A Fistful of Dollars? Foreign Sales Platforms and Profit Shifting in Tax Havens*

Sébastien Laffitte† ENS de Paris-Saclay CREST

Farid Toubal‡ ENS de Paris-Saclay CREST and CEPII

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Abstract

Using public macro-level data on activities of multinationals, we document that U.S. firms geographically disconnect sales and production to avoid paying corporate taxes. We revisit both theoretically and empirically the location determinants of foreign platforms and show that market access motives are far less relevant when considering tax havens. We characterize these countries and shed light on the attractiveness of different tax havens for specific sectors of activity. Our quantification shows that profit shifting by foreign sales platforms in tax havens amounts to about $80bn in 2013. Our findings contribute to the recent policy debate on the reform of international taxation.

JEL codes: F23, H26, H73

Keywords: International Taxation; Tax avoidance; Foreign platforms; Tax havens; Profit shifting; Firms' organization.

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†Corresponding author. ENS de Paris-Saclay, 61 Avenue du Président Wilson, 94230 Cachan. sebastien.laffitte@ens-cachan.fr

‡ENS de Paris-Saclay, 61 Avenue du Président Wilson, 94230 Cachan. ftoubal@ens-cachan.fr

1 Introduction

Recent media leaks have highlighted the spread and magnitude of corporate tax avoidance. In spite of much anecdotal evidence, little is known about how multinational companies organize their foreign activities to avoid paying taxes.[1] Figure 1 highlights a feature common to most cases. Multinational firms locate their sales platforms in low-tax jurisdictions where worldwide sales are concentrated (left side of Figure 1) and produce elsewhere (right side of Figure 1).[2] This system has been adopted by many firms such as Apple in Ireland (Levin, 2013), and Caterpillar (Levin, 2014), Kering (Philippin, Malagutti and Rosenberg, 2018) and BASF (Auerbach, 2016) in Switzerland.

— Figure 1 about here —

In this paper, we show that U.S. MNEs organize their profit shifting in tax havens through sales platforms.[3] A sales platform is defined as a foreign affiliate for which the non-local part of the sales activity predominates. We distinguish foreign sales platforms from export platforms because the activity of multinationals in tax havens can involve foreign sales without exports. The case of Apple described in details in Appendix illustrates this argument. Apple has an Irish affiliate which holds the contracts with Apple's Chinese contract manufacturers and owns the inventory they produce. These Chinese producers are exporting directly to retailers so that goods never cross the Irish border. However, the financial transaction occurs between the owner of the goods and the final customer, in this case, between the Irish affiliate and retailers. This contract manufacturing strategy is only one of the many tax planning strategies that involves the activities of foreign sales platforms. They could be also involved

[1] A large volume of information on various cases and techniques of tax avoidance have been released in the press, which has led to a number of very detailed and interesting papers (see for instance Clausing, 2003, 2006, Cristea and Nguyen, 2016 and Davies et al., 2018 for transfer mispricing of goods, Hebous and Johannesen, 2015 for transfer mispricing of services, Buettner and Wamser, 2013 for debt shifting, Jenniges et al., 2018 for cost-sharing agreements).

[2] In a simple model of production and sales with a single production factor, the share of affiliates' total sales in a country should correspond to its share of total employment given the country-specific productivity.

[3] As it will be clear in the rest of the paper, the sales platforms encompass many profit shifting techniques. As the sales platform activity is only linked to the real activity of firms, it excludes any profit shifting based on debt manipulation.

in transfer pricing (of goods or services) or strategic intangible assets relocation and play a particular role in tax avoidance strategies when firms engage in real activities (especially it excludes any debts manipulation strategy). This implies that the amounts of profits shifted to low-tax jurisdictions organized using this mode represent a subset of total profits shifted each year.

We investigate what factors determine the location of foreign sales platforms and quantify their contributions to profit shifting activities of U.S. multinationals. The conventional wisdom is that multinational firms set up foreign sales platforms close to large markets to benefit from proximity to consumers. We also investigate the role of the host country's tax environment and show that this has a strong effect on where MNEs set up their foreign sales platforms relative to the market access motive. Our analysis sheds light on the specific role played by tax havens that implement a tax environment that facilitates corporate tax avoidance.[4] It also documents their relative specialization in different types of services or manufacturing activities.

To guide our empirical analysis, we discuss the theoretical determinants of the location of foreign sales platforms. Our stylized model captures both market access motives and the tax strategies of multinational companies. This model builds on Head and Mayer (2004)'s as it describes the location of foreign sales platforms. The Head and Mayer (2004) model allows us to predict the impact of the market potential on the location and sales of foreign affiliates. Within this framework, we incorporate elements of the profit shifting literature that we borrow from Hines and Rice (1994) and Gumpert, Hines and Schnitzer (2016). We assume that the host countries are heterogeneous in terms of their taxation environments. In particular, firms may locate their affiliates in tax havens to host profits that are shifted from high-tax foreign locations. These shifted profits are the economic outcomes that we then analyse empirically.

The model predicts that profits reported in high-tax countries decrease with the degree

[4]Our definition of a tax haven is broad and takes into account the tax environment of the country, its degree of compliance with U.S. rules and many features of the local law, not just its (low) corporate tax rate. A precise definition of what constitutes a tax haven is provided in Appendix B.

of transparency of the country's tax environment and with its corporate tax rate. It also predicts that the effect of market access on the profits of foreign sales platforms is lower in tax havens. The presence of tax havens therefore reduces the relative importance of market access as an incentive to locate foreign affiliates.

Our empirical analysis uses information at the aggregate and sector levels from the Bureau of Economic Analysis to examine the location of U.S foreign sales platforms and their role in the profit shifting strategies of U.S multinational companies for the period 1999–2013. The information in the data set is very well suited to examine our economic question as it has information on the sector and geographic distribution of local sales as well as foreign sales and profits before income tax of foreign affiliates of U.S. multinational firms. Importantly, this information is publicly available and commonly used in the economic literature to study international corporate activities. According to the BEA USDIA data, 22% of total sales activity of US majority-owned foreign affiliates are in tax haven countries. This figure amounts to 33% if we restrict the data to intra-firm sales. This shows the importance of these specific locations for U.S multinational firms.

