopolistic competition, profits are given by a net markup, $\frac{-1}{1+\varepsilon}$, times costs, ρK_c, which yields country profits $\pi_c = \frac{-\rho}{1+\varepsilon}K_c$. Global profits are then:

$$\frac{-\rho}{1+\varepsilon}(K_d+K_f) = \frac{-\rho}{1+\varepsilon}K_d\left[1+\left(\frac{I_d}{I_f}\right)^{\varepsilon}\left(\frac{1-t_d}{1-t_h}\right)^{\varepsilon}\right] = \pi_0\phi^{-(1+\varepsilon)}\left[1+\left(\frac{I_d}{I_f}\right)^{\varepsilon}\left(\frac{1-t_d}{1-t_h}\right)^{\varepsilon}\right],$$

where $\pi_0 = \frac{-\rho}{1+\varepsilon}\left[\frac{1+\varepsilon}{\varepsilon}\frac{I_d}{\rho/(1-t_d)}\right]^{-\varepsilon}$.

The hybrid tax planning strategy increases the value of producing in the foreign country since $t_h < t_d$ and $\varepsilon < -1$ imply that $\left(\frac{1-t_d}{1-t_h}\right)^{\varepsilon} > 1$. Note that this term includes two forces. First, since the effective cost of capital is lower, the MNC invests more abroad, which increases profits. Second, the MNC keeps a larger fraction of its profits since it shifts profits to tax havens.

Stage 2: R&D Investment

The MNC decides how much to invest in R&D, which impacts ϕ. The investment decision takes into account the fact that its intellectual property is non-rival within the firm and will increase profits in both locations. For an MNC i, let $\phi_i = \zeta_i \times D_i^{\gamma}$, where $\gamma < \frac{1}{-(1+\varepsilon)}$, ζ_i is the MNCs existing stock of IP, and D_i is R&D. The MNC solves the R&D investment problem:

$$\max_{D_i} \ \pi_0\zeta_i^{-(1+\varepsilon)}D_i^{-\gamma(1+\varepsilon)}\left[1+\left(\frac{I_d}{I_f}\right)^{\varepsilon}\left(\frac{1-t_d}{1-t_h}\right)^{\varepsilon}\right] - D_i - \frac{b_i}{2}D_i^2.$$

The term b_i is a firm-level adjustment cost of R&D investment. This term captures the fact that some firms may have a greater potential to engage in R&D projects. Since tax planning

is complementary with R&D, firms with a higher potential to engage in R&D—i.e., those with lower values of b_i—may be more likely to set up HTPs.

To understand how differences in productivity ζ_i and tax rates impact R&D investment, consider the simpler case where $b_i = 0$. In this case, the optimal choice of $R\&D$ is given by:

$$D_i^* = \left\{ -\gamma(1+\varepsilon)\pi_0 \zeta_i^{-(1+\varepsilon)} \left[1 + \left(\frac{I_d}{I_f} \right)^{\varepsilon} \left(\frac{1-t_d}{1-t_h} \right)^{\varepsilon} \right] \right\}^{\frac{1}{1+\gamma(1+\varepsilon)}}.$$

It follows from this expression that the optimal choice of R&D is increasing in firm productivity ζ_i and in the relative reduction in foreign tax rates $\left(\frac{1-t_h}{1-t_d}\right)$. That is, MNCs conduct more R&D if they have a larger stock of IP and if setting up a hybrid tax structure will increase its returns from R&D investment abroad.[17] For this reason, MNCs with higher values of ζ_i have more to gain from establishing HTPs.

Let $\Pi(t_d, t_h, \zeta_i, b_i)$ denote the value function from conducting the optimal level of R&D using a hybrid tax planning structure. Similarly, let $\Pi(t_d, t_d, \zeta_i, b_i)$ denote the value of remaining in the worldwide tax system.

Stage 1: Tax Planning

Setting up a hybrid tax planning structure has a fixed cost c_i. This cost includes legal and accounting services related to tax planning, the cost of transactions to establish HTPs, as well as differences in executive attitudes toward aggressive tax planning structures.

