Tax Deficits and the Income Shifting of U.S. Multinationals

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Abstract

Significant controversy has emerged about the scope of the international tax planning of U.S. multinational firms, with estimates of income shifted out of the U.S., profits recognized in tax havens, and revenue loss ballooning over time. Most studies that derive these empirical estimates use macroeconomic data which support inferences drawn at an aggregate level but are not conducive to analyses at more granular levels. In this study, we use microeconomic data from firms' publicly available financial statements to derive firm-year estimates that we use to evaluate existing aggregate estimates and to analyze the distributions of these amounts within the economy. We document significant variation in foreign effective tax rate and the percentage of income shifted out of the U.S. and find consistent evidence that rates and percentages calculated using macro data are not representative of the typical U.S. multinational. We also show foreign and U.S. tax deficits are concentrated in three industries and dominated by a small number of very large firms.

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1. Introduction

The globalization of economies has created opportunities for multinational corporations (MNCs) to shift profits to low-tax jurisdictions and reduce their overall tax bills (Hines and Rice [1994], Huizinga and Laeven [2008], Dharmapala [2019]). Combating this shifting has become a major point of focus for policymakers in high-tax countries. For example, the Organization for Economic Cooperation and Development's (OECD) ongoing Base Erosion and Profit Shifting (BEPS) Project, a collaborative effort among more than 125 countries, seeks to identify and limit conditions that allow firms to shift profits from jurisdictions with high tax rates to those with low tax rates. In addition, individual countries continue to propose and implement policies and regulations to address the issue.[1] However, designing policies aimed at combating profit shifting is challenging because the magnitudes of the income shifted and the tax revenue lost are difficult to estimate, and because little is known about the distribution of income shifting across firms (i.e., the number of companies that shift any income, and the extent of shifting done by those firms that shift). Without a clear picture of this distribution, it is difficult for policymakers both to design policies to reduce shifting and to assess the effectiveness of implemented policies (Dharmapala, Slemrod, and Wilson [2011]).

We use firm-level accounting data to generate estimates of four important measures of the overall tax avoidance of U.S. MNCs: foreign effective tax rates, foreign tax deficits, profits shifted out of the U.S., and U.S. tax deficits due to outbound income shifting.[2] Our estimates provide complements to those generated using macroeconomic data that are useful on multiple

[1] For example, the Biden Administration has considered a proposal to assess a minimum tax on the worldwide financial statement income of U.S. corporations. In another example, France has attempted to implement a 3% tax on so-called "digital revenue" that is generated in France by large multinationals (i.e., firms with greater than €750 million in global revenue).

[2] Because our analyses rely on publicly available data at the firm-level, the term "U.S. MNCs" in our paper refers to publicly traded multinational firms that are incorporated in the U.S.

dimensions. First, the macroeconomic data used in prior research do not support inferences about the typical multinational firm because estimates generated from them are inherently weighted by firm size and therefore dominated by the largest firms. Our granular data – which can be used in aggregated and disaggregated analyses – allow us to evaluate the sensitivity of prior estimates to this weighting and explore heterogeneity within the universe of MNCs. Second, our data are not subject to double-counting concerns that exist with macroeconomic data provided by the Bureau of Economic Analysis (BEA) (e.g., Blouin and Robinson [2020]). Finally, consolidated accounting data capture all of a firm's economic activities, allowing us to avoid reporting bias issues that plague many profit shifting analyses that use microeconomic data from other sources Dharmapala [2019]. For example, databases such as Orbis are often missing financial information for subsidiaries located in known tax havens.[3]

We begin with an examination of the foreign effective tax rates (foreign ETRs) of U.S. MNCs. A downward trend in aggregate foreign ETRs over the last three decades is documented using macroeconomic data by Wright and Zucman [2018], who then decompose the decrease into three components: a reduction in foreign statutory tax rates, the relocation of factors of production from high-tax to low-tax countries, and the shifting of profits to tax havens. We first replicate Wright and Zucman [2018] using both the macro-level BEA data they use and aggregates of our micro-level firm-year data. The trend in the aggregated micro data is consistent with that in the macro data, suggesting the two series capture the same underlying economics, as they should. We then take advantage of the micro data to decompose the sample in multiple ways to show that the decline in the foreign ETRs is highly concentrated in three industries and

[3] A limitation of our data is that they aggregate all foreign data into one reported number, preventing us from directly analyzing individual foreign countries. We mitigate this limitation by using required supplementary disclosures of subsidiary locations to estimate allocations among countries, but acknowledge it remains a limitation on our ability to produce precise country-level estimates.

in a small set of large, highly profitable firms. Further, we show that relatively small firms in the sample saw only slight decreases in their foreign ETRs over the sample period. Our analyses provide strong and consistent support for the conclusion that the foreign ETRs calculated using aggregate data are often not representative of the typical firm.

Foreign ETRs, in isolation, are not sufficient to estimate foreign tax deficits because they are not expressed in dollars and are not relative to a benchmark.[4] To generate a dollar-value estimate of the foreign tax deficit for each firm-year, we combine the inputs to the foreign ETR, the foreign income reported by the firm, and the statutory corporate tax rates of the countries in which the firm has significant operations. We find that while the aggregate amount of foreign tax deficit increases steadily over the sample period, a substantial proportion of firms in any given year do not have a foreign tax deficit. For example, in 2016, nearly 47% of firms in our sample do not have a foreign tax deficit. Moreover, we find that for most years, greater than half of the aggregate foreign tax deficit is attributable to just 10 firms and that the pharmaceutical and technology industries account for the largest proportions of the total foreign tax deficit.

We also show that large aggregate foreign tax deficits do not reflect a simple correlation between foreign tax deficit and MNC size by documenting significant variation in firm-level foreign tax deficits within size groupings. For example, we find that a third of the firms on the list of the 30 largest foreign tax deficits in 2016 were not in the top 30 largest firms that year by either foreign pretax income or market capitalization. These details are important because they reveal that reforms relying on size thresholds may be ineffective in reducing these deficits.

[4] We define a foreign tax deficit as the difference between what a corporation pays in taxes to foreign governments and what the corporation would have paid to foreign governments if all foreign profits were subject to the statutory tax rate in the country in which they were earned.

We next turn our attention to estimating the amount of income shifted out of the U.S. by U.S. MNCs and the resulting U.S. tax deficit.[5] To estimate the amount of income shifted out of a country, it is first necessary to estimate the amount of income that should have been taxed in the country. The amount shifted is then the difference between the expectation and the amount reported and the tax deficit is the home-country tax foregone on income shifted out. Using macroeconomic data, Clausing [2016] estimates that the U.S. lost between $77 and $111 billion in tax revenue in 2012 to outbound shifting by MNCs. Using firm-year data and assumptions similar to prior research, we estimate a U.S. tax deficit from profits shifted out of the U.S. equal to $37.4 billion in 2012, less than half of the lower-bound estimate of the same number generated using macro data in Clausing [2016].

We again leverage the granularity of the micro data to calculate outbound shifting and U.S. tax deficit amounts for each specific firm-year and analyze how they are distributed across the economy. For most years between 1996 and 2020, we find that the majority of shifted income and U.S. tax deficit is attributable to a small number of firms. For example, in 2016, 10 (30) firms – representing 1.2% (3.6%) of the firms in our sample – are responsible for over 51% (73%) of the aggregate outbound shifting and associated U.S. tax deficit. Many of these firms are in either the pharmaceutical or technologies industries, suggesting that policies targeting specific industries may be appropriate to mitigate shifting activities.

Our study contributes to multiple streams of literature focused on the international tax planning of multinational corporations by calculating firm-year estimates to complement and

[5] The U.S. tax deficit is the amount of U.S. tax not paid when income that would otherwise have been taxed in the U.S. is shifted out of the U.S. A more descriptive label would be "U.S. tax deficit due to income shifting". We use the simpler "U.S. tax deficit" but note that this construct is narrower in scope than a foreign tax deficit. It is calculated as the product of the amount of income shifted out of the U.S. and the statutory corporate tax rate in effect in the year and is independent of the amount of foreign tax (if any) paid on the shifted profits. Consistent with Clausing [2020], the calculation assumes infinite deferral of the repatriation of the shifted income under the pre-2018 tax laws.

calibrate existing aggregate estimates. First, we show that the downward trend in foreign ETRs varies widely across the population of U.S. MNCs. While our estimates of aggregate foreign ETRs are consistent with those generated using macro data, our results indicate that estimates of the percentage of profits booked in tax havens inferred from aggregate foreign ETRs are not representative of a typical U.S. MNC. Our findings highlight the importance of using firm-level data to support conclusions or inferences about particular firms.

Second, we quantify the foreign tax deficit of each firm each year and document significant heterogeneity across firms. This heterogeneity cannot be identified using macro data. Because tax policy is ultimately implemented at the firm level, quantification at the microeconomic level is an important complement to the single aggregate estimate provided by macroeconomic data for academics, policymakers, and international organizations like the OECD and International Monetary Fund (IMF). Our calculations identify the firms avoiding the most foreign tax and also reveal that many U.S. MNCs do not contribute to aggregate foreign tax deficits at all.

Finally, we provide estimates of the amount of profit shifted out of the U.S. by each U.S. multinational each year and the U.S. tax revenue lost on that shifted income. We again show that a small number of firms are responsible for most of the income that is shifted out of the U.S. but that it is not simply the MNCs with the most income or largest market capitalizations that shift the most income. In addition, we aggregate these measures, which are not subject to the contamination and limitations of those generated using macroeconomic data Blouin and Robinson [2020], and show that the U.S. tax revenue lost to profit shifting annually across our sample period was significantly lower than that estimated using macro data.

The consistent thread running through our findings is that both the aggregate foreign tax and the aggregate U.S. tax avoided by U.S. MNCs through international tax planning is dominated by a small number of firms; the average U.S. MNC is neither shifting substantial profits out of the U.S. nor avoiding substantial foreign taxes. These findings suggest that policies targeting specific companies and/or specific industries are more likely to reduce tax deficits while minimizing deadweight costs than broader reforms affecting all companies.

2. Background

Incentive exists for companies to locate their profits in jurisdictions with lower tax rates because tax represents a significant expense for all profitable companies. As economies became more globalized, competition between countries for economic activity and tax base intensified. Many countries decreased the tax burden (using both tax rate reductions and tax base exclusions) to attract and retain business activity. At the extreme, several countries made tax a primary pillar of their pitch to companies and earned themselves the label, "tax haven". In this competitive landscape, MNCs can achieve significant returns if they are able to legally and cost-effectively alter the jurisdiction in which their profits are taxed.

2.1 Tax havens

The term, "tax haven" appeared in the early 20th century and originally referred to countries in which wealthy individuals could live comfortably in retirement while paying minimal amounts of tax. In the 1950s, as countries looked for ways to attract business capital and corporations began to respond, the label "tax haven" was expanded and various organizations (e.g., the OECD) and academic studies created lists of tax haven countries. Hines and Rice [1994] note that the literature tended to identify tax havens in terms of four attributes that make a jurisdiction attractive for doing business: 1. Low corporate or personal tax rates; 2. Legislation

that supports banking and business secrecy; 3. Advanced communications facilities; and 4. Self-promotion as an offshore financial center. In practice, they begin with a list of 32 countries identified as havens by the Internal Revenue Service, remove countries in which U.S. companies had an effective tax rate greater than 20%, add countries identified by two concurrent studies (Beauchamp [1983] and Doggart [1983]), and end up with a list of 41 tax havens.

Gravelle [2009] combines lists from the OECD, Tax Justice Network, and Hines and Rice (1994) to create an updated list of 50 tax haven countries used for either corporate tax avoidance, personal tax evasion, or both. Gravelle [2009] highlights that some countries not on the Hines and Rice [1994] list (e.g., Mauritius, Niue) because U.S. investment in them was minimal belong on a list of tax havens that includes those that facilitate individual tax evasion.

Wright and Zucman [2018] take a narrower outcome-based approach and identify tax havens as, "countries where the effective tax rate faced by majority-owned affiliates [of U.S. MNCs] was below 10% in 2015 (plus the Netherlands where the effective rate was 12%)." Those countries are: Ireland, Luxembourg, the Netherlands, Singapore, Switzerland, Bermuda and Caribbean havens (i.e., British Virgin Islands, Cayman Islands, Montserrat, and Turks and Caicos Islands).

We follow Dyreng and Lindsey [2009] and consider a country to be a tax haven if it was identified as a haven by at least three of four sources in 2008. Those four sources are: Organization for Economic Co-Operation and Development (OECD), the International Monetary Fund (IMF), taxresearch.org, and the US Stop Tax Havens Abuse Act. Appendix B reports a full list of the countries identified as havens using the lists of Wright and Zucman [2018] and Dyreng and Lindsey [2009].

2.2 Opportunities for international tax planning

Because tax systems around the world are idiosyncratic and generally uncoordinated, it is common for multiple countries to claim the right to tax the same dollar of a company's income. However, countries generally agree on two basic principles: the country in which income is earned should have the right to tax it first, and income should not be taxed more than once. As a result, the sourcing of income – the determination of where it is earned – is important to both firms and governments. Bilateral tax treaties and intergovernmental agreements determine the treatment of disputed amounts with the aim of mitigating double-taxation. These complex agreements sometimes interact unexpectedly and result in "stateless income" that is untaxed by all countries Kleinbard [2011]. Moreover, even when profits are not stateless, they are often recognized in tax havens. Thus, as a company's operations expand to more countries, it sees increases in both the complexity of the laws with which it must comply and the opportunities to strategically arrange transactions to minimize taxes Barrios et al. [2012].

The geographic scope of U.S. MNCs' operations has been expanding consistently for the last two decades, frequently including the formation of subsidiaries in tax haven countries. In Figure 1, we plot the fraction of U.S. MNCs reporting at least one significant subsidiary in a tax haven country and show that it increased steadily over our sample period, from just below 40% in 1996 to over 60% in 2020. In Figure 2, we split the growth in foreign subsidiaries between that in tax haven countries and that in non-haven countries and show that the overall growth in foreign subsidiaries has been driven by growth in tax haven subsidiaries.