We provide new results on the geographical distribution of U.S. foreign sales platforms with an emphasis on their activities in tax havens. One of the striking facts is that U.S. multinationals concentrate their worldwide sales in platforms located in a small number of tax haven countries. When a U.S. foreign sales platform is set up in a low-tax country, this may not be a desirable location to actually manufacture and sell the product. We show that U.S. foreign sales platforms in low-tax jurisdictions contract intensively with manufacturers in high-tax countries, which produce the goods and then ship them directly to the final consumer. In contract manufacturing arrangements, the tax haven country imports the service of producing the goods from manufacturing countries in exchange for property rights. Owning the property rights of the products allows U.S. multinational firms to concentrate their sales in tax havens.[5] We also document the fact that the level of profits per employee

[5]In terms of trade statistics, three transactions are observed: the transaction between the tax haven and the manufacturing country for the import of a service from the tax haven. There is a physical transaction when the goods are bought, recorded in customs data as an import into the final consumer's country from the

is very high in tax havens compared with other countries. Our description of the dataset highlights the role played by different tax havens on the organization of U.S. multinational companies. Caribbean tax havens, which are small and situated close to the U.S., are more specialized in hosting foreign sales platforms in the services sector, while larger and more distant tax havens in Europe and in Asia tend to be more specialized in hosting foreign sales platforms in the manufacturing sector.

We examine the determinants of the location of U.S. foreign sales platforms and of sales decisions. As U.S. multinationals can use these foreign sales platforms to both serve the market of the host country and other markets outside the host country, we analyse whether their location is primarily determined by the host countries' market access or not. The location of foreign sales platforms may also be affected by the local tax environment. We control for the role of the corporate tax rate, the haven status of the host country and for tax agreements with the United States, distinguishing double taxation conventions from tax information exchange agreements. Zucman (2014) has shown that the worldwide distribution of profits is biased towards tax havens. However, less is known about how firms operate in these countries. We therefore analyse the profits of U.S. multinational companies with a particular focus on the role of foreign sales platforms and the impact of tax havens. We develop a new methodology which allows quantifying the effect of foreign sales platforms in the profit shifting strategies of U.S. multinational firms.

We show that the tax environment, especially the tax haven status of the host country and poor transparency information exchange with the U.S., are key determinants of the location of foreign sales platforms. Their location is only marginally influenced by market-driven factors such as the foreign and domestic market access of the host country. Compared with the aggregate analysis, exploiting the broad industry classification reveals the specific effects of foreign market access and the tax environment on the location of sales platforms across industries. Overall, the location of sales platforms across industries suggests that the tax

manufacturing affiliate. There is also a financial transaction between the final consumer's country and the tax haven. This would be recorded as an import in the balance of payments since the balance of payments measures trade based on change of ownership.

haven effects described above are driven by the services sector, while foreign market access remains a determinant of the location of U.S. sales platforms in manufacturing industries.

When disentangling these effects between tax havens, we show that tax havens located in the Caribbean are specialized in concentrating the sales of foreign sales platforms active in the services industry while other (and bigger) tax havens such as Switzerland or Ireland are more specialized in concentrating sales in the manufacturing sector.

Based on the model, we quantify the amount of profit that is shifted by foreign sales platforms in tax havens. We estimate that it represents between $70bn and $80bn in 2013. This corresponds to a substantial share of the profit shifting activities of U.S. firms.[6]

Our paper is related to a strand of the literature that has investigated the tax avoidance strategies of U.S. multinational firms (Grubert and Mutti, 1991; Hines and Rice, 1994; Clausing, 2016).[7] Similarly to these authors, we estimate a profit equation. We however extend it to understand how multinational firms organize their sales and production in the presence of tax havens.[8] We also contribute to the literature that examines the role of tax havens in explaining the location of foreign affiliates. Using data similar to ours at the micro level, Desai, Foley and Hines (2006) have shown that larger and more internationally-oriented U.S. firms are the ones most likely to own affiliates in tax havens. They also document how U.S. MNEs use different tax havens in different ways. In particular, they show that larger tax havens are used to shift profits while smaller ones are used to facilitate the deferral of U.S. taxation. Using German data, Gumpert, Hines and Schnitzer (2016) show that a higher foreign tax rate is associated with a larger probability of owning a foreign affiliate in a tax

[6]Using national account and balance of payment data, Zucman (2014) calculates that US firms avoid around 20% of corporate income taxes by shifting their profits to tax havens. In a recent contribution, Torslov, Wier and Zucman (2018) estimates that U.S. firms shifted about $142bn of their profits to tax havens in 2015.

[7]Recent interesting contributions have also examine the importance of profit shifting of U.S firms on the measurements of aggregate outcomes such as gross domestic product and productivity. These includes the paper of Guvenen et al. (2018) among others.

[8]Our approach is also related to papers that study the impact of the tax environment on companies' locations without specifically considering tax haven countries or sales platforms. Interesting papers include Devereux and Griffith (1998) on U.S. multinationals and Barrios et al. (2012) on European firms. They both study the location of multinational firms by taking into account the tax environment but without considering the specific role of sales platforms in low-tax jurisdictions. Besides Altshuler, Grubert and Newlon (2000) and Mutti and Ohrn (2018) study the elasticity of the location of U.S. investment abroad.

haven. While manufacturing firms drive this relationship, the effect is less marked for firms operating in the services industry. We show that U.S. foreign sales platforms concentrate sales in tax havens in order to shift profits. Hines and Rice (1994) and Gumpert, Hines and Schnitzer (2016) also provide the theoretical grounds for optimal profit shifting in a simple framework. Our model is built on these grounds.