The MNC decides to set up a hybrid tax planning structure when the profits it gains from doing so exceed the costs of setting-up the structure, i.e., if

$$\Pi(t_d, t_h, \zeta_i, b_i) - c_i > \Pi(t_d, t_d, \zeta_i, b_i).$$

This inequality captures the four forces driving selection into HTPs. First, the likelihood that a firms adopts an HTP is increasing in the tax wedge $t_d - t_h$. Second, increased productivity ζ_i leads to an increase in the productivity of adopting an HTP. Third, for firms with the same productivity ζ_i, those with better prospects for conducting R&D—i.e., lower b_i—will be more likely to adopt an HTP. Finally, firms with lower cost c_i will also be more likely to adopt an HTP. As we discuss below, these different sources of selection have implications for the interpretation of

[17] Taking logs and differentiating shows that $\frac{\partial \ln D_i^*}{\partial \ln \zeta_i} = \frac{-(1+\varepsilon)}{1+\gamma(1+\varepsilon)} > 0$ and $\frac{\partial \ln D_i^*}{\partial \ln\left(\frac{1-t_h}{1-t_d}\right)} = \frac{-\varepsilon}{1+\gamma(1+\varepsilon)} > 0$. These elasticities are attenuated when $b_i > 0$.

the difference-in-differences estimates as well as for the concentration of profits and R&D among adopting and non-adopting firms.

6.2 Difference-in-Differences Estimates Through the Lens of the Model

Let β^D denote the difference-in-differences estimate of the relative change in log-R&D. From the discussion above, β^D combines a behavioral increase in R&D from exposure to lower tax rates, as well as differences in R&D that are attributed to selection based on productivity ζ_i and R&D potential b_i. From the equation describing the evolution of TFP, ϕ_i, we can write average relative changes in log-ϕ_i as $\Delta \ln \phi_i = \Delta \ln \zeta_i + \gamma \beta^D$, where the first term captures selection into tax planning based on ζ_i and the second captures how differences in R&D relate to differences in TFP ϕ_i.

Recall that optimal capital in a given country is given by: $K_c = (\phi_i)^{-(1+\varepsilon)} \left[\frac{1+\varepsilon}{\varepsilon} \frac{I_c}{\rho/(1-t_c)} \right]^{-\varepsilon}$. This expression and the preceding ones allow us to write the difference-in-differences estimates on domestic and foreign capital as follows:

$$\text{Domestic Capital:} \quad \beta^{K_d} = -(1+\varepsilon) \times \left(\Delta \ln \zeta_i + \gamma \beta^D \right) \tag{2}$$

$$\text{Foreign Capital:} \quad \beta^{K_f} = \beta^{K_d} - \varepsilon \ln \left(\frac{1-t_d}{1-t_h} \right). \tag{3}$$

Intuitively, we observe relative increases in domestic capital either because of differences in R&D or because of selection on ζ_i. The expression for foreign capital shares this TPF effect but additionally allows for capital investment to be influenced by tax differentials.

Letting the estimate on foreign ETR be given by: $\beta^{ETR} = \ln \left(\frac{1-t_d}{1-t_h} \right)$, we can then identify the parameter ε using the domestic and foreign capital effects as follows: $-\varepsilon = \frac{\beta^{K_f} - \beta^{K_d}}{\beta^{ETR}}$.[18] We can also recover the parameter γ by solving the expression for β^{K_d} above as follows:

$$\gamma = \left(-\frac{\beta^{K_d}}{(1+\varepsilon)} - \Delta \ln \zeta_i \right) / \beta^D.$$

This expression depends on the term $\Delta \ln \zeta_i$, which we will estimate using the selection model in the tax planning stage.