In Table 1, we identify the specific tax haven countries that are important for U.S. MNCs. The table describes the geographic footprints of the U.S. MNCs in our sample in 2016.[6] The first

[6] When reporting results for a single year, we generally select 2016, as this is the last year that was unaffected by the Tax Cuts and Jobs Act of 2017. However, results are similar for other years both prior to and after 2016.

column reports the number of U.S. MNCs with subsidiaries in the country and the second column scales the number of firms by the population of the country. We sort the table in descending order of the per capita number to highlight the number of tax haven countries at the top of the list. The table makes clear that the location of significant subsidiaries is neither random nor independent of tax considerations; the Cayman Islands hosts nearly 200 times the number of subsidiaries per 10,000 residents hosted by the U.S.'s largest trading partner, Canada.[7]

Accompanying this steady expansion in the global footprints of U.S. MNCs has been an increase in their foreign income, both in absolute terms and as a percentage of total income. In Figure 3, we plot the aggregate foreign pretax income of U.S. MNCs over the sample period and show that the amount has increased substantially, from around $100 billion in 1996 to around $600 billion in 2018. To put this growth in foreign income in the context of overall income growth, we scale aggregate foreign pretax income by aggregate worldwide pretax income in Figure 4. The proportion of total income that is foreign increased steadily in the first half of our sample period and then remained in a band between 55% and 60% in the most recent 10 years. This suggests that the growth in foreign income over the sample period is not simply a function of income being shifted from the U.S. to foreign countries.

2.3 Tax deficits

A tax deficit is the difference between the tax collected by a tax authority and an expectation for the tax that should have been collected. If a firm operating in a single country generates income, the expectation is that it will pay tax on that income at the statutory corporate income tax rate in effect at the time the income is earned. However, the tax paid may be lower than this expectation for two reasons: rate reductions and base exclusions. First, the taxing

[7] 74.797/0.378 = 197.9.

authority may offer the company a reduced rate for a specified period (e.g., a tax holiday), or it may have lower rates for different types of income (e.g., an intellectual property (IP) box). Second, the taxing authority may reduce the company's taxable base by permitting increased permanent deductions or credits (e.g., investment tax credits) or exempting certain types of income from tax (e.g., municipal bond interest in the U.S.).[8] If either or both conditions are present, the firm's effective tax rate will be lower than the statutory tax rate and a tax deficit will exist.

If the firm operates in a second jurisdiction, the tax deficit takes on additional dimensions. First, the total tax deficit is now comprised of the tax deficit in Country H (high tax) and the tax deficit in Country L (low tax), both of which can unilaterally offer the rate reductions and base exclusions described in the single-country setting. Second, the total taxable base of the firm is now allocated between the two countries based on the laws and treaties that exist. Even absent intentional tax planning by the firm, any misallocation of the base in estimating the expected tax paid in each country may result in a tax deficit. When we add the possibility that the firm may shift income from Country H to Country L to reduce its aggregate tax bill, a new component of the Country H tax deficit, the tax revenue lost to income shifting, arises.

To summarize, a tax deficit is a deviation from an expectation. If the expectation is generated using the assumption that all income will be taxed at the statutory tax rate in the jurisdiction in which it is earned, the tax deficit for a firm operating in two countries, one of which is a tax haven with a 0% tax rate, will be comprised of the following components:[9]

1. Tax holidays or other rate reductions granted by the non-haven country.
2. Base exclusions allowed by the non-haven country.

[8] The firm may also create its own base exclusions by not complying with the existing tax laws and underreporting its taxable income.

[9] An additional component is underreporting of taxable income. While non-compliant filing is possible, we assume that the multiple monitoring mechanisms on corporate reporting keeps it below a material level.

3. Income earned in (correctly sourced to) the tax haven.
4. Income shifted to the tax haven.
5. Measurement error in the expectation.

The methods and data available to researchers often make it difficult to decompose a tax deficit into its components, so it is important to note the assumptions that underlie attribution of tax deficits to any individual component. In particular, if the other four components are underestimated or ignored, the estimate of the amount of profits shifted to tax havens will be overstated.

3. Foreign effective tax rates

3.1 Calculation of ETRFO

We use firms' required financial statement disclosures to calculate the foreign effective tax rate ($ETRFO$) for each firm in each year:

$$ETRFO = \frac{Current\ foreign\ tax\ expense}{Pretax\ foreign\ income}$$

The inputs are from audited financial statements.

3.2 Sample

Our primary sample consists of approximately 25,000 firm-years of U.S.-incorporated multinational companies in non-regulated industries (excludes SIC codes between 4900-4999, 6000-6999) that have revenues and assets of at least $10 million, foreign pretax income of at least $1 million and non-negative foreign current tax expense.[10] We begin our sample in 1996 because SEC electronic filings were sparse before then. We end our sample in 2020 because it was the most recent year with complete data available.[11] The sample size varies depending on the analysis, as described in Table 2. For example, when we estimate regressions to generate the

[10] A firm is considered to be a multinational if it reports any of foreign pretax income ($PIFO$ in Compustat), foreign current tax expense ($TXFO$), or foreign deferred tax expense ($TXDFO$).
[11] In many of our analyses, we examine a specific year to be comparable to existing macroeconomic studies.

elasticities used to compute profits shifted, we restrict the sample to observations with positive foreign pretax income and positive worldwide pretax income. That subsample consists of 20,578 firm-years.

Because a primary goal of our study is to make comparisons to estimates generated using macro data, we report the proportion of the full universe of public U.S. multinationals captured in our sample. For example, in our Sample #2 (used to generate firm-year estimates of the foreign effective tax rates and foreign tax deficits), our sample represents 94% (74%) of all of the foreign pretax income (sales) of U.S. MNCs in Compustat. The final column of Table 2 reports the aggregate Foreign ETR (the aggregate of foreign current tax expense scaled by the aggregate of foreign pretax income) for the given sample to assess the impact of the exclusion of firms from the specific subsample. The consistency of the Foreign ETR across the samples provides comfort that the samples contain firms with similar foreign tax characteristics.

3.3 The decline in foreign effective tax rates

Using macroeconomic data, Wright and Zucman [2018] document a decline in the aggregate foreign ETR and use trends in statutory tax rates and real activities to infer the amount of income shifted to tax havens. Because we are interested in examining the sensitivity of income shifting estimates to implicit weighting in macroeconomic estimates, we begin by replicating their study, first using macroeconomic data and then using aggregated firm-level data. The results are shown in Figure 5.

We note a few differences between the firm-level data in Compustat and the macro data provided by the BEA. First, Compustat includes data of publicly traded companies only, while the BEA includes data of both public and private firms. BEA data are gathered from firms that

meet certain size thresholds, whereas no size threshold exists for Compustat.[12] To increase comparability, we restrict our sample to firms in non-regulated industries and firms having at least $1 million in foreign pretax income. Despite these differences, Figure 5 shows that the trends in aggregate Foreign ETR are generally consistent across the two data sources.

A significant limitation of macroeconomic data is that they support conclusions about trends in foreign effective tax rates only at the aggregate level. To examine the importance of heterogeneity masked by the aggregation inherent in macro data, and specifically the implicit weighting by the level of pretax income in aggregate effective tax rates, we divide firms into quartiles based on the level of pretax foreign income and calculate the aggregate Foreign ETR separately for each group. The results are presented in Figure 6. A general downward trend is common to each of the four groups from 1996 to 2009, but the foreign ETRs of firms with more foreign income are systematically lower than those of firms with less foreign income. The largest contrast is seen from 2013 to 2020: the aggregate Foreign ETRs of the three bottom quartiles remained largely unchanged while the aggregate Foreign ETR of the top quartile dropped from 24.8% in 2013 to 17.2% in 2020, hitting a low of 16.8% in 2016.

This analysis reveals that the aggregate Foreign ETR is largely determined by firms with the greatest foreign income and is not representative of the typical U.S. MNC. This is important because it suggests the conclusions reached by Wright and Zucman [2018] about the drivers of the trends may not generalize to all MNCs. For instance, Wright and Zucman [2018] assert that the decline in the Foreign ETR can be separated into three components: the decline in statutory tax rates, the relocation of economic activity to low-tax countries, and the shifting of profits to

[12] Foreign affiliates of U.S. MNCs are generally required to participate in BEA surveys if their assets, revenues or net income for a given year exceed $60 million. (See https://www.bea.gov/sites/default/files/2018-04/a-guide-to-bea-direct-investment-surveys.pdf)

tax havens. In their study, the Foreign ETR drops from 32 percent in 2000 to 17 percent in 2015, a decline of 15 percentage points. During this same period, the average statutory foreign tax rate declined eight percentage points, accounting for 53% of the decline. The remaining seven percentage points are attributed to income shifting: one percentage point due to shifting of real economic activity to tax havens, and six percentage points due to paper profit shifting to tax havens. We find that the average annual Foreign ETR of firms in the lowest quartile of pretax foreign income went from 37 percent in 2000 to 36 percent in 2015. Given that these firms, on average, saw the same 8-percentage-point decline in foreign statutory tax rates as all other firms, the 1-percentage-point decline in their average Foreign ETR suggests that these firms not only did not relocate inputs to low-tax countries or shift income into tax havens, but that they did not even achieve the full benefits of reduced statutory tax rates.

Our results do not contradict those of Wright and Zucman [2018]; the trends in aggregate foreign ETRs documented using macro and micro data are consistent. However, our firm-level analyses show that the explanations for trends in the aggregate numbers may not extend to the trends of the typical firm and suggest the possibility that pointed policy responses might be more effective than broad-based changes. To examine the idiosyncratic nuances in these trends further, we next analyze the determinants of the firm-year Foreign ETR more directly.

3.4 Determinants of foreign effective tax rate

We use the variation in our firm-year data in a regression framework to examine the determinants of Foreign ETR. We expect that the foreign statutory tax rate (operations in tax havens) will be a positive (negative) determinant of the ETR, but it is the magnitudes of the relations that is the focus of this analysis. We estimate the following model on the sample of U.S. MNCs for which we can calculate all variables:

$$ETRFO5_{it} = \beta_0 + \beta_1 AVGRATE5_{it} + \beta_2 LN(NHAVENCOUNTRIES)_{it} + \sum \beta_k Controls + \varepsilon \quad (1)$$

where

$ETRFO5_{it}$	is $\frac{sum(foreign\ current\ tax\ expense)}{sum(foreign\ pretax\ income)}$ for Firm i for the 5-year period ending in Year t.
$AVGRATE5_{it}$	is the weighted average of the statutory tax rates of the non-zero-rate countries in which Firm i has significant subsidiaries in the 5-year period ending in Year t. Weighting is by the number of subsidiaries in each country.
$LN(NHAVENCOUNTRIES)_{it}$	is the natural log of the number of tax haven countries in which the firm lists significant subsidiaries Firm i has in tax haven countries in Year t.
$Controls$	are other determinants of foreign effective tax rates: size, geographic footprint, and research and development expense (as a proxy for the mobility of income associated with intangible assets).

We present results from this analysis in Table 3. Consistent with predictions, the estimate of the coefficient on the foreign tax rate is strongly positive, and the estimate of the coefficient on the number of tax haven countries is strongly negative. The coefficient on the tax rate (0.563 in Model 3) is well below one, the magnitude implied in the assumption of a one-to-one mapping between the statutory rate and the effective rate. Moreover, the adjusted R-squared is relatively low, consistent with existing research examining the determinants of effective tax rates Dyreng and Lindsey [2009], but inconsistent with the notion that effective rates covary strongly with statutory tax rates. Part of the reason statutory rates do not explain more of the variation in effective rates likely arises from the lack of precision in weighted-average statutory rates (the ideal weight would be income, not the number of countries), but it is also likely that a portion of the difference is driven by other factors, including changes in tax base that coincide with changes

in tax rate, tax holidays, special rates on some types of income, or other factors not captured by the statutory tax rate.[13]

The estimate of the coefficient on the number of tax haven subsidiaries is negative, indicating that, consistent with Wright and Zucman [2018], foreign ETR is lower for firms with access to tax havens. The estimate of the coefficient on an indicator variable for firms in the top quartile of foreign pretax income is also negative, consistent with Figure 6 above. However, when we include the interaction between the number of haven subs and the high-PIFO indicator, the estimate of the coefficient is insignificant. This suggests that the ETR-reducing effect of tax havens is not different for the two groups of firms and that the divergence of the ETRs shown in Figure 6 is not explained by differential use of tax havens across the two groups.

3.5 Income booked in tax havens

Wright and Zucman [2018] estimate that U.S. multinational firms recorded about half of their foreign profits in foreign tax havens in 2015. Other studies have also generated estimates of the amount of corporate income booked in tax havens. For example, Garcia-Bernardo and Jansky [2021] estimate that MNCs domiciled around the world (i.e., not just U.S. MNCs) recorded more than $1 trillion in tax havens in 2016, and Tørsløv, Wier, and Zucman [2022] estimate that close to 40% of the foreign profits of MNCs were shifted to tax havens in 2015. We adapt the method

[13] We examine the sensitivity of our results to weighting by the number of subsidiaries in each country by instead equally weighting each country in which a firm reports a subsidiary. Results are qualitatively similar. Ideally, we would weight by the pretax income in each country for each firm, but those data are not available. An alternative approach is to assign weights for each country based on the proportion of aggregate foreign income or foreign sales reported in that country across all foreign subsidiaries of U.S. MNCs. Two main issues prevent us from using the aggregate data published by the BEA to calculate the weights. First, aggregate foreign income of U.S. MNCs for some country-years is negative and assigning negative weights would be impractical. Second, BEA data on the location of foreign sales and foreign income for U.S. MNCs is available for only approximately 60 countries, whereas our subsidiary data include more than 150 countries. Indeed, we are unable to assign weights to more than 25% of the subsidiaries for more than half of our observations using this approach. We also considered using income data for foreign subsidiaries reported in Bureau van Djik's Orbis database to assign weights. Again, data coverage was not sufficient: for the median MNC, more than 50% of foreign income (as reported in the Compustat segment files) is unaccounted for in the ORBIS database.

used by Wright and Zucman [2018] to our sample of firm-years to estimate how much foreign profit is recorded in tax havens for each firm-year. To estimate the amount of income a firm records in tax havens in a year, we assume that the effective foreign tax rate is:

$$ETRFO_{it} = \frac{(1-x_{it})(PIFO_{it})(t_{nonhavens})+(x_{it})(PIFO_{it})(t_{havens})}{PIFO_{it}}, \quad (2)$$

where

$ETRFO_{it}$	is the foreign effective tax rate for Firm i in Year t.
x_{it}	is the fraction of pretax foreign income ($PIFO$) recorded in haven countries by Firm i in Year t.
$t_{nonhavens}$	is the average tax rate faced by Firm i in non-haven countries in Year t.
t_{havens}	is the average tax rate faced by Firm i in haven countries in Year t.