Our paper is also related to the trade literature that examines the determinants of the location of foreign sales platforms.[9] Hanson, Mataloni and Slaughter (2001) analyse the determinants of a firm's vertical organization, examining export platforms and wholesale affiliates. They note that affiliates' activities in tax havens allow tax minimization strategies through wholesale affiliates. Their empirical results are sensitive to how the estimation sample is defined when it includes tax havens. We show both theoretically and empirically that tax havens have specific location effects. Head and Mayer (2004) provide a straightforward model of the location of foreign affiliates that serve both local and non-local demand. We integrate this concept into our theoretical framework.

This paper makes several contributions. To the best of our knowledge, our paper is the first to analyse the impact of tax havens on firms' organization and trade using publicly available macro-level data. Other important papers based on macro data are Zucman (2014), Clausing (2016) and Torslov, Wier and Zucman (2018), which estimate for the U.S. or at the global level the amount of profit shifted to tax havens. We go beyond these papers by analysing how the existence of low-tax jurisdictions shapes a firm's organization. Profit shifting is a phenomenon that is generally hard to identify. It is by definition hidden and requires precise and multinational information to be identified at the micro level. In our study, following Zucman (2014), we show that several important patterns and channels of profit shifting can be documented using simple variables (sales, profits, employment) found in publicly available and aggregated data sets.

Our empirical investigations are guided by a straightforward model of the location of

[9]Theoretical contributions on this topic include Head and Mayer (2004); Ekholm, Forslid and Markusen (2007); Mrázová and Neary (2011); Ito (2013) and Tintelnot (2017).

foreign sales platforms that includes profit shifting incentives. This model uses simple tools and shows that market-based determinants of foreign sales platforms become less important when the tax environment is taken into account.

We also document the heterogeneity of tax havens. In the tax avoidance literature, tax havens are generally classified in terms of their population.[10] In line with the location model, we adopt a different point of view and separate tax havens based on their remoteness from the U.S.[11] We show that Caribbean countries (close to the U.S. and small) and large tax havens (far from the U.S. and larger) are used differently by U.S. MNEs. Caribbean tax havens are more specialized in hosting affiliates from service industries while manufacturing industries are more likely to locate in larger tax havens.

We quantify the impact of foreign sales platforms on profit shifting by U.S. firms. Comparing our estimate with other, more general ones, such as Torslov, Wier and Zucman (2018)'s or Clausing (2016)'s, we show that foreign sales platforms account for a large share of total profit shifting. This finding contributes to the policy debate about the reform of international taxation. By showing that firms manipulate sales location, it suggests that apportionment systems should target precisely the type of sales that are considered as allocation factors and include precise anti-abuse provisions.

Our paper proceeds as follows. In section 2, we describe the datasets on the foreign activities of U.S. multinationals and on the market access and tax environment of the host countries. In section 3, we present four key facts about the geographical distribution of the profits and sales of U.S. multinational companies. Our conceptual framework is described in section 4 and we present our econometric strategy in section 5. In section 6, we estimate the profit shifted through foreign sales platforms. We conclude and discuss related matters, especially recent policy debates, in Section 7.

[10] See for instance Hines and Rice (1994).

[11] Our classification is also supported by the big data analysis of recent leaks. See Garcia-Bernardo et al. (2017)

2 Data

2.1 Data on foreign affiliates

The data on the activity of U.S.-owned foreign affiliates comes from the annual and benchmark surveys of the Bureau of Economic Analysis (BEA).[12] As mentioned by Clausing (2016), these data are more suited to capturing the profit shifting problem than many other data sources. The BEA data set tracks affiliate sales not only in manufacturing but also in services sectors, which have received less attention in the literature. The data set has sufficient information to carry over the full empirical analysis.

We investigate majority-owned foreign affiliates because the BEA collects more data on this type of affiliates. We use these datasets from 1999 onwards, for 56 countries and 14 industries.[13] The datasets include many different variables such as total assets, property, plant and equipment assets, employment, local and foreign sales of goods and services, and net income or profit-type return, available for 56 countries. Importantly, the profit-type return variable measures profits before income taxes and excludes non-operating items (such as special charges and capital gains and losses) and income from equity investments (Bureau of Economic Analysis, 2004). This measure of profit is particularly interesting for our study. It excludes financial revenues that are by definition not generated by the export activities of the firm. The measure of profit shifting that we will present later on will then exclude financial transactions as we are only interested in how tax havens shape the real activities of the firm.[14]

The dataset allows the ratio of foreign to total sales to be calculated for each industry in each country: $FS_{ikt} = \frac{Foreign\ sales_{ikt}}{Total sales_{ikt}}$. The numerator includes sales to the U.S. We show in the supplementary material that all results remain when we exclude these sales. This ratio has been used in the literature when studying the role of the foreign export platforms

[12] These surveys are mandatory under the International Investment and Trade in Services Survey Act. Benchmark surveys are conducted every 5 years. They provide the most comprehensive coverage of U.S foreign business entities, transactions, and data items.

[13] The definition of the different industrial sectors is shown in Appendix A

[14] The same results are obtained if net income is used as a measure of profits.

of U.S. multinational companies (Tintelnot, 2017). This ratio will be our proxy for foreign sales platforms.[15] The change in the way sectors were defined in 1999 and the inclusion of all (rather than just non-bank) foreign affiliates from 2008 onwards leads us to define a sample from 1999 to 2013 that excludes the foreign affiliates of banks from the empirical analysis. When available, the information on sectors includes 11 industries.[16]

Our estimation sample covers 56 countries including 9 tax havens over the period 1999-2013. This should represent 9,240 observations. However, some of the observations in the dataset are missing either because of insufficient precision in assessing the value of the activity or because the data are subject to disclosure. In the first case, the BEA indicates that they do not have the exact sales value or the number of employees. This occurs for sales of between −$500000 and +$500000 and for employee numbers less than 50. Data that are subject to disclosure are erased. The sample in our empirical exercise reduces to 5,740 observations. The complete list of countries is given in Appendix A.

2.2 The host country's tax environment

The tax environment of the host country is characterized by the corporate tax rate, by its degree of compliance with U.S. tax regulations and by the tax haven status of the country. We define these three variables below.