Armed with an estimate of $\Delta \ln \zeta_i$, Equations 2 and 3 can be used to decompose the difference-in-differences estimates into behavioral responses to taxation and selection effects. Even without such an estimate, we can use Equations 2 and 3 to provide bounds on the selection and behavioral

[18] The main assumption behind this result is that domestic and foreign productivity R&D are equally (or at least proportionally) affected by the underlying productivity of the MNCs.

responses of HTP adoption. Under the assumption that $\Delta \ln \zeta_i = 0$, we would attribute all of the changes in domestic and foreign capital to behavioral responses to lower tax rates. In this case, domestic capital increases as a result of the productivity effects of the additional (tax-driven) R&D. Foreign capital additionally increases due a tax-investment effect. In contrast, consider now the largest possible role for selection. In this case, the entirety of the R&D and domestic capital changes would be due to selection.[19] Additionally, the behavioral response to lower taxes would then explain $1 - \frac{\beta^{K_d}}{\beta^{K_f}}$ of the changes in foreign capital. While these bounds may be informative, one of the benefits of the model is to obtain a more precise decomposition of the forces behind the difference-in-differences estimates.

6.3 Model Estimation

We now discuss how we parameterize and estimate the model. We assume that the drivers of selection (ζ_i, b_i, c_i) have a joint log-normal distribution $\mathcal{LN}(\mu, \Sigma)$. The vector $\theta = (\varepsilon, \gamma, \mu, \Sigma)$ includes parameters governing firm production and the distribution of drivers of selection.

We estimate θ using the method of simulated moments. For a given guess of θ, we simulate 30,000 firms and solve for their optimal capital use in each country, their optimal R&D, and their implied profits at home and abroad. Using these simulated firm choices, we compute moments of the firm size and profit distributions, the concentration of R&D in tax planning firms, and the fraction of tax planning firms. We also compute difference-in-differences estimates using the simulated data. Our estimate of θ is the value that minimizes the difference between these simulated moments and their empirical counterparts.

The discussion in the previous section shows how the difference-in-differences estimates can help identify ε and γ. We now provide intuition for how the additional data moments can help pin down the importance of the different drivers of selection. If only variation in c_i drives selection, we should expect to see that firm size is unrelated to HTP adoption. This would be the case if in the data we observed that the share of profits of HTP firms equaled the share HTP firms and their share of R&D. In this case, we would also find that $\Delta \ln \zeta_i = 0$. Alternatively, if HTP firms have a much larger share of profits, we would expect to find that $\Delta \ln \zeta_i > 0$. Similarly, if the share of R&D of HTP firms is larger than the share of HTP firms, this would be indicative of selection on R&D potential b_i. While the data help identify the parameters of the distribution of

[19] Since $\beta^D > 0$ and $\beta^{K_d} > 0$ it follows that $\gamma = 0$. We therefore have that $\Delta \ln \zeta_i = -\frac{\beta^{K_d}}{(1+\varepsilon)}$.

Table 8: Estimated Model Parameters

	(1) Elasticity of Product Demand	(2) Productivity Elasticity of R&D	(3) Dispersion in	(4) Dispersion in	(5) Dispersion in	(6) Mean Cost
			ζ_i	b_i	c_i	
	ε^{PD}	γ	σ	σ_b	σ_c	$\bar{c}$
Estimate	-1.650***	0.700***	0.932	4.281	7.048**	8.191
SE	(0.457)	(0.268)	(0.954)	(2.883)	(3.417)	(31.123)

Notes: This table provides estimates of selected model parameters based on the simulated method of moments.

(ζ_i, b_i, c_i), we are not able to idenfy all of the components of μ and Σ. We focus on estimating the mean and dispersion of c_i, the mean and dispersion of ζ_i, and the mean of b_i (we set $\mu_b = 0$).[20]