Because all variables in the equation except x_{it} are observable, we can calculate x_{it} for each firm-year. To reduce noise in $ETRFO_{it}$, we calculate a five-year average, following Dyreng, Hanlon, and Maydew [2008] and Klassen and Laplante [2012]. Because the headline tax rate in a country is often quite different from the rate actually paid by firms, we calculate effective tax rates for each country following the methods in Wright and Zucman [2018]. The values $t_{nonhavens}$ and t_{havens} for each firm-year are calculated based on the countries in which the firm reports significant subsidiaries in Exhibit 21 of its 10K, weighted based on the number of significant subsidiaries located in each country.

We use these firm-year estimates to calculate aggregate amounts of income in havens each year, as well as average and aggregate ratios of income in havens to total foreign income. We again find that the weighting of firms significantly affects inferences. In Figure 7, we plot annual estimates for the simple (equal-weighted) average percentage of foreign income in havens across firms and the annual aggregate (weighted) average of the same percentage (aggregate

income in havens/aggregate foreign income). The simple average percentage remains in a relatively narrow band between 5% and 10% across the sample period, while the aggregate measure rises steeply in the last decade of the sample. Importantly, our estimate remains below that of Wright and Zucman (2018) throughout the sample period while demonstrating a consistent trend. Our estimate of the aggregate percentage for 2016 is 32.6%, which is relatively similar to estimations by Tørsløv, Wier, and Zucman [2022] using a global sample of MNCs for the same year. However, the divergence of the two lines in Figure 7 makes it clear that the average U.S. MNC is booking a significantly smaller share of its foreign profits in tax havens.

We next focus on the top of the distribution and identify the 30 companies with the most income booked in havens in 2016. The amount of income recorded in tax havens is calculated as the product of x_{it} and $PIFO_{it}$. Table 4 lists the top 30 firms based on the amount of income recognized in havens. Apple Inc. and Microsoft Corp lead the way and are the only firms with more than $10 billion booked in havens in 2016. In the third column, we report the firms' fraction of total foreign income that is recognized in havens.[14] As a group, these 30 firms recognized $118.7 billion in havens in 2016, representing an average of 58.4% of total foreign income for the average firm in the group. The $118.7 billion represents 86% of $138.6 billion of total income booked in tax havens in 2016 across all U.S. MNCs in our sample.

The final two columns of Table 4 report the firm's rank in 2016 by foreign pretax income and market capitalization, respectively. If the amount of income booked in tax havens was a simple function of firm size, the firms listed in Table 4 would also be in the top 30 on these two size dimensions. However, that is not what is observed: 12 (14) of the top 30 amounts booked in

[14] Estimates greater than 100% are reset to 100%. Firms can have a value greater than 100% because the firm's effective foreign tax rate is lower than the average effective tax rate in the tax haven countries in which the firm lists significant subsidiaries.

tax havens belong to firms outside the top 30 in both foreign pretax income (market capitalization).

Overall, our results provide evidence that inferences and conclusions about the amount of income booked in tax havens depend heavily on whether one is thinking of the aggregate or the average and illustrate that weighting is an important consideration for policymakers.

4. Foreign tax deficits

4.1 Calculation of the measure

To compute foreign tax deficits, we first generate the expected amount of foreign tax paid by the MNC in the year using the weighted average of the statutory corporate income tax rates in the non-haven countries in which the firm has significant subsidiaries, where the weight is the number of subsidiaries in each country. We then multiply this rate by the total reported foreign pretax income to generate the expected foreign tax. The difference between the expected foreign tax and the current foreign tax expense reported is the foreign tax deficit. The following example demonstrates the process using PepsiCo Inc.'s 2019 data.

4.2 PepsiCo Inc. 2019

We estimate the foreign tax deficit of PepsiCo Inc. in 2019 to be $490 million as follows (all numbers in millions):

Weighted average foreign statutory tax rate[15]	25.0%	A
Total foreign pretax income (income tax footnote)	$5,189	B
Expected foreign tax	$1,297	A*B
Current foreign tax expense (income tax footnote)	807	C
Foreign tax deficit	$490	A*B - C

[15] PepsiCo discloses in Exhibit 21 that it has significant subsidiaries in 88 different countries. The average of the corporate statutory tax rates in the non-haven countries among those 88 (weighted by number of subsidiaries in the country) is 25.0%.

4.3 Required disclosures on geographic footprint

Publicly traded U.S. companies are required to disclose the names and locations of their significant subsidiaries in Exhibit 21 of their 10-K filings, even if the subsidiaries themselves are privately held. A subsidiary is considered significant if it reports greater than 10% of consolidated assets or 10% of consolidated income. In addition, subsidiaries that fall below these thresholds must be disclosed if, when considering all undisclosed subsidiaries as a single subsidiary, they reach either threshold. In practice, this results in firms disclosing subsidiaries until 90% of the cumulative value of consolidated earnings and assets are covered, leaving undisclosed only those subsidiaries that, when combined, account for 10% or less of consolidated assets and earnings.[16] For example, if a firm has subsidiaries in (% of consolidated earnings) France (10%), Germany (9%), Belgium (8%), China (8%), Japan (8%), Australia (7%), Switzerland (7%), Canada (6%), Bermuda (6%), Ireland (5%), Malaysia (4%), and Singapore (3%), it must disclose all of the subsidiaries except those in Malaysia and Singapore.[17]

Because we rely on Exhibit 21 disclosures to derive the appropriate tax rate in our calculations, their accuracy affects the reliability of our calculations. Dyreng et al. [2020] use confidential IRS data to assess compliance with the disclosure requirements for Exhibit 21 and find that, on average, firms are highly compliant with the requirements. They also find that firms are more likely to omit a significant subsidiary (i.e., not comply) when that subsidiary is in a tax haven. Because we are relying on the accurate disclosure of firms' *non-haven* subsidiaries, the evidence of selective nondisclosure found by Dyreng et al. [2020] does not pose a threat to the reliability of our calculations.

[16] See 17 CFR 270.8b-2 and 17 CFR 229.601(b)(21) of Regulation S-K.
[17] Alternatively, the firm could leave Malaysia and Ireland undisclosed, but disclose Singapore, or any other combination such that the aggregate value of undisclosed subsidiaries is less than 10%.

4.4 Comparison to macro estimates

We aggregate the foreign tax deficit each year across all firms in our sample and compare it to an annual aggregate foreign tax deficit estimated with BEA data and the method used by Wright and Zucman [2018]. As shown in Figure 8, the two methods produce similar magnitudes and trends across the sample period. This provides further assurance both that conclusions drawn at the aggregate level are similar across the two data sources and that firm-year estimates coming from the micro data are reliable.

4.5 Aggregate foreign tax deficits by industry

To further examine the distribution of foreign tax deficits, we aggregate firm-year estimates by industry. Both empirical and anecdotal evidence suggest that firms in industries with more mobile input factors are able to avoid more tax (De Simone, Mills, and Stomberg [2019]; Drucker [2010]; Grubert [2003]). Table 5 reports the aggregate foreign tax deficits for each industry in 2016. Consistent with expectations, the Computer and Pharmaceutical industries account for 35.5% and 24.7% of the total foreign tax deficit, respectively.

4.6 Top 30 firms by foreign tax deficit

Drilling down to the firm level, we list the 30 firms with the largest foreign tax deficits in 2016 in Table 6.[18] Apple Inc. leads all firms with over $7.7 billion in foreign tax deficit in 2016, followed by Microsoft Corp ($4.75 billion), Pfizer Inc. ($2.99 billion), Gilead Sciences, Inc. ($2.2 billion), and several other large, well-known tech and pharma companies. The total foreign tax deficit of these 30 firms is $35.8 billion. Figure 9 shows that $35.8 billion represents 80% of the entire aggregate foreign tax deficit of $44.7 billion in 2016. However, foreign tax deficits are

[18] The choice of 2016 is arbitrary but corresponds with the last full year before information about TCJA could have affected firm behavior. The list looks similar year over year.

not solely an artifact of foreign profits as Figure 9 also shows that the foreign pretax income of these 30 firms represents less than 50% of the aggregate foreign pretax income in 2016.

The identification of these specific firms as having large tax deficits is not novel. Many of the firms on the list have been closely scrutinized by the U.S. Congress, foreign governments, tax advocacy groups (e.g., Citizens for Tax Justice), and/or journalists, and estimates of their tax avoidance are in the public domain. What is novel, however, is the quantification of the deficits at the firm-year level using publicly available data. This quantification allows us to relate a firm's foreign tax deficit to its other characteristics and identify that foreign tax deficits are not simply a function of firm size. For example, the two final columns of Table 6 reveal that 11 (13) of the 30 largest MNCs by foreign pretax income (market capitalization) did *not* rank in the top 30 by foreign tax deficit in the year. This suggests that targeted reforms intending to reduce foreign tax deficits efficiently cannot likely rely solely on firm size in determining which firms to target.

4.7 Limitations of the foreign tax deficit calculation

There are factors that, if present, could impair the accuracy of our foreign tax deficit estimates for a given firm-year. We identify three such factors and describe the analyses we perform to mitigate concerns that they threaten the validity of the measure. First, if a firm has a net operating loss carryforward (NOL) in a foreign country, it will be able to deduct that loss against its income in the foreign country and its foreign current tax expense (an input into our calculation) will be lower relative to its foreign pretax income (also an input into our calculation). This would result in our estimate of foreign tax deficit being overstated. To determine whether foreign NOLs may affect the calculations in our sample, we examine the sensitivity of our results to excluding all observations with large changes in tax loss

carryforwards (50% or greater change), as captured by Compustat. In untabulated results, we find that inferences from our results are robust to excluding observations with large changes in tax loss carryforwards. Moreover, because the tax loss carryforward variable in Compustat is notoriously noisy, we also verify that results and inferences are robust to removing observations with negative cumulative foreign earnings over the life of the firm.

Second, if a firm has made a significant foreign acquisition in the year, the relation between its foreign current tax expense and its foreign pretax income could change. In addition, its geographic footprint (location of foreign subsidiaries) could also change if the target firm has subsidiaries in different countries. To ensure that our estimation of foreign tax deficit is not distorted by large foreign acquisitions, we verify that results and inferences are not sensitive to removing firm-years with large increases in total assets (which we define as an increase of 100% or more) from the sample.

Finally, if a firm has a contingent foreign tax liability related to its foreign income in the year, its foreign current tax expense may be understated. For example, after an investigation of Apple Inc. in Ireland, the European Commission accused Ireland of granting illegal "state aid" to Apple in the form of reduced tax obligations. Apple would have recorded current tax expense only for the amount it actually paid to Ireland, but there is an additional amount of tax that would have to be paid if the European Commission ruled against Ireland. If such contingent liabilities are prevalent in our sample firms, our estimates of foreign tax deficits will be overstated. To allay concerns that firms with these contingent liabilities could be affecting our aggregate numbers, we verify that results are not sensitive to excluding observations that have large increases in unrecognized tax benefits (UTBs), which we define as an increase of 100% of more over a 5-year window.

5. Outbound profit shifting and U.S. tax deficits

We next turn our attention to the amount of income shifted out of the U.S. by U.S. MNCs, which creates U.S. tax deficits. Prior literature has examined how MNCs can strategically arrange intracompany transactions so that profits are recognized in low-tax or no-tax countries (i.e., income shifting) without violating the law (see Dharmapala [2014] for review). The most common tools are transfer pricing arrangements and intracompany financing arrangements. In transfer pricing arrangements, two subsidiaries of the parent company, one in a high-tax country, the other in a low-tax country, transact with one another. Because both subsidiaries are controlled by the same decisionmakers, those decisionmakers can strategically set prices to move income from the high-tax jurisdiction to the low-tax jurisdiction. Similarly, intracompany financing arrangements can be used to locate tax-deductible interest expense in high-tax countries and shift income from the high-tax to the low-tax jurisdiction.

To prevent companies from using these mechanisms to avoid tax, most countries require intracompany transactions to take place at the arms-length price, that is, the price that would have been charged if the transaction had occurred between unrelated parties. However, taxing authorities often find the arms-length standard difficult to enforce, because comparable arms-length prices are often unobservable Clausing [2003]. This is particularly true of companies with business models that rely heavily on intellectual property and other intangible assets. These companies can shift income more easily because the rights to intellectual property can be located in almost any jurisdiction, and because the value of intellectual property is generally unobservable, making arms-length prices difficult to enforce (e.g., De Simone, Mills, and Stomberg [2019].

5.1 Estimating outbound profit shifting

Researchers, policymakers, and tax enforcement agencies are keenly aware of the difficulty in enforcing the arms-length standard, but just how large the problem is, in economic terms, is difficult to estimate. The difficulty arises, in part, because the counterfactual (i.e., what the allocation of income across jurisdictions would be absent any tax motivation) is unobservable and so must be estimated. Researchers have devised a variety of methods to estimate shifted income, and the estimates generated by those methods vary widely (see Heckemeyer and Overesch [2017]).

Because we are interested in comparing to an existing estimate generated using macro data, we modify the approach developed by Clausing [2016] to generate a firm-year estimate of the amount of profit shifted out of the U.S. Clausing [2016] uses macroeconomic data and regresses country-level income on GDP and the average effective tax rate of foreign firms operating in that country (sometimes with additional control variables). We adapt the model to the firm-year level and estimate the following:

$$LN(PIFO)_{it} = \beta_0 + \beta_1 LN(PI)_{it} + \beta_2 FTR_{it} + \varepsilon\,, \tag{3}$$

where

$LN(PIFO)_{it}$	is the natural log of Firm i's foreign pretax income in Year t.
$LN(PI)_{it}$	is the natural log of Firm i's worldwide pretax income in Year t.
FTR_{it}	is one of several measures of the foreign tax rate faced by Firm i in Year t.