Our main corporate tax rate variable, widely used in the profit shifting literature (Grubert

[15] Tintelnot (2017) uses this ratio as a proxy for export platforms. As explained earlier, we believe that it is safer to use this ratio as a proxy for foreign sales platforms as foreign sales may differ from exports, particularly in transactions involving tax havens.

[16] We do not use the information from the *Utilities* sector in this study. The utilities industry consists of firms operating in "electric power generation, transmission and distribution", "natural gas distribution" or "water, sewages and others systems". This industry operates locally and represents 0.03% of the U.S. total export share and accounts for 0.75% of the total number of U.S. foreign affiliates. We also exclude the *Other industries* sector since the coverage of our database in terms of foreign sales platform share is relatively low for this sector. The *Other industries* sector includes 3558 affiliates in 1999 (corresponding to 17% of the MOFAs). It accounts for 18% of total assets, 7% of sales, 31% of net income and 21% of employees. Inside this composite sector, the "Management of non-bank companies and enterprises" that include holding companies account for a large share of affiliates (43%), of total assets (74%) and of net income (89%). On the other hand, this sub-sector only accounts for 3% of net property plants and equipment, 1% of sales and 1% of employees of the *other industries* sector. We provide additional tables later on that include these sectors in order to evaluate the robustness of our results. The complete list of industries in presented in Appendix A.

and Mutti, 1991; Schwarz, 2009; Clausing, 2016; Dowd, Landefeld and Moore, 2017), is the statutory tax rate. However, one could argue that the relevant costs associated with the profit-shifting process are based on the average tax rate, which, because of special tax rules or negotiated tax rates, more accurately reflects the true tax cost of reporting income in a jurisdiction. The average tax rate is the percentage of a firm's overall taxable income that is paid in taxes. Unlike the statutory tax rate, it is harder to observe directly and the additional information required to compute it reduces the size of the sample. For U.S. foreign affiliates in non-haven countries the average and statutory tax rates are similar, but they differ substantially and in a country-specific manner for affiliates in tax havens (see Appendix B for a discussion of what defines a tax haven). The average tax rate is indeed a function of the statutory tax rate and takes implicitly into account the advantages of being located in tax haven. Using an average tax rate variable thus absorbs part of the effect attributed to the tax haven.

We collect information on corporate taxes for each of the 56 countries in the sample. The OECD tax database reports information for most of these countries. The missing statutory tax rates are collected from various other sources which have series that can be compared across years and countries. We use data from KPMG's *Corporate Tax Rates Table and Corporate Tax Rate Surveys*, Deloitte's *International Tax Source* and EY's *Corporate Tax Guide*.

To characterize the tax havens, we use the definition proposed by Hines and Rice (1994) and recently used by Dharmapala and Hines (2009). A tax haven is defined as a location with low corporate tax rates, banking and business secrecy, advance communication facilities and self-promotion as an offshore financial centre (Hines and Rice, 1994, Appendix 1 p. 175). Compared with the list of tax havens produced by the OECD (2000), the definition of Dharmapala and Hines (2009) encompasses a number of additional tax havens such as Switzerland and Honk-Kong. We provide a full characterization of these countries in Appendix B. In our estimation sample, Barbados, Bermuda, the British Virgin Islands, the Cayman Islands, Hong Kong, Ireland, Luxembourg, Montserrat, Panama, Singapore,

Switzerland and the Turks and Caicos Islands are classified as tax havens. The available data on foreign affiliates' activities for the British Virgin Islands, the Cayman Islands, Montserrat and Turks and Caicos are gathered into a single country-level observation. We refer to this meta-country as the British Virgin Islands.

Among tax havens, we make the distinctions between the Caribbean tax havens (Barbados, Bermuda, the British Virgin Islands, the Cayman Islands, Montserrat, Panama and the Turks and Caicos Islands) and the large tax havens (Hong-Kong, Ireland, Luxembourg, Singapore, Switzerland). This distinction is based on two factors. First, the two groups of countries differ by the economic size and the activity. For instance, in 2013 the average employment of U.S. affiliates in large tax havens is 52610 against 1950 in Caribbean tax havens and the real GDP is 13 times larger on average in large tax havens. Second, the countries in both groups share a similar proximity from the U.S. While Caribbean tax havens are located close to the U.S. (the average distance to the U.S. is 2615km), the large tax havens are located in more remote places (the average distance to the U.S. is 9326km). These two differences between Caribbean and large tax havens may impact the way they are used by U.S. firms.

We include information on any tax agreements between the United States and the countries of the affiliates, distinguishing between two types of agreements: Double Taxation Conventions (DTCs) and Tax Information Exchange Agreements (TIEAs). DTCs are mainly used to avoid taxing firms twice. They often include an article that implements the sharing of tax information between the two signatories (see article 26 of the OECD Tax Convention Model).[17] TIEAs guarantee the exchange of information to prevent tax fraud or tax avoidance. The number of TIEAs increased markedly when the OECD put pressure on several non-cooperative countries by blacklisting them if they had not signed at least 12 TIEAs. In 2015, 665 of 894 TIEAs involved tax havens. The majority do not involve *automatic* exchange of information. A request of one of the two signatories (Johannesen and

[17] A recent version of this tax convention model can be found here: https://www.oecd.org/ctp/treaties/model-tax-convention-on-income-and-on-capital-condensed-version-20745419.htm

Zucman, 2014) must be supported by well-documented suspicion of tax avoidance, which is often difficult to gather (see Chavagneux, Palan and Murphy, 2010). The information on worldwide tax treaties is obtained from the Exchange of Information database provided by the OECD.[18] The coverage of the dataset is particularly good for the U.S. which has signed agreements with 88 jurisdictions in 2017. Both DTC and TIEA conventions have special clauses on the exchange of information between the host countries and the U.S. The exchange of information is particularly relevant when characterizing the degree of compliance of each partner country with the U.S. tax authorities. We therefore construct a measure of exchange of information from both DTC and TIEA conventions. In our empirical exercises, we include information on exchange of information as well as double taxation conventions.