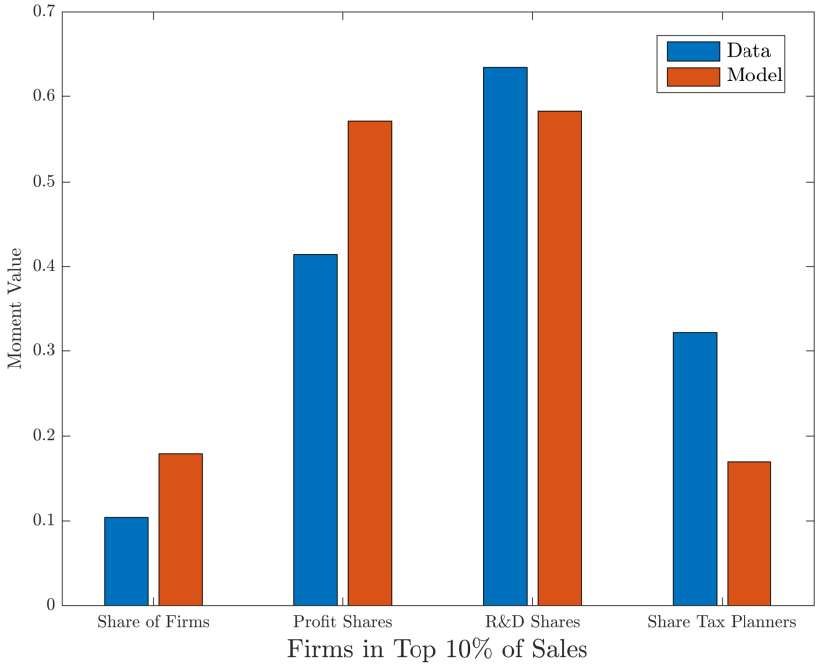
Table 8 reports the results of this estimation. We estimate a value of $\varepsilon = -1.65$. This value of the elasticity of product demand implies large markups, which may be reasonable in IP-heavy industries such as technology and pharmaceutical manufacturing. We estimate a value of $\gamma = 0.7$, which we interpret as the long-run effect of R&D on productivity. Of the drivers of selection, we estimate the largest value for σ_c. This result implies that idiosyncratic differences in the costs of adopting an HTP play a significant role in explaining selection. Nonetheless, as we show below, the model also attributes a large fraction of the changes in real economic activity to selection based on b_i and ζ_i.

Figure 12 shows how the estimated model matches the data. The estimation targets the share of firms, profits, tax planning firms, and R&D at four ranges of the firm size distribution. Since tax planning firm are more likely to be larger, Panel A plots the model and data shares for firms in the Top 10% of the sales distribution. This figure shows that the model parameters do a good job at matching the importance of firms in the top of the distribution. Panel B plots aggregate moments and difference-in-differences estimates. While the model matches the overall share of planners and the estimates on domestic and foreign capital, the model has a hard time fitting the large fraction of foreign profits in HTP firms as well the large relative changes in R&D.

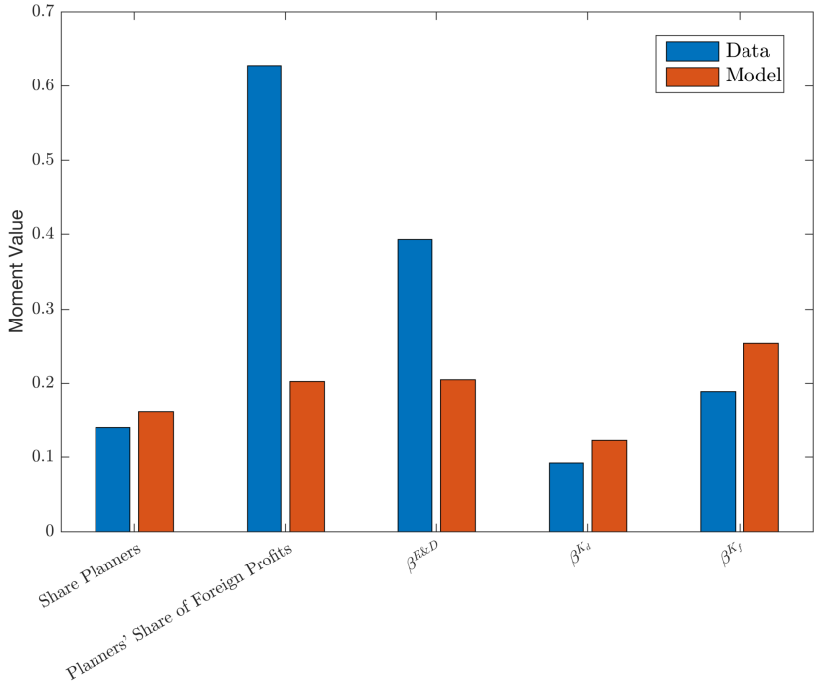
[20] We set all correlations to zero, except for $\rho_{\zeta,c}$ which we initially calibrate to 0.15.