The intuition underlying both our model and the model in Clausing [2016] is that the tax rate should not affect pretax earnings. That is, if earnings are determined by fundamental economic forces, β_2 should be insignificant when estimating Equation (3) (see, for example,

Hines and Rice 1994). To the extent that β_2 is significantly different from zero when estimating Equation (3), taxes affect pretax earnings, which is evidence of income shifting. When we interpret the β_2 coefficient as income shifting, we implicitly assume the counterfactual for foreign pretax income to be what would have been reported if the tax rate had no influence on earnings.

One concern with Equation (3), and with the corresponding models estimated by Clausing [2016] using macro data, is that endogeneity of the tax rate could bias the estimate of β_2. For example, Clausing [2016] uses the effective tax rate firms actually achieved (based on their endogenous location choices and operating decisions) as the tax variable in the model. Our firm-level data allow us to address the most serious endogeneity concerns by following a technique in Faulkender and Smith [2016] and Harris and O'Brien [2021]. First, we use statutory tax rates set by the government and exogenous to the firm. Second, to overcome the endogenous choice of subsidiary location, we use the subsidiary locations from each firm's first year in our data. This forces all subsequent variation in the firm's foreign tax rate to arise through exogenous changes in statutory tax rates, and not endogenous changes to the firm's location Faulkender and Smith [2016]. Third, we include firm fixed effects to control for any constant characteristics of the firm that might affect income shifting. Finally, we include year fixed effects to control for the known growth in foreign earnings, and the known decline in foreign tax rates.

We estimate Equation (3) for the sample of firms with positive foreign pretax earnings and positive worldwide pretax earnings (i.e., Sample 3 in Table 2) to generate an estimate of β_2, the semi-elasticity of foreign pretax income with respect to tax. Because the true tax incentive for each firm-year is not directly observable, we generate multiple estimates of β_2 using different proxies for the tax incentive, each of which relaxes some aspect of our preferred method of

identification described above.[19] For example, in one set of results we eliminate fixed effects. In another set of results, we use effective tax rates instead of statutory tax rates. In another set of results, we use the location of the firms' subsidiaries each year, which allows for the possibility that the endogenous location choice biases the coefficient. Each of these results is presented to help the reader see the sensitivity of the elasticity to our controls for endogeneity.

Results are presented in Table 7. Estimates of the semi-elasticity range from -0.975 when using the weighted average foreign statutory tax rate with firm and year fixed effects as the tax incentive to -3.244 using the weighted average foreign statutory tax rate without any fixed effect structure. Our preferred model, Model 4, provides a semi-elasticity of -1.301.[20] This compares to an average elasticity of -2.92 (-2.72) estimated by Clausing [2020] (Blouin and Robinson [2020]) using macro data.

As an additional test, we estimate our preferred model using quantile regression instead of OLS and report results in Figure 10. The figure suggests low quantiles of earnings are not highly responsive to foreign tax rates, but high quantiles of earnings are relatively more responsive compared to the mean response of -1.301. Indeed, a one-unit change in the FTR corresponds to a statistically insignificant change in $LN(PIFO)_{it}$ at the 5th percentile of $LN(PIFO)_{it}$, yet a change of -3.68 in $LN(PIFO)_{it}$ at the 95th percentile of $LN(PIFO)_{it}$.

5.2 Aggregate income shifted out of the U.S. over time

Using the semi-elasticities from Table 7, we estimate the amount of pretax profit each firm shifts out of the U.S. each year using Equation 4[21]:

[19] See Appendix A for definitions of all tax incentive variables.
[20] Model 4 is our preferred model because it includes firm and year fixed effects and uses as the tax rate measure most likely to be exogenous to firms' income shifting strategies, following the identification strategy in Harris and O'Brien [2021].
[21] Following Clausing [2016], we assume a U.S. effective tax rate of 30%.

$$Outbound\ Shifting = -PIFO * \left(\left(e^{Elasticity*(0.3-FTR_{it})} - 1\right)\right), \quad (4)$$

where

$PIFO_{it}$	is firm i's foreign pretax income in year t.
$Elasticity$	is one of the coefficient estimates (β_2) from estimating Eq. (3) shown in Table 7.
FTR_{it}	is one of several measures of the foreign tax rate faced by firm i in year t.

To examine trends in aggregate outbound shifting, we aggregate the firm-year amounts by year based on each elasticity calculated in Table 7 and plot the annual amounts in Figure 11. Using our preferred model (Model 4), the total amount of income shifted out of the U.S. by U.S. MNCs in our sample increased steadily from $2.2 billion in 2005 to a high of $40.5 billion in 2018 before declining slightly in 2019 and 2020. The overall increasing trend is consistent with results in Klassen and Laplante [2012] using similar data but a different research design. They find that their sample of 380 firms shifted, in aggregate, approximately $10 billion more income out of the U.S. each year in the period 2005 to 2009 than they did in the period 1998 to 2002. To compare our magnitudes with those of Klassen and Laplante [2012], we aggregate over the same periods. In the period 1998-2002 we estimate that our sample firms shifted $18.7 billion *into* the U.S. and shifted $35.1 billion *out of* the U.S in the period 2005-2009. This translates into an average annual difference between the two periods of $11 billion.[22] Our estimate is expected to be larger for at least two reasons. First, we are aggregating per-firm estimates of approximately 900 firms in the later period, more than twice the number of firms included in their sample. Second, their estimate is an equal-weighted average while ours does not impose any averaging

[22] $11 billion is equal to the sum of $19.2 and $35.9 billion divided by five.

across firms. Given these differences, we conclude that the estimates generated by Klassen and Laplante [2012] support the validity of our calculations.

5.3 U.S. tax deficits

By aggregating our firm-year estimates of the amount of profit shifted out of the U.S., we can estimate the aggregate U.S. tax deficit. To do so, however, requires assumptions about the tax rate the earnings would have faced in the U.S. and the likelihood that U.S. tax would be collected on the earnings even if they were shifted out of the U.S. We follow Clausing [2016] and assume that the earnings would have been taxed in the U.S. at a marginal rate of 30 percent and that any residual U.S. tax on earnings shifted to foreign jurisdictions would be deferred indefinitely.[23] Under these assumptions and using our preferred elasticity of -1.301 from Model 4 in Table 7, we estimate an aggregate U.S. tax deficit of $7.6 billion in 2016. Clausing [2016] estimates the U.S. lost between $77 and $111 billion in revenue in 2012 to income shifting. Our estimate of the aggregate U.S. tax deficit in that year is $6.7 billion. Our estimates are much closer to those of Blouin and Robinson [2020], who show that the estimates in Clausing [2016] are likely overstated because of double-counting in the macroeconomic data used in that study.

5.4 Sensitivity analysis

Because the elasticity cannot be estimated precisely, we examine the sensitivity of our estimates to the elasticity used by calculating aggregate estimates of shifted income for a single year, 2016, for each elasticity between -4.0 and -0.25 at 0.25 intervals. The estimates are plotted in Figure 12. At the extreme, if the true elasticity is -4.0, our use of -1.301 understates the

[23] From the beginning of our sample period until 2018, the foreign income of U.S. MNCs was taxed at the U.S. statutory tax rate (35% federal rate for our entire sample period). However, the U.S. tax on foreign income was deferred until the income was repatriated to the U.S. as a dividend. Multiple empirical studies support the assumption that most profits shifted out of the U.S. were not repatriated and, therefore, remained untaxed by the U.S. (De Simone, Piotroski, and Tomy [2019]).

aggregate income shifted out of the U.S. in 2016 by approximately $45.3 billion ($70.6 billion – 25.3 billion), or 64%. Using the elasticity of -2.92 used by Clausing [2020] generates an estimate of income shifted out of the U.S. of $53.5 billion, just over twice our preferred estimate. Because these estimates span the range of estimates generated by the quantile regression reported in Figure 10, we do not calculate separate estimates of shifted income based on those results.

While the sensitivity to variation in the elasticity is both material and unsurprising given how shifted profits are calculated, we note that even under the most generous assumptions that yield an elasticity four times our preferred elasticity, the estimates of the amount of profit shifted out of the U.S. are approximately half the size of the estimates in Clausing [2020] using macro data.

5.5 Estimating profit shifted and U.S. tax deficit by firm

We again leverage the power of our micro data to examine the heterogeneity in shifting across the distribution of U.S. MNCs. Using firm-year estimates generated using the semi-elasticity from Model 4 in Table 7, we examine trends over time, the distribution of income shifted across industries, and the concentration of shifted income in specific firms.

As we did with foreign tax deficits, we examine the distribution of income shifted out of the U.S., first by comparing aggregate amounts across industries, and then by documenting which firms shifted the most income. Once again, we focus on the year 2016. Table 8 shows that firms in the Computer industry account for $9.4 billion (37%) of the total of $25.3 billion shifted out of the U.S. 2016. The Pharmaceutical (13%) and Electrical Equipment (12%) industries are the only other industries representing more than 10% of the income shifted.

In Table 9, we list the thirty firms with the most income shifted out of the U.S. in 2016. Apple Inc. leads the way with $2.9 billion shifted, followed by Alphabet ($2.5 billon), and

Exxon ($1 billion). In 2016, the top 12 firms each shifted more than $500 million out of the U.S. and each of the top 30 firms shifted more than $100 million. Figure 13 shows that these 30 firms account for 69.5% of the total amount of income shifted out of the U.S. in 2016 by our sample firms.[24] By comparison these same 30 firms account for 57.6% (40.2%) of aggregate pretax foreign (worldwide) income for 2016.

We again provide evidence that it is not simply the largest firms that are shifting the most income out of the U.S. by reporting each firm's rank on other size dimensions in the final two columns of Table 9. Six of the top 30 are not in the top 30 by foreign pretax income and nine are not in the top 30 by market value of equity.

6. Conclusion

We use firm-year data to re-examine and complement prior macroeconomic studies of the tax avoidance behavior of multinational firms. First, we show that the downward trends in aggregate foreign effective tax rates highlighted in prior research are driven by a few very large, profitable firms and that those trends do not generalize to all firms. Indeed, our data suggest that the typical firm recognizes about 10% of its foreign profits in tax havens, significantly less than the 50% inferred by Wright and Zucman [2018] using macro data. We also estimate aggregate U.S. revenue loss (i.e., the U.S. tax deficit) due to income shifting out of the U.S. at about 20% of the estimate in Clausing [2016]. Our firm-year estimates of U.S. revenue loss again show significant heterogeneity across the sample of U.S. MNCs and reveal that many firms do not contribute to aggregate tax deficits.

Our findings suggest caution in matching appropriate data to the empirical question being asked. Because macroeconomic data are implicitly weighted by firm size (often foreign income),

[24] 69.4% = $17,583//$25,303.

estimates generated using them are likely to be driven by a few large firms and not reflective of the typical multinational firm. To the extent that policies are implemented to solve income shifting problems and affect all firms when the problem resides in only a few firms and certain industries, significant economic costs could be imposed on smaller, less profitable firms. Thus, researchers and policymakers should exercise caution when extrapolating from the macro level to the micro level.

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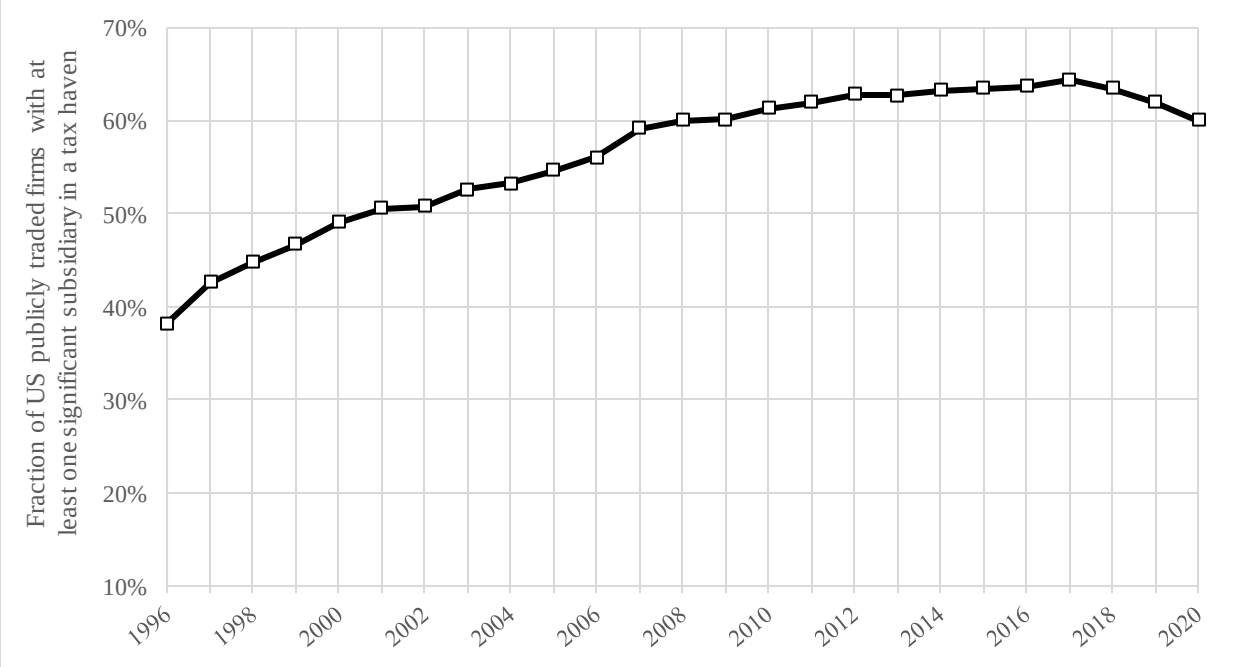
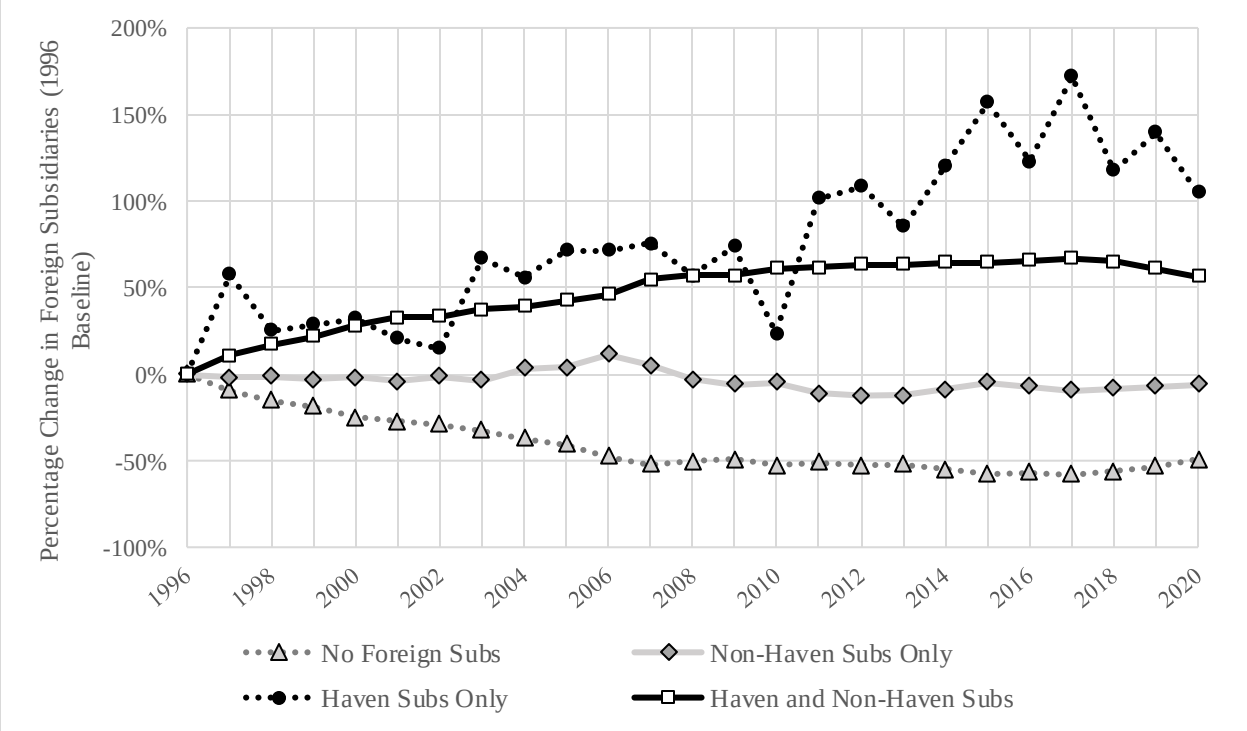
Figure 1 – Fraction of Firms With At Least One Tax Haven Subsidiary