2.3 Other variables

The activities of U.S. foreign affiliates do not only depend on the tax environment of their host country. They also reflect local and foreign demand (Redding and Venables, 2004; Head and Mayer, 2004; Head and Mayer, 2011). In Head and Mayer (2004)'s framework, foreign affiliates sell to domestic and foreign countries with foreign sales discounted by bilateral trade costs. In order to compute the foreign market access variable, we follow their panel approach and proceed in two steps. We first calculate the predicted bilateral transport costs between countries using a bilateral gravity equation. These predictions come from a regression analysis of bilateral trade against bilateral distance ($Distance_{ij}$), contiguity ($Contig_{ij}$), former colonial status ($Colony_{ij}$), common language ($ComLang_{ijt}$), regional trade agreements (RTA_{ijt}) and exporter×year (μ_{it}) and importer×year (μ_{jt}) fixed effects for the period 1999-2013.[19]

[18] Accessible at http://www.eoi-tax.org.

[19] This corresponds to a theoretically-founded gravity equation, with exporter×year (μ_{it}) and importer×year (μ_{jt}) fixed effects accounting for multilateral resistance terms (Head and Mayer, 2011)

$$
\begin{aligned}
ln(Trade_{ijt}) &= \alpha + \beta_1 ln(Distance_{ij}) + \beta_2 ln(Contig_{ij}) + \beta_3 Colony_{ij} \\
&+ \beta_4 ComLang_{ijt} + \beta_5 RTA_{ijt} \\
&+ \mu_{it} + \mu_{jt} + \epsilon_{ijt}
\end{aligned}
$$

where ϵ_{ijt} is the error term. We compute the ease of access to market j for exporters in i at year t:

$$
\hat{\phi_{ijt}} = Dist_{ij}^{\hat{\beta_1}} \times exp(\hat{\beta}_2 Contig_{ij} + \hat{\beta}_3 Colony_{ij} + \hat{\beta}_4 ComLang_{ijt} + \hat{\beta}_5 RTA_{ijt})
$$

The foreign market access variable can be defined as $FMA_i = \sum_j (exp(\hat{\mu}_{jt}) \times \hat{\phi}_{ij})$, which does not include the country's internal demand. The FMA is high for countries close to large foreign export markets and low for remote countries.

The foreign market access variable is computed using (external) data for all bilateral pairs of countries in the world. The series on bilateral trade were taken from UN COMTRADE, the vectors of trade impediments from CEPII gravity, and the common language data from Melitz and Toubal (2014). Finally, the series on real GDP were obtained from the Penn World tables (Feenstra, Inklaar and Timmer, 2015).

3 Facts

Table 5 in Appendix C shows that U.S. foreign affiliates in tax havens report larger average sales per employee and larger profits per employee than foreign affiliates in other countries, a feature that we attribute to sales and profit shifting as we will see later on. Importantly, this table also shows that despite representing 4.4% of the total number of employees of foreign U.S. affiliates in 2013, tax havens represent 26% of their total sales and 32.4% of their total profits.

Examining the activities of U.S. foreign affiliates across the world reveals at least four

salient facts. First, contrary to conventional wisdom, U.S. multinationals concentrate their sales by the means of platforms located in a small number of tax havens. Second, the usual determinants of U.S. foreign sales platforms do not necessarily apply when the host country is a tax haven. Third, U.S. foreign affiliate sales from tax haven countries to the U.S. are an order of magnitude larger than their exports. We interpret this as a sign of tax-based contract manufacturing. Finally, foreign affiliates located in tax havens unsurprisingly report average profits that are way above average.

Fact 1. Tax havens and U.S. multinationals' foreign sales platforms. Multinational firms can organize their global production to concentrate their sales in low-tax countries. For instance, Caterpillar SARL, the Swiss affiliate of Caterpillar reports more than 85% of Caterpillar's non-US profits despite having no manufacturing facilities and only 0.3% its employees (Levin, 2014). More generally, recent anecdotal evidence shows that firms use tax havens to produce and sell where it is optimal to do so (See Appendix D for more details in the case of Apple). This suggests that there are activity distributions between countries that are specific to global manufacturers and to global sellers. To illustrate this idea, we compute the ratio of foreign sales to total sales (foreign and domestic sales) for each country. This *foreign sales* ratio gives an indication of the magnitude of a firm's foreign sales platforms. In order to examine the geographic distribution of these platforms and which countries they are concentrated in, we proceed as above and regress the foreign sales ratio on a set of country fixed effects, μ_i, and a time trend, μ_t. We cannot exploit the sector classification in detail because of missing data. We can however compute what this equation predicts for both sales of goods and sales of services.

$$\frac{Foreign\ Sales_{it}^{j}}{Total\ Sales_{it}^{j}} = \mu_t + \mu_i + \epsilon_{it} \quad j = goods; services$$

Figure 2 shows how these predictions deviate from the average (*predicted*) global sales of non-tax haven countries (in Panel A for goods and Panel B for services).

— Figure 2 about here —

Interestingly, the deviations from average are larger for sales of services than they are for sales of goods. This tends to confirm the fact that tax havens are more specialized in the services sector. But for goods the ranking remains: the figure shows large deviations from the average in tax haven countries.

Fact 2. Location of U.S firms' foreign sales platforms Figure 3 relates the foreign sales ratio to foreign market access. According to the standard model, U.S. firms locate their foreign sales platforms in distant, low-cost foreign locations with relatively high foreign market access (Tintelnot, 2017; Mrázová and Neary, 2011). Figure 3 shows that there is a positive correlation between the foreign sales ratio and foreign market access. This positive relationship is weaker for countries close to the U.S. (Canada, Mexico, Central America, Caribbean countries) and for tax havens once we exclude Panama from the sample of tax havens.[20] This is interesting for tax havens because it shows that there is no strong relationship between foreign market accesses and the foreign to total sales ratio. The market-size based determinants of foreign activities do not apply to tax havens.