Figure 12: Comparison of Data and Model Moments

(A) Shares of Economic Activity of Hybrid Tax Planners Among Firms in the Top 10% of Sales



(B) Shares of Economic Activity of Hybrid Tax Planners Among All Firms and Difference-in-Differences Estimates



Notes: These figures compare simulated moments with data moments. Panel A compares share of economic activity of HTPs among firms in the top 10% of the sales distribution. Panel B shows aggregate shares and difference-in-differences estimates.

Table 9: Model Decomposition of Difference-in-Differences Estimates

	(1) DiD	(2) Model	(3) Tax Effect	(4) Selection	(5) Share due to ΔETR
R&D: $\beta^{R\&D}$	0.39	0.20	0.04	0.17	0.17
Domestic Capital: β^{K_d}	0.09	0.12	0.05	0.07	0.42
Foreign Capital: β^{K_f}	0.19	0.25	0.18	0.07	0.72

Notes: This table decomposes the difference-in-differences estimates into tax and selection effects. Column (1) lists the estimates from Section 5.2. Column (2) lists the model-implied values of these estimates. Column (3) lists the relative change in each outcome that can be attributed to the behavioral response to the tax change. Column (4) lists the selection effect and column (5) lists the ratio of columns (3) and (2).

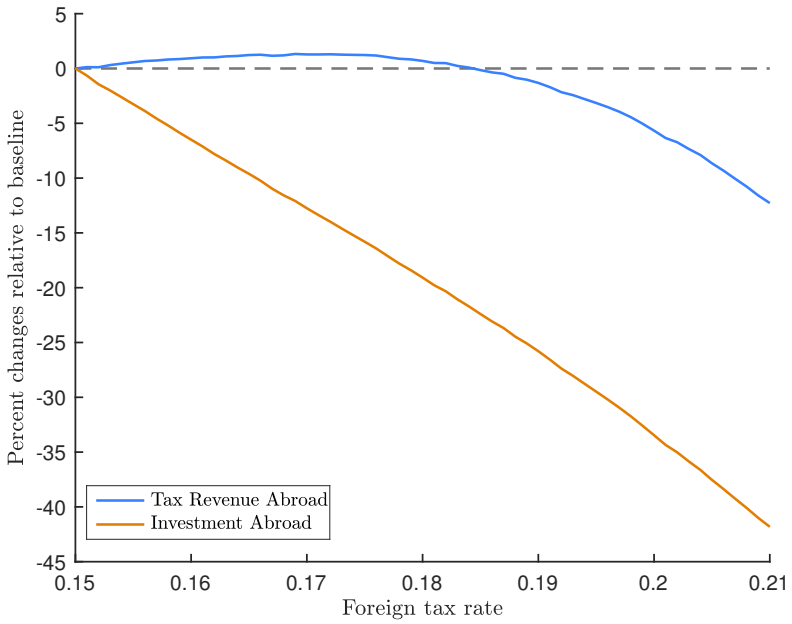
6.4 Decomposition and Counterfactual Effects

As discussed in Section 6.2, we can use the model estimates to decompose the estimates of the difference-in-differences models into selection and behavioral responses of the tax effect of HTPs. Table 9 performs this decomposition. The first two columns list the data and model-based estimates of the difference-in-differences models. As discussed above, the model does a good job of matching the foreign and domestic capital estimates but undershoots the relative changes in R&D. Column (3) lists the contribution of the behavioral response to the tax effect to column (2) and column (4) lists the contribution of the selection term. Finally, column (5) lists the fraction of the effect in column (2) that can be attributed to the tax effect. In the case of R&D, the model implies that upward of 80% of the relative change is driven by selection. In the case of domestic capital, 40% of the relative change is driven by the effect of the tax advantage from HTPs. However, the model shows that about 70% of the change in foreign capital is driven by the response to lower taxes abroad.

This decomposition has meaningful implications for tax policy design. For the US, this result says that a significant fraction of the relative increase in the domestic activity of tax-planning MNCs is not driven by low tax rates. That is, the benefits to the US from tax planning are muted by selection.