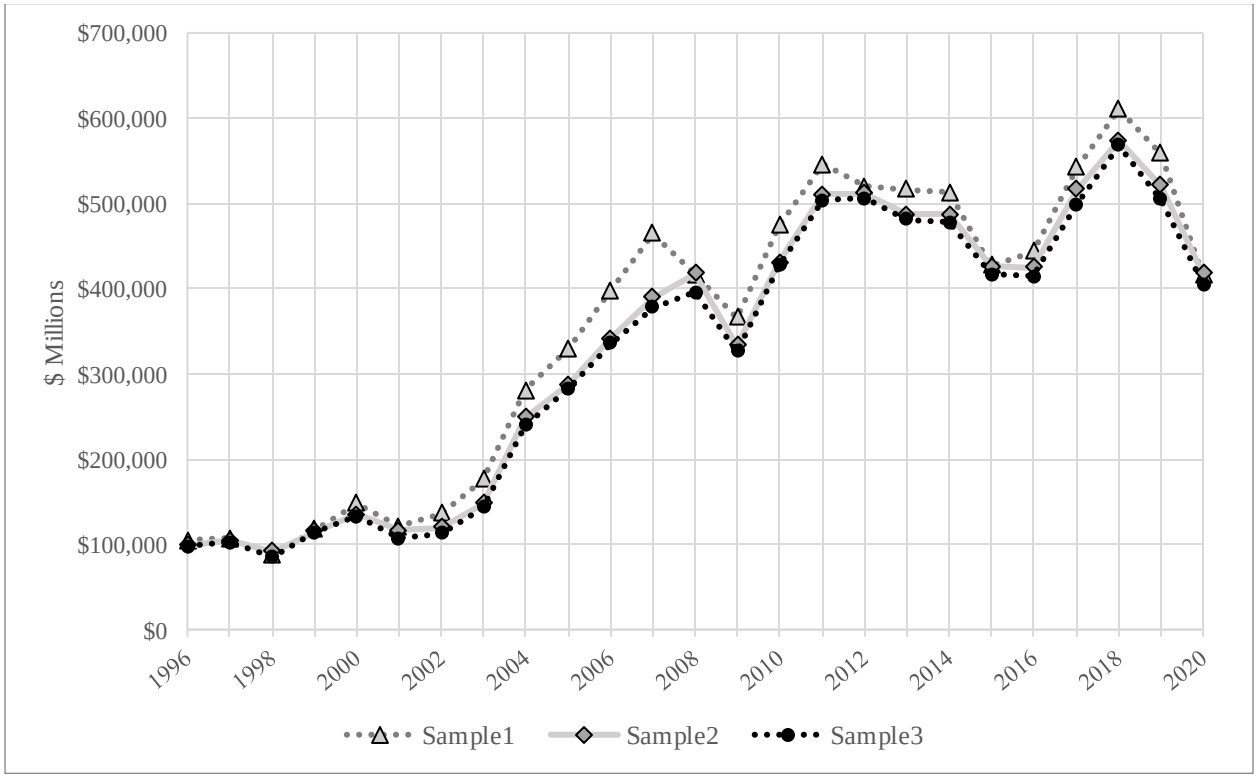
Notes: This figure presents the fraction of U.S. public multinational corporations that disclose at least one significant subsidiary in a tax haven country.

Figure 2 – Percentage Change in Foreign Subsidiaries (1996 Baseline)



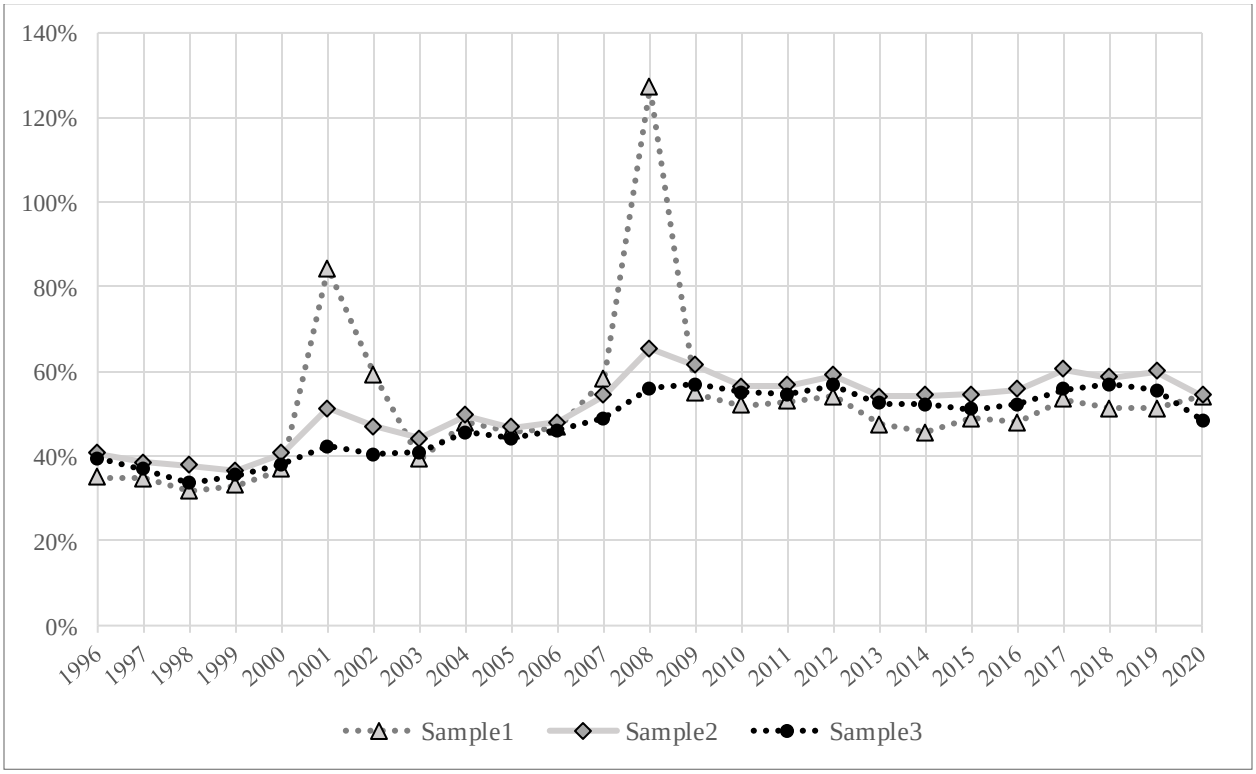
Notes: This figure presents the percentage of U.S. public multinational corporations, relative to a 1996 baseline, that: 1. disclose no significant foreign subsidiaries (···△···); 2. disclose significant foreign subsidiaries, all of which are in tax haven countries (···●···); 3. disclose significant foreign subsidiaries, all of which are in non-tax haven countries (—◇—); and 4. disclose significant foreign subsidiaries in both tax haven and non-tax haven countries (—□—).

Figure 3 – Aggregate Pretax Foreign Income



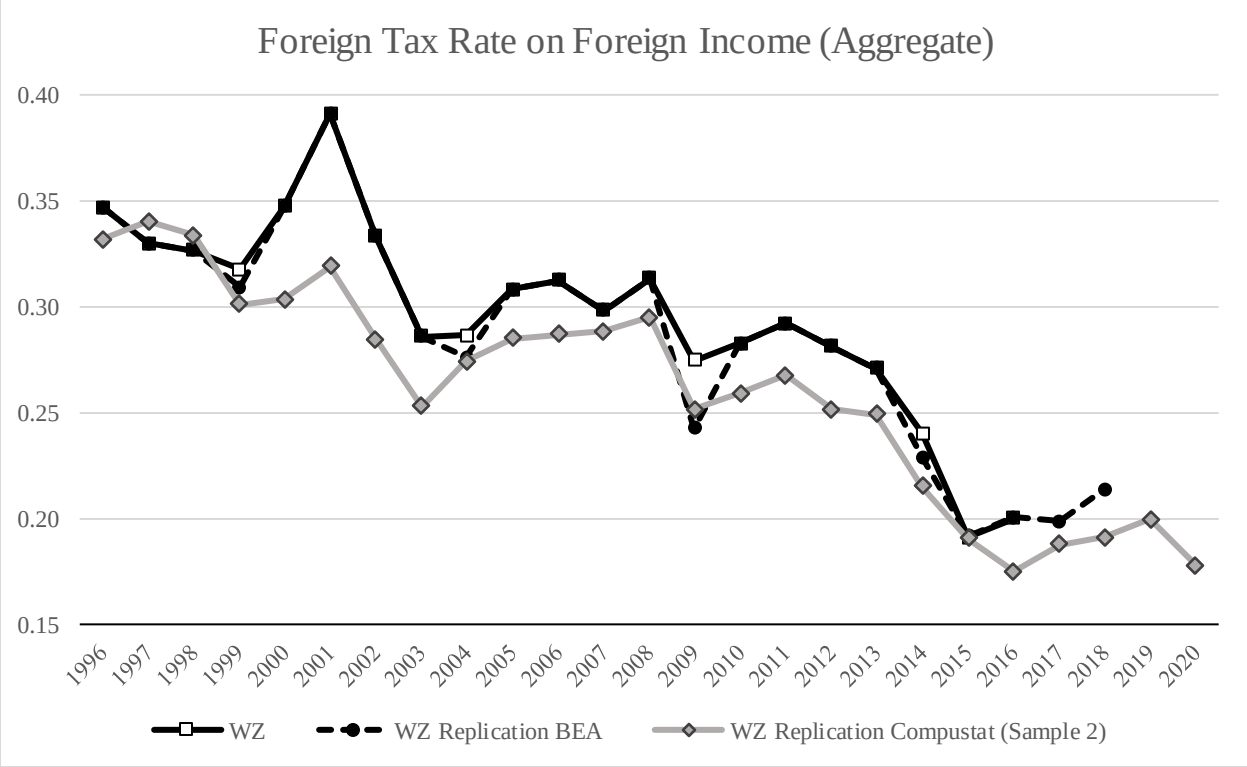
Notes: This figure plots the aggregate pretax foreign income (PIFO) of U.S. public corporations. *Sample 1* includes all firms in Compustat reporting total assets. *Sample 2* is the subset of Sample 1 having total sales greater than $10 million, and a foreign ETR between 0% and 100%. *Sample 3* is the subset of Sample 2 having non-negative pretax income. See Table 2 for further details of the samples.