— Figure 3 about here —

Fact 3. Signs of contract manufacturing. The cases of Caterpillar and Apple suggest that firms concentrate their sales and profits in tax haven countries. Focusing on goods rather than services, we compare the foreign sales of each country to the U.S. with their total exports to the U.S. BEA declaration requirements allow us to compare these values to official U.S. trade data (see Bureau of Economic Analysis, 2004). U.S. trade in goods have to be reported on a "shipped" basis (meaning on the basis of the *physical* transaction). U.S sales and purchases are however reported on a "charged" basis (meaning on the basis of the *financial* transaction). According to the BEA (Bureau of Economic Analysis, 2004, page 34): "*The two bases are usually the same, but they can differ substantially. For example, if a U.S. parent buys goods from country A and sells them to country B and if the goods are shipped*

[20]Notice from Figure 2 that the relative attractiveness of Panama for foreign sales platforms is below average.

directly from country A to country B, the parent's books would show a purchase from country A and a sale to country B. Because the goods never entered or left the United States, on a shipped basis, they would not be recorded as either U.S. imports or U.S. exports. However, if the parent's trade data were reported on a charged basis, the purchase would appear as a U.S. import and the sale would appear as a U.S. export." In the case of tax-based contract manufacturing, if an affiliate located in a tax haven purchases goods from China and sells them to the U.S. and if the goods are shipped directly from China to the U.S., the affiliate's books would show a sale to the U.S. and the export would be recorded in China in the customs data.

Figure 4 plots the sales to exports ratio for U.S. foreign affiliates in the countries in our sample. Since the BEA does not record exports to countries other than the U.S., Figure 4 shows the *sales-to-exports ratio* computed by excluding all destinations other than the U.S. To make sure the two measures are comparable, we concentrate on sales and physical exports of goods *only*. Contrary to conventional wisdom, the sales-to-exports ratio is larger than one in many countries. On average, the sales of foreign affiliates to the U.S. are 55 times larger than their exports to the U.S. A striking feature of Figure 4 is the disproportionate role of tax havens in explaining the sales-to-exports ratio. Panel A shows that the deviation is larger for tax-haven countries than non-tax haven countries. The sales to the U.S. of U.S. foreign affiliates in tax-haven countries are 371 times larger than their exports. The corresponding *sales-to-exports ratio* from non-tax-haven countries is 1.9. Panels B and C show that this imbalance is mainly due to transactions within U.S. multinational companies as the ratio is close to unity for transaction with unaffiliated parties.[21]

These facts suggest that U.S. parent companies are shifting sales from affiliates located in non-tax haven countries to affiliates located in tax havens. It is worth stressing that most of these shifts take place within multinational firms. As argued by Gravelle (2015), low-tax countries may not be good locations to actually manufacture and sell products.

[21]The fact that the sales-to-exports ratio is also positive for transactions with unaffiliated parties may be due to how unaffiliated parties are defined, as they include minority-owned affiliates, and the difficulty for the BEA to identify the ultimate beneficial owner of the affiliate.

Instead, affiliates in tax havens can contract with a firm in a different country as a *contract manufacturer* to produce the good with a fixed mark-up that may involve transfer mispricing (as suggested by Levin, 2014 and Levin, 2013 in the cases of Caterpillar and Apple). Subpart F regulations should impede this type of contract, but these arrangements can involve hybrid entities that allow firms to defer their US tax bill through the check-the-box loophole. From 1997 to 2004 indeed, 25% of the foreign income of US MNEs was located in affiliates that used the check-the-box exception (see Grubert, 2012).[22]

Fact 4. Profits of U.S. foreign affiliates in tax haven countries If multinational firms can artificially shift profits from high-tax to low-tax jurisdictions, the profit per employee should be larger in low-tax countries than in others. It is not surprising that more profits are reported in tax havens than in other countries. What is striking however is the scale of the difference, as we see below.

There are many reasons why profits per employee vary between countries, such as differences in performance or sector-specific shocks. To calculate the relative profit per employee for different countries, we estimate equation 3 by regressing the aggregate profit per employee on sector × year and country-specific effects.

$$\frac{Profit_{ikt}}{Employment_{ikt}} = \mu_t + \mu_i + \mu_{kt} + \epsilon_{ikt}$$

where $\frac{Profit_{ikt}}{Employment_{ikt}}$ is the profit per employee of the affiliates registered in sector k and located in country i at time t, and μ_t is a parametric trend that accounts for global business cycles. μ_{kt} are sector × year fixed effects that allow us to control for unobserved shocks at the sector level that vary across time. μ_i are the set of country-specific effects. The predictions of this equation are country-specific influences net of other sector or year determinants. For each country, we compute the ratio of the prediction to the predicted average for non-tax haven countries. The countries are ranked in Figure 5 according to the size of the deviation.

[22] According to Grubert (2012) in 2004, 38% of the aggregate net income of U.S. MNEs was located in tax havens. Since most hybrid entities are located in tax havens, this suggests that a large share of income over this period fell under the check-the-box regime.

— Figure 5 about here —

The profit per employee is larger than the average (*predicted*) profit in most tax havens. In the British Virgin Islands, Bermuda and Barbados, for instance, close to the U.S.A., and in Ireland and Switzerland, in Europe, the profits per employee are 2.8 to 125 times larger than the average.

4 Theoretical Framework

The facts described above show how the tax environment has a strong influence on the geographical location and activities of U.S. multinational companies. We show in particular that U.S. multinationals organize their affiliate networks to concentrate their sales and profits in foreign sales platforms located in tax havens. Foreign market access plays a minor role in these choices. In this section, we present a stylized theoretical framework that illustrates these facts. The model is parsimonious and shows how the foreign market access and the tax environment of host countries shape the geographic distribution of foreign affiliates. The host country's tax environment is characterized by the local corporate tax rate, the country's degree of compliance with U.S tax regulations, and by the tax haven status of the host country. This stylized framework is borrowed from Head and Mayer (2004), who develop a straightforward locational model where firms face monopolistic competition. In this framework, firms satisfy a *local* and a *non-local* demand. We call these firms "*foreign sales platforms*" as they sell in domestic and foreign countries with foreign sales discounted by bilateral trade costs. These foreign sales platforms also pay domestic taxes. As described in Hines and Rice (1994) and Gumpert, Hines and Schnitzer (2016), they may want to shift part of their total sales to a tax haven. This strategy comes however at a cost that we will detail below. For the sake of simplicity, we assume that each multinational company has at least one affiliate in a tax haven. In our stylized framework, firms are always able to shift sales to a tax haven.