To study the implications of our results for foreign governments, we use our estimated model to simulate the impact of reducing the tax advantage from HTPs from a 5pp. point differential to zero. In the model, we assume that the foreign tax rate under a HTP increases from 15% to 21%. Figure 13 plots the percentage changes in investment abroad and foreign tax revenues as this tax rate increases. The yellow line shows that investment abroad decreases significantly

Figure 13: Counterfactual Analysis: Increasing Tax Haven Tax Rate t_h



Notes: This figure plots simulated percentage changes in tax revenues an investment in the foreign country as the tax rate in the tax haven is increased from 15% to 21%.

with the tax increase. This result is consistent with the decomposition in Table 9 showing that the tax advantage of HTPs explains a large share of the relative changes in foreign capital. The blue line shows that tax revenues initially increase with the tax rate. However, this increase is short-lived and tax revenue declines for foreign tax rates greater than 18.5%. Figure 13 paints a bleak picture for foreign governments wishing to increase the fiscal obligations of US MNCs, as it shows that limits to tax planning may significantly reduce investment and may lead to small increases or even declines in tax revenue.

7 Conclusion

Complex tax planning strategies have been a focus of media attention and have played an important role in motivating international tax reforms. Despite this focus, policy makers, practitioners and academics lack a comprehensive understanding of the prevalence of these strategies and their role in explaining some key facts surrounding international taxation.

Using an unique integration of tax data covering the domestic and foreign operations of US MNCs, we fill this important gap by reconstructing the ownership networks of foreign affiliates of US MNCs. This allows us to identify the adoption of three important tax planning strategies:

the Double Irish and Reverse Hybrid Mismatch arrangements through the Netherlands and Luxembourg. We show that these structures account for a significant fraction of the foreign profits of US MNCs. We also link the use of these structures to financial transactions that companies could use to shift profits to low tax (and tax haven) countries. While only 16% of US MNCs adopt these structures, those that do obtain a significant tax advantage abroad over other MNCs. Remarkably, these few companies are responsible for the bulk of the increase in cash held abroad over the period we study.

Our analyses using the tax data reveal that the adoption of hybrid tax planning structures is accompanied by significant changes in real economic activity. We find that firms that adopted the structures we study also had significant increase in foreign tangible and intangible assets. While our differences-in-differences estimates measure large change in domestic payroll and R&D, our model attributes most of these changes to differential selection into tax planning. This result suggests that the gains to the domestic economy are smaller than the difference-in-differences estimates would imply. While our model accounts for selection, it also finds that foreign investment is sensitive to changes in tax planning opportunities. This result implies that policies that increase tax costs abroad may lead to small gains in tax revenues for foreign governments and significant declines in tangible investment.

The fact that few specific tax planning structures play an outsize role in explaining aggregate trends in MNC behavior that is associated with income shifting is important for the design of the international tax system. Rather than focusing efforts on integrating policies over 137 countries, our results show that monitoring tax motivated structures set up in three specific countries may go a long way in curbing profit shifting.

References

Albertus, James F. 2019. "Does Foreign Tax Arbitrage Promote Innovation?" SSRN.

Altshuler, Rosanne, and Harry Grubert. 2006. "The Three Parties in the Race to the Bottom: Host Governments, Home Governments and Multinational Corporations." *Florida Tax Review*, 7(3): 137–209.

Bilicka, Katarzyna Anna. 2019. "Comparing UK Tax Returns of Foreign Multinationals to Matched Domestic Firms." *American Economic Review*, 109(8): 2921–53.

Bilicka, Katarzyna Anna, Yaxuan Qi, and Jing Xing. 2019. "Real responses to anti-tax avoidance policies: Evidence from UK's worldwide debt cap." *Working Paper*.

Blouin, Jennifer L., and Leslie Robinson. 2020. "Double Counting Accounting: How Much Profit of Multinational Enterprises Is Really in Tax Havens?" SSRN September 1, 2020.

Blouin, Jennifer L., and Linda K Krull. 2014. "Does Organizational Form Affect Firms' Foreign Operations? The Role of "Check-the-Box" on Multinational Tax Planning." Vol. 107, 1–31, JSTOR.