Figure 4 – Aggregate Pretax Foreign Income to Aggregate Pretax Worldwide Income



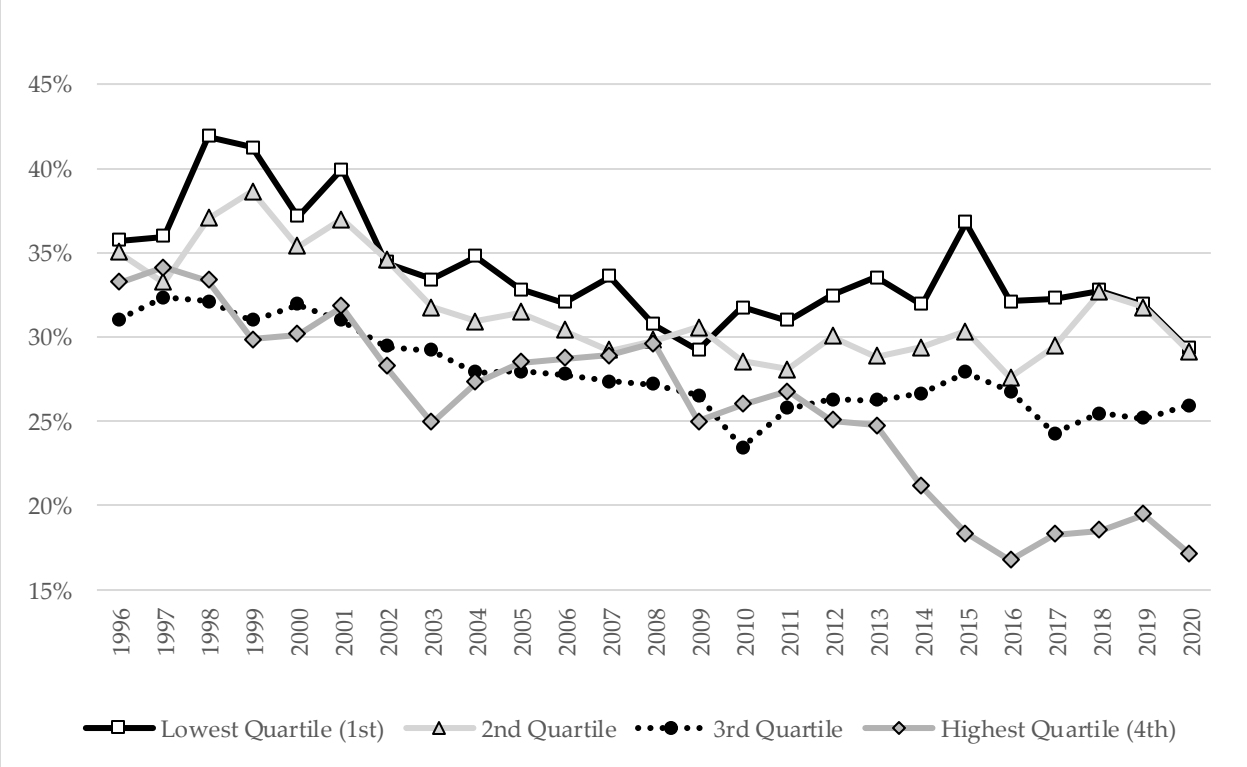
Notes: This figure plots the annual aggregate amount of pretax foreign income (PIFO) scaled by aggregate total pretax income (PI) for U.S. multinationals. *Sample 1* includes all firms in Compustat reporting total assets. *Sample 2* is the subset of Sample 1 having total sales greater than $10 million, and a foreign ETR between 0% and 100%. *Sample 3* is the subset of Sample 2 having non-negative pretax income. See Table 2 for further details of the samples.

Figure 5 – Replication of Wright and Zucman (2018) with Macro and Micro Data



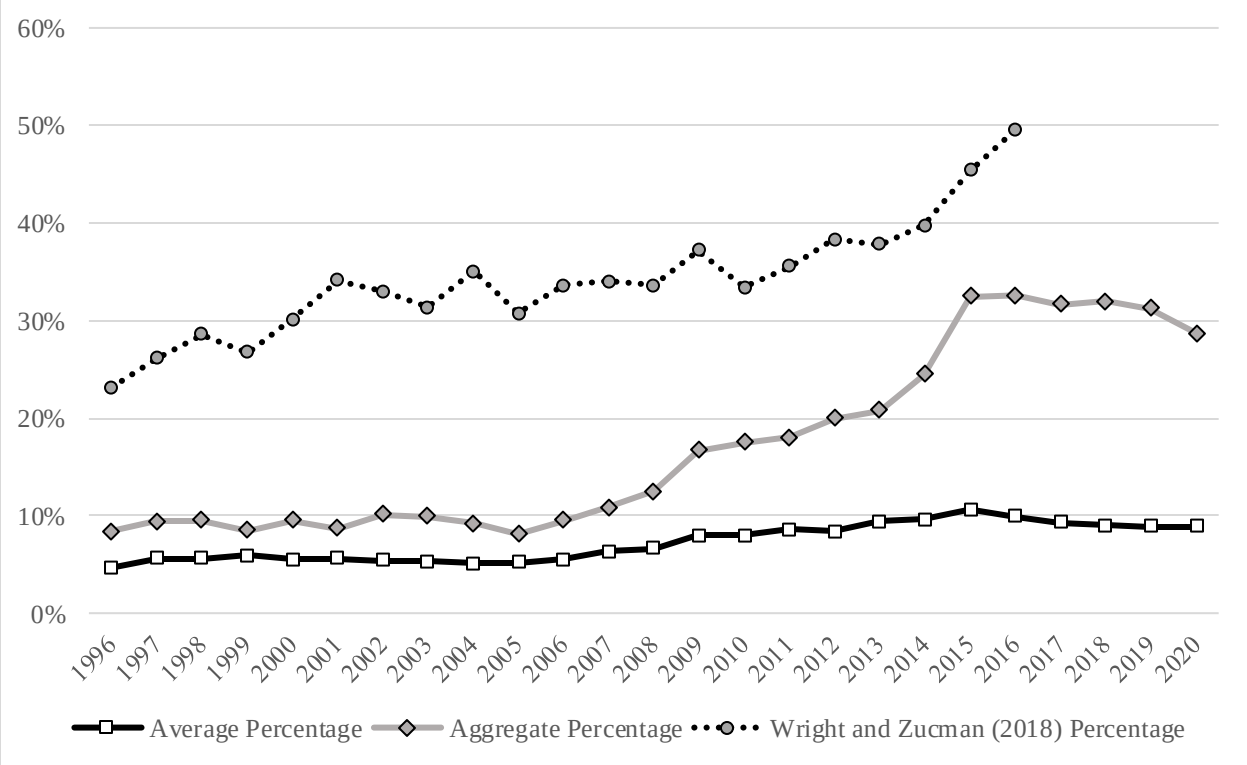
Notes: This figure plots the aggregate foreign tax rate. "WZ" plots values reported by Wright and Zucman [2018]. "WZ Replication BEA" plots values calculated using aggregate data available from the Bureau of Economic Analysis (BEA). "WZ Replication Compustat" plots values calculated as (aggregate foreign current tax expense)/(aggregate pretax foreign income) each year using the data of firms reported in Compustat.

Figure 6 – Foreign ETR by Quartile of Pretax Foreign Income



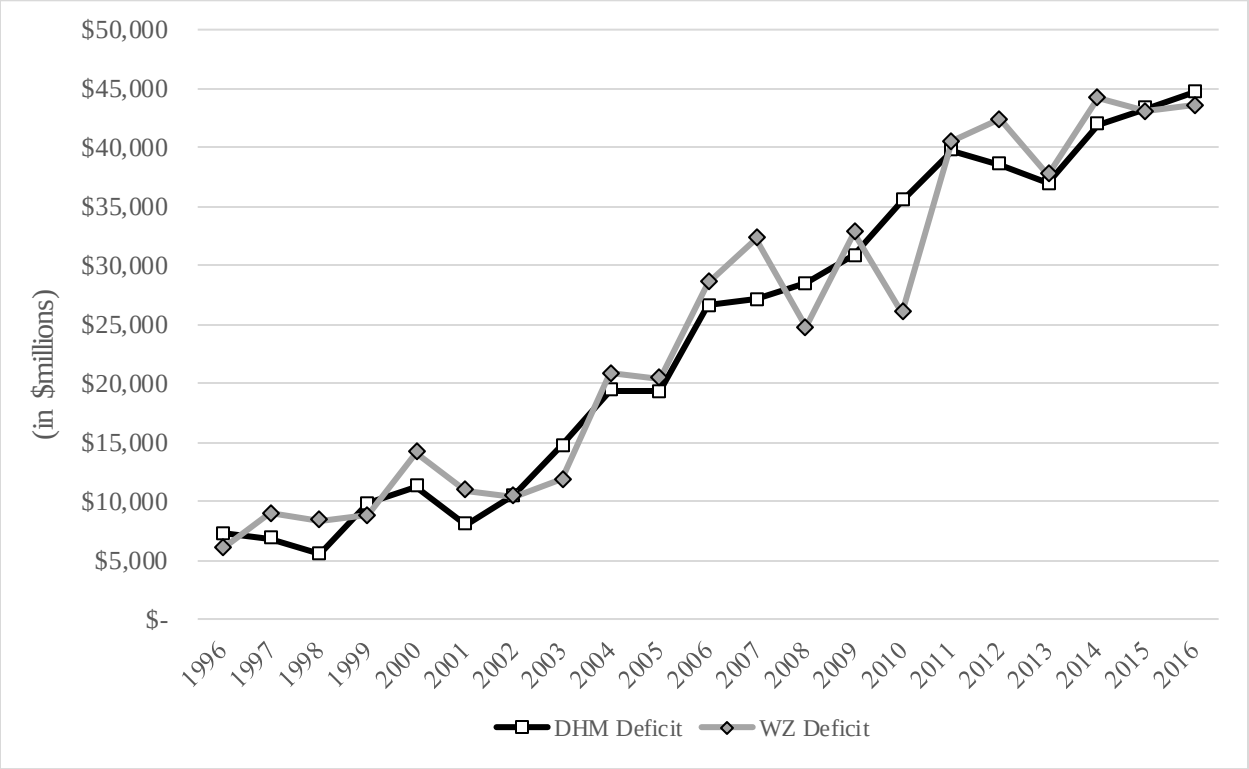
Notes: This figure plots the aggregate foreign tax rate for the top and bottom quartiles of Pretax Foreign Income. ETRFO = (aggregate foreign current tax expense)/(aggregate pretax foreign income) of firms reported in Compustat.

Figure 7 – Proportion of Foreign Income of US Firms Recognized in Tax Havens



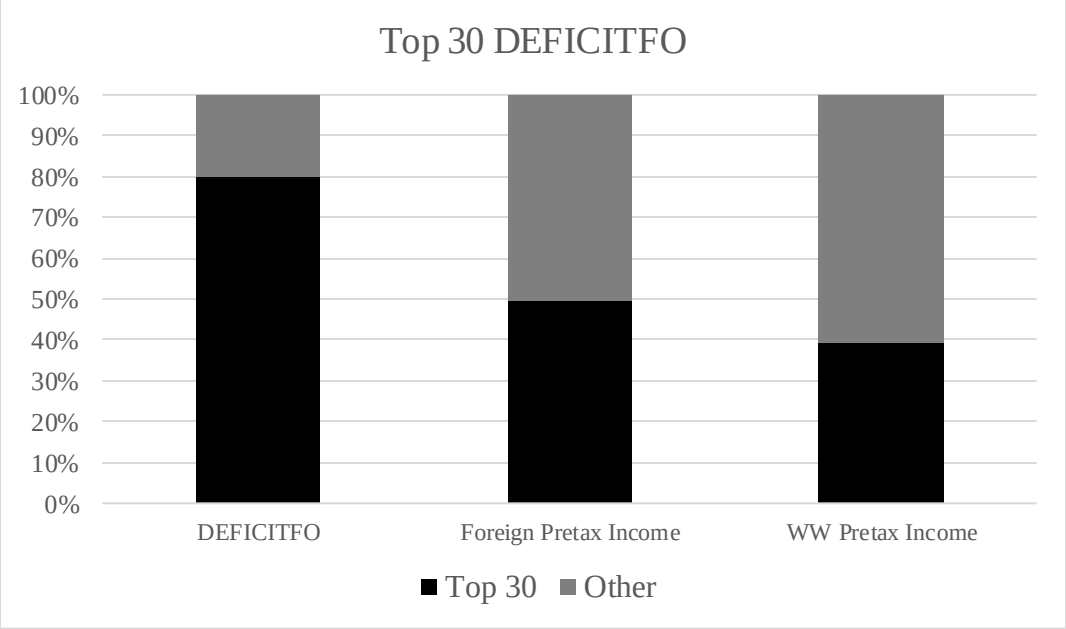
Notes: This figure plots our estimates of the average and aggregate portions of foreign pretax profit recorded in tax havens each year. The figure also plots the portion of foreign pretax profit recorded in tax havens from Wright and Zucman [2018].

Figure 8 – Foreign Tax Deficits over Time



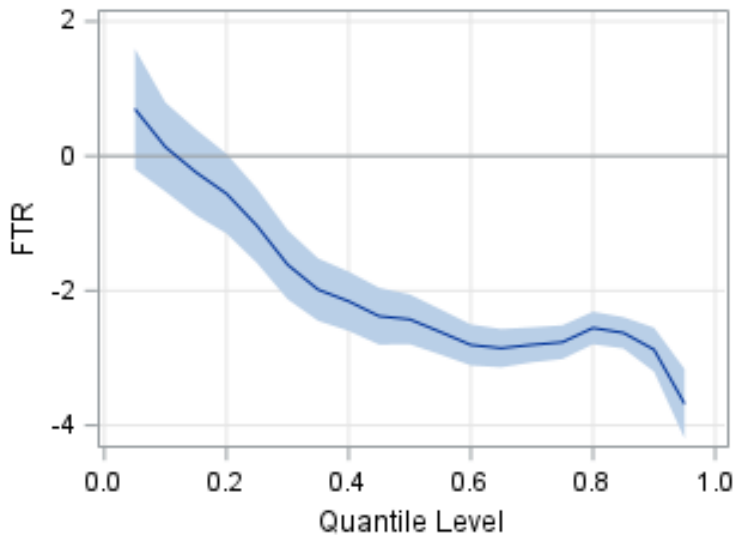
Notes: This figure plots the aggregate foreign tax deficits estimated using the aggregate of firm-year estimates generated using the firms in Compustat (DHM Deficit) and using the annual macroeconomic data used in Wright and Zucman [2018].