The tax environment of multinational firms. Multinationals can invest in a range of countries $i = 0, \cdots, n$ including a tax haven, denoted country 0. As in Hines and Rice (1994), we denote ρ_i the before-tax profits earned in country i by the affiliate. We denote F_i the fixed cost of operating foreign affiliates. The reported profits are taxed at rate T_i in country i. The tax haven country is assumed to have a corporate tax rate of zero, $T_0 = 0$.

As in Hines and Rice (1994) and Gumpert, Hines and Schnitzer (2016), firms can reallocate an amount Ψ_i of their actual income in country i to the tax haven country. By shifting profit, the firm incurs a reallocation cost that becomes increasingly expensive as the amount shifted increases relative to the amount earned in country i. These costs are incurred in the country from which the income is shifted and are assumed to be $\left(a^{1/\gamma_i}/2\right)(\Psi^2/\rho_i)$. The parameter $a \in (0, \infty)$ captures how much the cost of income reallocation increases with the amount reallocated. In contrast with Hines and Rice (1994) and Gumpert, Hines and Schnitzer (2016), we assume that this cost depends on how transparent the tax environment in the host country is. The parameter $\gamma_i \in (1, \infty)$ decreases the more transparent country i's tax environment is. Transparency entails that U.S. and local authorities have access to information on the ownership of the affiliates, but also to bank information that may be relevant for criminal and civil tax matters (OECD, 2001). The degree of transparency depends therefore on information exchange between the host countries and the U.S. The companies' ability to shift profit to a tax haven means that the reported profit in country i has a fixed and a mobile component and can be written

$$\pi_i = \rho_i - \Psi_i - \frac{a^{1/\gamma_i}}{2}\frac{\Psi^2}{\rho_i} \tag{1}$$

A multinational that reallocates income chooses its income transfers (Ψ_i) to maximise after-tax profits, taking as given the fixed profits earned (ρ_i). As in Gumpert, Hines and Schnitzer (2016), and assuming that the firm has a tax haven affiliate, we derive the optimal amount of income, Ψ_i^*, to be reallocated.

$$\Psi_i^* = \frac{1}{a^{1/\gamma_i}} t_i \rho_i \tag{2}$$

with $t_i = \frac{T_i}{(1-T_i)}$.

Proof: See Appendix E.

The profit equation for foreign sales platforms. We now turn to the formal definition of ρ_i. The fixed component of the foreign sales platform's profit function in each potential location i is the sum of the after tax gross profit earned for each destination j.

Let E_j be the expenditure in a representative industry in country j. Consumers allocate their spending across differentiated varieties in the representative industry. The consumers' utility function is a subutility function of the CES type: the elasticity of substitution between varieties, σ, is the same for any pair of products and larger than one. Maximizing this subutility function subject to expenditure, E_j, and the delivered prices from all possible product origins, we obtain the demand curve for a representative variety in the representative industry:

$$q_{ij} = \frac{p_{ij}^{-\sigma}}{\sum_r n_r p_{rj}^{1-\sigma}} E_j \tag{3}$$

where p_{ij} is the delivered price faced by consumers in destination country j for products from origin country i. p_{ij} is the product of the mill price p_j and iceberg trade costs τ_{ij} between the pair of countries $p_{ij} = p_j \tau_{ij}$. Assuming monopolistic competition, the price of a variety is a constant mark-up over the marginal cost. We can therefore derive the sales of a firm from country i in country j:

$$q_{ij} = \frac{\sigma - 1}{\sigma} \frac{(c_i \tau_{ij})^{-\sigma}}{G_j} E_j \tag{4}$$

where c_i is the marginal cost in country i and $G_j = \sum_r n_r p_{rj}^{1-\sigma}$.

The fixed component of the profit function of the foreign affiliate in each potential location i is the composite of each after-tax gross profit earned in each destination j. It can be written

$$\begin{aligned} \rho_i = \sum_j \rho_{ij} &= \sum_j (p_i - c_i)\, \tau_{ij} q_{ij} \\ \rho_i &= \frac{c_i^{1-\sigma}}{\sigma} \sum_j \Phi_{ij} \frac{E_j}{G_j} \end{aligned}$$

where $\Phi_{ij} = \tau_{ij}^{1-\sigma}$ is a measure of the access of affiliates from country i to market j. Denoting $M_i = \sum_j \Phi_{ij} \frac{E_j}{G_j}$ the market access of country i, we can rewrite the fixed component of the profit function as

$$\rho_i = \frac{c_i^{1-\sigma}}{\sigma} M_i \tag{5}$$

In line with Head and Mayer (2004), equation 5 shows that the fixed component of profits is decreasing in country i's production costs and increasing in its access to foreign markets.

The total after-tax profit of the foreign sales platform in country i does not simply depend on the fixed component, ρ_i, but is also a function of the amount of income shifted between countries. Given the optimal amount of income shifted worldwide and assuming a tax rate equal to zero in the tax haven, the reported profit of the tax haven affiliate can be written:[23]

$$\begin{aligned} \Pi_i^{th} &= \rho_i + \sum_j \Psi_j^* - F_i \\ &= \frac{c_i^{1-\sigma}}{\sigma} M_i + \sum_j \frac{1}{a^{1/\gamma_j}} \frac{c_j^{1-\sigma} M_j}{\sigma} t_j - F_i \end{aligned} \tag{6}$$

The first term on the right-hand side of equation 6 is the profit of the firm earned in the

[23] For ease of exposition, we drop the index th and ^{nth} from the market access and production cost variables.

tax haven as defined in Head and Mayer (2004). This suggests that firms face a trade-off between low production costs and high market potential. The second term represents the effect of corporate taxes and the transparency of the tax environment on the amount of profits shifted from non-haven countries to the tax haven. A higher degree of transparency in each country j decreases the amount of profit shifted to the tax-haven country. A higher corporate tax rate increases the amount of profit shifted to the tax haven.