Clausing, Kimberly A. 2016. "The Effect of Profit Shifting on the Corporate Tax Base in the United States and Beyond." *National Tax Journal*, 69(4): 905–934.

de Mooij, Ruud A., and Li Liu. 2018. "At A Cost: the Real Effect of Transfer Pricing Regulations on Multinational Investment."

Dowd, Tim, Paul Landefeld, and Anne Moore. 2017. "Profit shifting of U.S. multinationals." *Journal of Public Economics*, 148: 1–13.

Drucker, Jesse. 2010. "Google 2.4% Rate Shows How $60 Billion Is Lost to Tax Loopholes."

Duhigg, Charles, and David Kocieniewski. 2012. "How Apple sidesteps billions in taxes."

Dyreng, Scott, and Michelle Hanlon. 2021. "Tax avoidance and multinational firm behavior."

Faulkender, Michael W, Kristine W Hankins, and Mitchell A Petersen. 2019. "Understanding the rise in corporate cash: Precautionary savings or foreign taxes." *The Review of Financial Studies*, 32(9): 3299–3334.

Grubert, Harry. 2012. "Foreign taxes and the growing share of US multinational company income abroad: Profits, not sales, are being globalized." *National Tax Journal*, 65(2): 247–281.

Grubert, Harry, and Joel Slemrod. 1998. "The Effect of Taxes on Investment and Income Shifting to Puerto Rico." *Review of Economics and Statistics*, 80(3): 365–373.

Guardian. 2018. "From Seattle to Luxembourg: How tax schemes shaped amazon."

Guardian. 2019. "EU investigates Nike's tax status in the Netherlands."

Hardeck, Inga, and Patrick U. Wittenstein. 2018. "Assessing the Tax Benefits of Hybrid Arrangements - Evidence from the Luxembourg Leaks." *National Tax Journal*, 71(2): 295–334.

Hines, James R., and Eric M. Rice. 1994. "Fiscal Paradise: Foreign Tax Havens and American Business." *The Quarterly Journal of Economics*, 109(1): 149–182.

IRS. 2011. "SOI Sampling Methodology and Data Limitations." U.S. Internal Revenue Service https://www.irs.gov/pub/irs-prior/p946--2002.pdf (Accessed: February 7, 2022).

IRS. 2022*a*. "SOI Tax Stats - Controlled Foreign Corporations ." U.S. Internal Revenue Service Web Site https://www.irs.gov/statistics/soi-tax-stats-controlled-foreign-corporations (Accessed: February 7, 2022).

IRS. 2022*b*. "SOI Tax Stats - Corporation Complete Report." U.S. Internal Revenue Service Web Site https://www.irs.gov/statistics/soi-tax-stats-corporation-complete-report Accessed: February 7, 2022).

Kleinbard, Edward D. 2013. "Through a latte, darkly: Starbucks's stateless income planning." *Tax Notes*, 1515–1535.

Mutti, John, and Harry Grubert. 2009. "The effect of taxes on royalties and the migration of intangible assets abroad." In *International trade in services and intangibles in the era of globalization*. 111–137. University of Chicago Press.

Samarakoon, Navodhya. 2022. "The Effect of the Closure of the Double Irish Loophole on the Location of U.S. Multinational Companies' Profits." SSRN November 23, 2022.

Suárez Serrato, Juan Carlos. 2018. "Unintended Consequences of Eliminating Tax Havens." Duke University Working Paper.

Sun, Liyang, and Sarah Abraham. 2021. "Estimating dynamic treatment effects in event studies with heterogeneous treatment effects." *Journal of Econometrics*, 225(2): 175–199. Themed Issue: Treatment Effect 1.

Tørsløv, Thomas R, Ludvig S Wier, and Gabriel Zucman. 2018. "The Missing Profits of Nations." National Bureau of Economic Research Working Paper 24701.

Yagan, Danny. 2015. "Capital Tax Reform and the Real Economy: The Effects of the 2003 Dividend Tax Cut." *The American Economic Review*, 105(12): 3531–3563.

Zwick, Eric, and James Mahon. 2017. "Tax Policy and Heterogeneous Investment Behavior." *American Economic Review*, 107(1): 217–48.