Figure 9 – Top 30 Foreign Tax Deficit in 2016



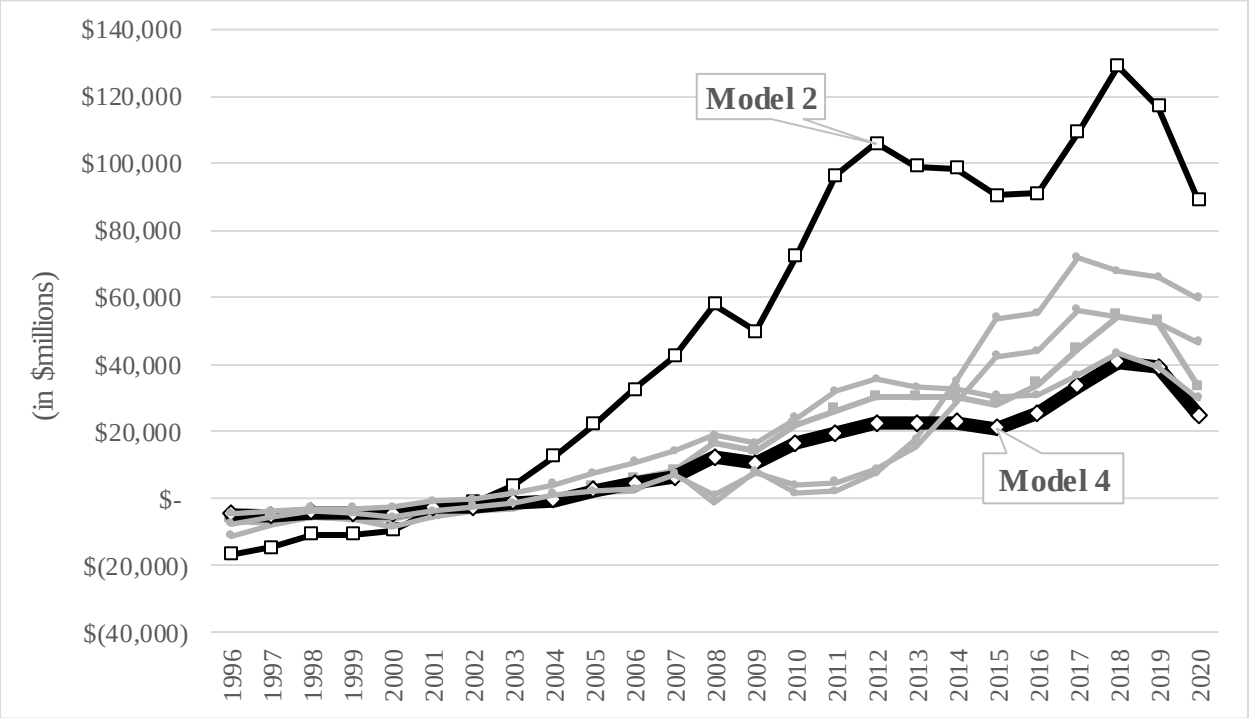
Notes: This figure plots the proportion of aggregate foreign tax deficit, foreign pretax income and worldwide pretax income in 2016 attributable to the 30 firms with the largest foreign tax deficit.

Figure 10 – Shifting Elasticities by Quantile



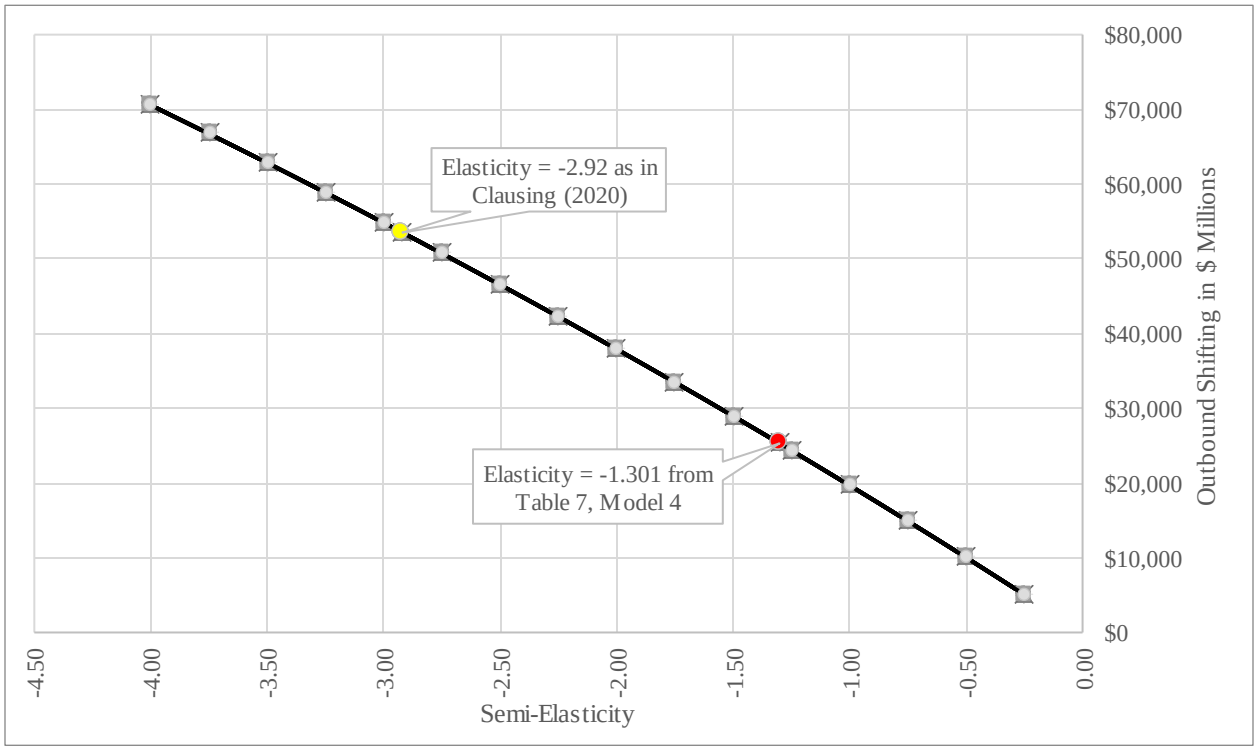
Notes: This figure plots the shifting elasticity estimates from a quantile regression. The dark blue line shows the elasticity estimate by quantile and the shaded blue region surrounding the dark blue line represents a 95% confidence interval.

Figure 11 – U.S. Outbound Income Shifting over Time



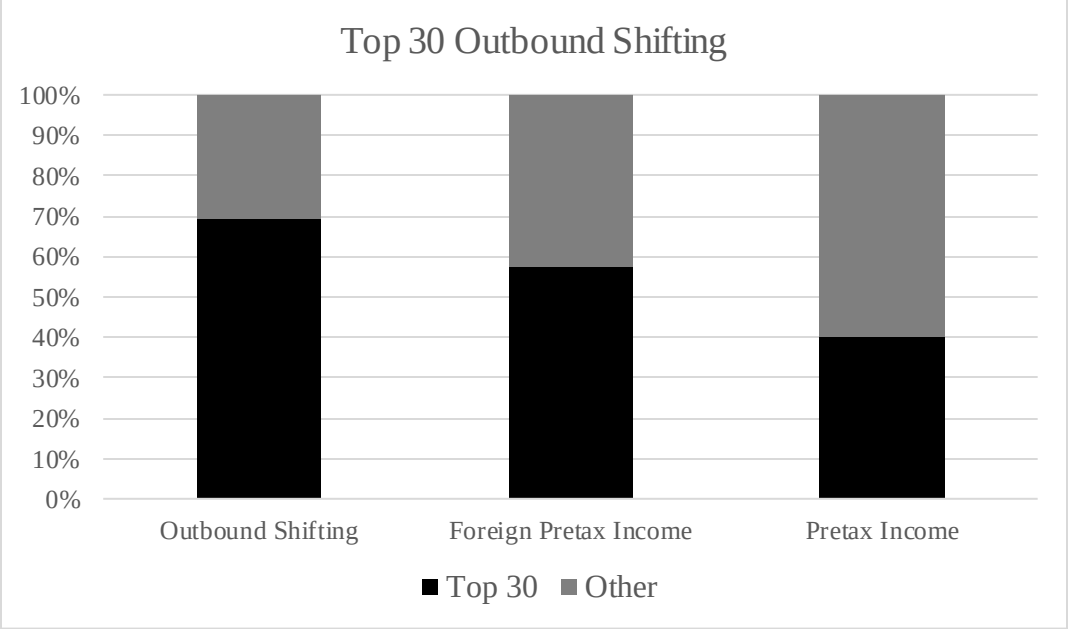
Notes: This figure plots our estimates of the aggregate amount of pretax profit shifted out of the U.S. by the U.S. multinational corporations in our sample each year.

Figure 12 – U.S. Outbound Income Shifting Estimates with Different Elasticities in 2016



Notes: This figure describes the sensitivity of our estimate of the aggregate amount of income shifted out of the U.S. in 2016 by our sample firms to the elasticity of foreign income to the tax rate incentive. The estimate used in our primary results is the semi-elasticity calculated with the Average Statutory Tax Rate, -1.335.

Figure 13 – Top 30 Outbound Shifting in 2016



Notes: This figure plots the proportion of aggregate outbound shifting, foreign pretax income and worldwide pretax income in 2016 that is attributable to the 30 firms with the largest amount of outbound shifting.

Table 1 – Geographic Distribution of Subsidiaries of U.S. Multinationals in 2016

Rank	Country	Number of U.S. Multinationals in Country	Number of U.S. Multinationals in Country per 10,000 Population
1	Cayman Islands	468	74.797
2	British Virgin Islands	199	67.791
3	Bermuda	376	58.245
4	Gibraltar	70	20.749
5	Luxembourg	539	9.261
6	Turks and Caicos Islands	31	8.479
7	Marshall Islands	32	5.543
8	Barbados	143	5.004
9	Isle of Man	36	4.322
10	Virgin Islands (US)	43	4.000
11	Monaco	15	3.940
12	Liechtenstein	12	3.187
13	Mauritius	195	1.543
14	Aruba	16	1.526
15	Singapore	795	1.418
16	Bahamas, The	53	1.402
17	Seychelles	12	1.267
18	Guam	20	1.227
19	Ireland	565	1.188
20	Hong Kong	830	1.131
38	Canada	1,364	0.378
53	United Kingdom	1,425	0.217

Notes: This table presents number of U.S. multinational corporations that have at least one subsidiary in the country in 2016. The first column reports the number of U.S. MNCs with subsidiaries in the country. The second column reports that number scaled by the population of the country (in 10,000s). Only the top 20 countries are listed, and Canada and the UK are included as benchmarks. For example, there are 74.797 (0.378) U.S. multinationals with subsidiaries in the Cayman Islands (Canada) for every 10,000 residents of the Cayman Islands (Canada).

Table 2 – Sample Selection

Criteria	Firms	Firm-years	PIFO	% of Sample 1	AT	% of Sample 1	Sales	% of Sample 1	Aggregate ETRFO
Sample #1 - All U.S. Multinational Firms in Compustat with non-missing values of total assets, sales, pretax foreign income, and foreign current tax expense	5,199	44,115	8,820	100%	391,890	100%	193,690	100%	0.270
Less: Observations from regulated industries, with Sales<10, PIFO > 0, and ETRFO<0 or ETRFO>1	(1,833)	(19,271)	(565)	-6.4%	(216,650)	-55.3%	(50,160)	-25.9%	(0.028)
Sample #2	3,366	24,844	8,255	93.6%	175,240	44.7%	143,530	74.1%	0.241
Less: Observations with PI<=0	(464)	(4,266)	(200)	-2.3%	(11,330)	-2.9%	(8,480)	-4.4%	(0.002)
Sample #3	2,902	20,578	8,054	91.3%	163,910	41.8%	135,050	69.7%	0.239

Notes: This table presents the composition of the samples used in the paper. PIFO is the aggregate of the pretax foreign income of the firm-years represented in the row. AT is the aggregate of the total assets of the firm-years represented in the row. Sales is the aggregate of the total revenue of the firm-years represented in the row. % of Sample 1 reports the percentage of the aggregate amount of each variable (PIFO, AT, Sales) in Sample 1 represented in the row. Aggregate ETRFO is the aggregate of foreign current tax expense scaled by the aggregate of foreign pretax income for the firm-years in the row.

Table 3 – Determinants of Foreign Effective Tax Rate

	Model 1	Model 2	Model 3	Model 4
AVGRATE5	0.596***	0.473***	0.563***	0.461**
	(3.841)	(3.124)	(4.035)	(2.712)
LN(*NHAVENCOUNTRIES*)		-0.009*	-0.054***	-0.011
		(-1.924)	(-7.341)	(-1.283)
HIGH PIFO		-0.066***	-0.056***	-0.035**
		(-4.526)	(-3.476)	(-2.345)
HIGH PIFO * LN(*NHAVENCOUNTRIES*)		0.006	0.000	0.000
		(0.714)	(0.020)	(0.018)
LN(*NCOUNTRIES*)			0.048***	0.009
			(7.805)	(1.206)
LN(*ASSETS*)			-0.001	-0.021***
			(-0.524)	(-3.278)
R&D			-0.193***	0.540***
			(-3.028)	(3.455)
Fixed Effects	Industry and Year	Industry and Year	Industry and Year	Firm and Year
Number of Observations	10,791	10,791	10,791	10,556
Adjusted R-squared	0.081	0.109	0.132	0.590

$$ETRFO5_{it} = \beta_0 + \beta_1 AVGRATE5_{it} + \beta_2 LN(NHAVENCOUNTRIES)_{it} + \sum \beta_k Controls + \varepsilon \qquad (1)$$

Notes: This table presents the results of estimating Equation (1) on the sample of firm-years with required data. The dependent variable, $ETRFO5$, is the aggregate of foreign current tax expense for the 5-year period ending in the year scaled by the aggregate of foreign pretax income for the 5-year period ending in the year. $AVGRATE5$ is the weighted average of the statutory tax rates of the non-zero-rate countries in which the firm had material operations in the 5-year period ending in the year, where the weights are the number of subsidiaries in the country. $LN(NHAVENCOUNTRIES)$ is the natural log of the number of tax haven countries in which the firm has material subsidiaries in the year. $HIGHPIFO$ is an indicator variable equal to 1 if the firm is in the top quartile of pretax foreign income in the year. $LN(ASSETS)$ is the natural log of the firm's total worldwide assets in the year. $LN(NCOUNTRIES)$ is the natural log of the number of countries in which the firm had material operations in the year. $R\&D$ is the firm's Research and Development Expense scaled by Total Assets in the year. t-statistics are reported in parentheses below the estimates. Standard errors are clustered by firm and by year. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table 4 – Top 30 Income in Tax Havens (2016)

	Company	Foreign Pretax Income in Havens	Fraction of Foreign Pretax Income in Havens	Foreign Pretax Income RANK	MVE Rank
1	APPLE INC	$30,469	74.1%	1	1
2	MICROSOFT CORP	11,275	56.2%	2	3
3	GILEAD SCIENCES INC	8,694	92.0%	9	30
4	ALPHABET INC	8,464	69.8%	6	2
5	PFIZER INC	7,633	45.2%	3	11
6	ABBVIE INC	7,469	78.3%	8	26
7	CISCO SYSTEMS INC	6,025	60.2%	7	18
8	JOHNSON & JOHNSON	5,826	47.2%	5	6
9	META PLATFORMS INC	4,633	75.3%	14	5
10	AMGEN INC	3,728	79.6%	19	21
11	ORACLE CORP	2,984	37.4%	12	12
12	COCA-COLA CO	2,570	32.0%	11	13
13	PEPSICO INC	2,164	36.5%	16	19
14	EBAY INC	1,599	75.3%	***36***	***80***
15	WALGREENS BOOTS ALLIANCE INC	1,543	60.1%	***32***	***34***
16	LAS VEGAS SANDS CORP	1,527	68.8%	***34***	***64***
17	CELGENE CORP	1,336	81.6%	***46***	***31***
18	INTEL CORP	1,329	22.2%	15	14
19	NVIDIA CORP	1,128	86.4%	***55***	***43***
20	BIOGEN INC	990	77.5%	***56***	***45***
21	INTL BUSINESS MACHINES CORP	942	10.9%	10	17
22	BRISTOL-MYERS SQUIBB CO	921	32.7%	30	28
23	NIKE INC -CL B	852	23.4%	27	***35***
24	HONEYWELL INTERNATIONAL INC	830	23.9%	28	***33***
25	CONSTELLATION BRANDS	774	59.3%	***54***	***85***
26	LAM RESEARCH CORP	651	60.6%	***64***	***161***
27	ELECTRONIC ARTS INC	616	74.4%	***91***	***91***
28	VMWARE INC -CL A	604	60.7%	***73***	***81***
29	XILINX INC	594	91.3%	***100***	***151***
30	ANALOG DEVICES INC	551	57.8%	***77***	***121***

Notes: This table presents the estimate of the amount of income reported in tax havens by each firm in 2016. The third column reports the amount of income in tax havens as a percentage of the firm's total foreign income. The fourth column reports the firm's rank (based on Foreign Pretax Income) for 2016. The fifth column reports the firm's rank (based on market value of equity – MVE) for 2016. In Columns 4 and 5, ranks above 30 are shown in bold.

Table 5 –Foreign tax deficits by industry, 2016

Industry	NOBS	Total Deficit
Computers	249	$ 15,840
Pharma	39	11,034
ElectricEquip	50	7,943
Food	25	2,374
Instruments	89	1,645
Services	100	957
Other	60	887
Textiles	64	682
Chemicals	63	606
BldgMaterials	24	548
Machinery	61	541
MiscRetail	45	407
Wholesale	47	395
Extractive	14	257
TransportEquip	44	250
Restaurant	14	107
Metal	38	77
MiscManuf	11	69
Total	1,037	$ 44,619

Notes: This table presents the aggregate foreign tax deficit for each industry for 2016. A firm's foreign tax deficit for a year is calculated as $PIFO * AVGRATE - Foreign\ Current\ Tax\ Expense$. $PIFO$ is the firm's foreign pretax income in the year. $AVGRATE$ is the weighted average of the statutory tax rates of the non-zero-rate countries in which the firm has material operations in the year, where the weights are provided by the number of subsidiaries the firm has in the country. $Foreign\ Current\ Tax\ Expense$ is the foreign current tax expense reported in the firm's financial statements for the year.

Table 6 – Top 30 Foreign tax deficits, 2016

	Name	Industry	Deficit	Foreign Pretax Income	Foreign Pretax Income RANK	MVE Rank
1	APPLE INC	ElectricEquip	$ 7,749	$41,100	1	1
2	MICROSOFT CORP	Computers	4,752	20,076	2	3
3	PFIZER INC	Pharma	2,989	16,886	3	11
4	GILEAD SCIENCES INC	Pharma	2,193	9,451	9	30
5	ALPHABET INC	Computers	1,942	12,130	6	2
6	ABBVIE INC	Pharma	1,907	9,535	8	26
7	JOHNSON & JOHNSON	Pharma	1,589	12,346	5	6
8	INTL BUSINESS MACHINES CORP	Computers	1,283	8,680	10	17
9	COCA-COLA CO	Food	1,181	8,023	11	13
10	CISCO SYSTEMS INC	Computers	1,176	10,013	7	18
11	META PLATFORMS INC	Computers	1,158	6,150	14	5
12	AMGEN INC	Pharma	1,127	4,685	19	21
13	INTEL CORP	Computers	735	5,979	15	14
14	PEPSICO INC	Food	698	5,923	16	19
15	HP INC	Computers	576	3,293	29	***103***
16	NIKE INC -CL B	BldgMaterials	487	3,646	27	***35***
17	PAYPAL HOLDINGS INC	Computers	477	1,973	***37***	***59***
18	ORACLE CORP	Computers	401	7,984	12	12
19	HONEYWELL INTERNATIONAL INC	Other	372	3,471	28	***33***
20	LAS VEGAS SANDS CORP	Services	340	2,220	***34***	***64***
21	NVIDIA CORP	Computers	327	1,305	***55***	***43***
22	EBAY INC	Computers	326	2,122	***36***	***80***
23	CELGENE CORP	Pharma	311	1,638	***46***	***31***
24	BRISTOL-MYERS SQUIBB CO	Pharma	301	2,815	30	28
25	BIOGEN INC	Pharma	273	1,278	***56***	***45***
26	STRYKER CORP	Instruments	233	1,379	***52***	***61***
27	CONSTELLATION BRANDS	Food	231	1,305	***54***	***85***
28	WALGREENS BOOTS ALLIANCE INC	MiscRetail	229	2,567	***32***	***34***
29	KRAFT HEINZ CO	Food	212	1,665	***45***	23
30	ANALOG DEVICES INC	Computers	209	954	***77***	***121***
			$35,784	$210,592		

Notes: This table presents the aggregate foreign tax deficit for each firm for 2016. A firm's foreign tax deficit for a year is calculated as $PIFO * AVGRATE - Foreign\ Current\ Tax\ Expense$. $PIFO$ is the firm's foreign pretax income in the year. $AVGRATE$ is the weighted average of the statutory tax rates of the non-zero-rate countries in which the firm has material operations in the year, where the weights are provided by the number of subsidiaries the firm has in the country. $Foreign\ Current\ Tax\ Expense$ is the foreign current tax expense reported in the firm's financial statements for the year. The fifth column reports the firm's rank (based on Foreign Pretax Income) for 2016. The sixth column reports the firm's rank (based on market value of equity – MVE) for 2016. In Columns 5 and 6, ranks above 30 are shown in bold.

Table 7 – Elasticity calculations

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
LN(*PI*)	0.899***	0.889***	0.883***	0.404***	0.412***	0.388***
	(70.150)	(79.280)	(68.270)	(24.370)	(29.220)	(21.830)
AVGRATE_CFIXED	-1.777***			-1.301**		
	(-4.435)			(-2.166)		
AVGRATE		-3.244***			-0.975*	
		(-9.546)			(-1.747)	
ETRFO5			-1.557***			-1.158***
			(-11.850)			(-12.450)
CONSTANT	-0.046	0.332***	0.076	2.272***	1.954***	2.479***
	(-0.315)	(2.687)	(0.909)	(12.780)	(12.370)	(25.890)
Fixed Effects	None	None	None	Firm & Year	Firm & Year	Firm & Year
Number of Observations	16,033	20,578	14,483	15,584	20,066	14,131
Adjusted R-squared	0.680	0.684	0.714	0.920	0.914	0.929

$$LN(PIFO)_{it} = \beta_0 + \beta_1 LN(PI)_{it} + \beta_2 FTR_{it} + \varepsilon \qquad (2)$$

Notes: This table presents the results of estimating Equation (2) on the sample of firm-years with required data. The dependent variable, $LN(PIFO)$, is the natural log of the firm's pretax foreign income in the year. $LN(PI)$ is the natural log of the firm's worldwide pretax income in the year. $AVGRATE\_CFIXED$ is the the weighted-average of the statutory rates of the countries in which a firm reports subsidiaries from each firm's first year in our data, weights are based on the number of subsidiaries a firm reports in a given country for the firm's first year in our data. $AVGRATE$ is the 3-year weighted average of the statutory tax rates of the non-zero-rate countries in which the firm had material operations in the current and preceding year, where the weights are the number of subsidiaries in the country. $ETRFO5$ is the aggregate of the firm's foreign current tax expense for the 5-year period ending in the year scaled by the aggregate of the firm's foreign pretax income for the same period. t-statistics are reported in parentheses below the estimates. Standard errors are clustered by firm and by year. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table 8 – Outbound income shifting by industry, 2016

Industry	NFIRMS	Total Outbound Shifting
Computers	168	$ 9,400
Pharma	30	3,324
ElectricEquip	36	3,100
Food	23	1,574
Extractive	9	1,118
Instruments	78	1,000
Services	91	847
Other	47	801
Chemicals	57	782
MiscRetail	39	555
Textiles	58	510
Machinery	43	509
TransportEquip	41	454
Restaurant	12	405
Wholesale	42	359
BldgMaterials	19	320
Metal	29	135
MiscManuf	10	110
Total		$25,303

Notes: This table presents the aggregate pretax income shifted out of the U.S. by industry for the year 2016.

Table 9 – Top 30 Outbound Shifting, 2016

	Name	Industry	Outbound Shifting	Foreign Pretax Income RANK	MVE Rank
1	APPLE INC	ElectricEquip	$ 2,932	1	1
2	ALPHABET INC	Computers	2,470	6	2
3	EXXON MOBIL CORP	Extractive	1,012	4	4
4	META PLATFORMS INC	Computers	1,004	14	5
5	ABBVIE INC	Pharma	886	8	26
6	MICROSOFT CORP	Computers	841	2	3
7	INTEL CORP	Computers	764	15	14
8	ORACLE CORP	Computers	715	12	12
9	PEPSICO INC	Food	656	16	19
10	GILEAD SCIENCES INC	Pharma	565	9	30
11	INTL BUSINESS MACHINES CORP	Computers	563	10	17
12	PFIZER INC	Pharma	556	3	11
13	JOHNSON & JOHNSON	Pharma	461	5	6
14	LAS VEGAS SANDS CORP	Services	440	***34***	***63***
15	COCA-COLA CO	Food	411	11	13
16	QUALCOMM INC	Computers	401	26	24
17	HEWLETT PACKARD ENTERPRISE	Computers	313	22	***69***
18	CISCO SYSTEMS INC	Computers	264	7	18
19	GENERAL ELECTRIC CO	Other	256	13	7
20	MCDONALD'S CORP	Restaurant	238	18	25
21	WALGREENS BOOTS ALLIANCE INC	MiscRetail	232	***32***	***34***
22	NIKE INC -CL B	BldgMaterials	230	27	***35***
23	MERCK & CO	Pharma	214	23	16
24	BOOKING HOLDINGS INC	Computers	186	***42***	***39***
25	HP INC	Computers	182	29	***100***
26	CELGENE CORP	Pharma	178	***44***	***31***
27	AMGEN INC	Pharma	167	19	21
28	COLGATE-PALMOLIVE CO	Chemicals	158	***33***	***46***
29	NVIDIA CORP	Computers	147	***53***	***43***
30	BRISTOL-MYERS SQUIBB CO	Pharma	140	30	28
			$17,583		

Notes: This table presents the aggregate pretax income shifted out of the U.S. ($ million) for the Top 30 firms in 2016 based on amount shifted. The fourth, fifth, and sixth columns report the firm's rank in 2016 based on market value of equity, total assets, and worldwide pretax income, respectively. Ranks above 30 are shown in bold.

Appendix A – Variable Definitions

Variable	Description	Source*
	Main Outcome and Complexity Variables	
AVGRATE	The weighted average of the statutory tax rates of the non-zero-rate countries in which the firm had material operations in the current and previous two years, where the weights are the number of subsidiaries in the country	Exhibit 21 & World Bank
AVGRATE5	The weighted average of the statutory tax rates of the non-zero-rate countries in which the firm had material operations in the current and previous four years, where the weights are the number of subsidiaries in the country	Exhibit 21 & World Bank
AVGRATE_CFIXED	Following Harris and O'Brien [2021], we compute the weighted-average of the statutory rates of the countries in which a firm reports subsidiaries from each firm's first year in our data. Weights are based on the number of subsidiaries a firm reports in a given country for the firm's first year in our data.	Exhibit 21 & World Bank
ETRFO	Current foreign tax expense (TXFO) scaled by pretax foreign income (PIFO)	Compustat
ETRFO5	Aggregate current foreign tax expense (TXFO) scaled by aggregate pretax foreign income (PIFO) for the previous five-year period	Compustat
LN(ASSETS)	The natural log of one plus total, worldwide assets (AT)	Compustat
LN(NHAVENCOUNTRIES)	The natural log of one plus the sum of all tax haven countries for which a firm reports at least one material subsidiary	Exhibit 21
LN(NCOUNTRIES)	The natural log of one plus the sum of all countries for which a firm reports at least one material subsidiary	Exhibit 21
LN(PI)	The natural log of one plus worldwide pretax income (PI)	Compustat
LN(PIFO)	The natural log of one plus pretax foreign income (PIFO)	Compustat
R&D	Research and Development Expense (XRD) scaled by total assets (AT)	Compustat

Appendix B – Tax Haven Lists

Country	Wright & Zucman (2018)	Dyreng & Lindsey (2009)
Andorra	X	X
Anguilla	X	X
Antigua and Barbuda	X	X
Aruba	X	X
Bahamas	X	X
Bahrain		X
Barbados	X	X
Belize		X
Bermuda	X	X
Botswana		X
British Virgin Islands	X	X
Brunei Darussalam		X
Cape Verde		X
Cayman Islands	X	X
Cook Islands		X
Costa Rica	X	X
Curacao	X	
Cyprus		X
Dominica	X	X
Gibraltar		X
Grenada	X	X
Guernsey and Alderney		X
Ireland	X	X
Isle of Man		X
Jersey		X
Kitts and Nevis	X	X
Latvia		X
Lebanon		X
Liberia		X
Liechtenstein		X
Luxembourg	X	X
Macao		X
Maldives		X
Malta		X
Marshall Islands		X
Mauritius		X
Monaco		X
Montserrat	X	X
Nauru		X
The Netherlands	X	
Netherlands Antilles		X
Niue		X
Palau		X
Panama		X
Samoa		X
San Marino		X
Seychelles		X
Singapore	X	X
St. Lucia	X	X
St. Vincent and the Grenadines	X	X
Switzerland	X	X
Turks and Caicos	X	
U.S. Virgin Islands	X	X
Uruguay		X
Vanuatu		X

"X" in a column indicates that the paper considers the country to be a tax haven. We follow the list of Dyreng and Lindsey [2009] for our primary tests.