In the other countries, the combined after-tax profit is given by

$$\Pi_i^{nth} = \frac{c_i^{1-\sigma}}{\sigma} M_i \left(1 - \frac{t_i}{a^{1/\gamma_i}} \left(1 + \frac{t_i}{2}\right)\right) - F_i \tag{7}$$

Similarly, equation 7 gives the after-tax profit of the firm earned in the other locations. It is determined by the market access and the production costs of the host country but depends also on the volume of sales shifted to the tax haven country. This volume depends on the production costs in the host country and its market access, but also on its corporate tax rate and the degree of transparency of its tax environment.

The main focus of this paper is to determine the impact of the host country's market access and tax environment on the location of foreign sales platforms. Proposition 1 describes how a change in the corporate tax rate and in the degree of transparency of the host country affects the profits of foreign sales platforms. The following propositions follow readily from (6) and (7).

Proposition 1. The amount of profit reported decreases with the level of corporate taxes in the host country and its degree of compliance with U.S. tax regulations.

The amount of profit that is shifted to the tax haven country depends positively on the corporate tax rates in non-haven countries, but decreases the more transparent the tax haven is, in particular regarding the exchange of tax information with the U.S. In this framework, taking the tax environment into account produces markedly different incentives to locate foreign sales platforms in particular countries. In Head and Mayer (2004), the market access

elasticity has to equal one. In our framework, this elasticity is still equal to one for non-tax haven country but is less than unity for tax haven country. As shown in Appendix F, the impact of market access is moderated by the possibility firms have to shift sales to a tax haven. Proposition 2 describes how a change in the host country's market access affects the location of foreign affiliates.

Proposition 2. The effect of market access on the profits of foreign sales platforms is lower in tax havens.

From equation 6, we see that the elasticity of profits in tax havens to the FMA decreases as the shifted part of the profits increases. Consequently, the impact of the foreign market access in tax havens should be lower than in other countries.

Proof. See the Appendix F.

5 Econometric analysis

Our stylized model delivers several testable predictions. Propositions 1 & 2 characterize the influence of market access and the tax environment on companies' choices of host countries for foreign sales platforms and their ability to shift profits to tax havens.

In this section, we investigate the empirical relevance of the theoretical insights and conduct a series of sensitivity exercises to explore the robustness of the baseline findings. First, we examine the determinants of U.S. multinationals' decisions on production and on the location of foreign sales platforms. U.S. multinationals can use these foreign affiliates to serve the market of the host country and other markets outside the host country. We examine the effects of the market access and the tax environment of the host country on the location of foreign sales platforms, controlling for a large set of other important determinants that have been used in the literature. Secondly, we quantify the profit shifted by U.S. multinational and determine the contribution of foreign sales platforms using information on affiliates' profits.

Determinants of the location of foreign sales platforms. The distribution of foreign sales platforms is analysed by estimating the determinants of the foreign-to-total-sales ratio, FS_{ikt}, for each sector k of country i in year t as in equation (8).

$$\begin{aligned} FS_{ikt} &= \beta_0 + \beta_1 FMA_{it} + \beta_2 Tax_{it} + \beta_3 Treaties_{it} + \beta_4 Haven_i \\ &+ \beta_5 DMA_{it} + \mu_{kt} + \epsilon_{ikt} \end{aligned} \tag{8}$$

The baseline explanatory variables of interest are FMA_{it}, the foreign market access as defined in section 2.3, Tax_{it}, the statutory tax rate in the host country, $Treaties_{it}$, a vector of dummy variables that control for the enforcement of specific tax treaties between the host country and the U.S. $Haven_i$ is a dummy variable that equals one if the country is classified as a tax haven as per Dharmapala and Hines (2009) and zero otherwise.

We include the domestic market access DMA_{it}, measured by the GDP of the host country.

μ_{kt} controls for sector-specific shocks that vary over time. ϵ_{ikt} is the disturbance term. Standard errors are clustered at the country level.[24]

Since the foreign sales ratio is a fractional variable bounded by zero and one, and 86.3% of the distribution lies between 0 and 1 (excluded), we use fractional logit as our estimation method rather than standard logit, which expects a truly binary dependent variable (Papke and Wooldridge, 1996). We report the marginal effects evaluated at sample means. In the Appendix, we provide robustness tables where we use a linear estimator.[25] The main results remain.

The descriptive statistics for the variables of interest are reported in Table 1.

— Table 1 about here —

[24] In unreported regressions, we also show that our results are not sensitive to the choice of the levels of clustering regarding the standard errors. The results are available upon request.

[25] The quantile regression is a semi-parametric approach that has the advantage to avoid assumptions about the parametric distribution of the error process.

6 Results

The location of U.S. multinationals' foreign sales platforms. Table 2 reports the results of fractional logit regressions investigating the location of foreign sales platforms using the ratio of foreign sales to total sales. Marginal effects at the mean value are reported.

— Table 2 about here —

The results in column (1) show that the host country's foreign market access has a large effect on the country's likelihood of hosting a foreign sales platform. This result is in line with Hanson, Mataloni and Slaughter (2001) and Tintelnot (2017), who show that U.S. multinational companies set up foreign sales platforms to sell to nearby countries and beyond. The host country size as measured by GDP is not significantly affecting the location of sales platforms. Column (2) includes the level of corporate taxes as an additional variable. High corporate taxes discourage firms from locating foreign sales platforms in that country. The marginal effect is significant at the 95% confidence level. The introduction of the corporate tax rate variable increases the marginal effects of the GDP variable which becomes significant at 95% confidence level. This suggests that U.S. firms are selecting larger host country markets when corporate tax rate are higher.

The marginal effects of the corporate tax rate variable is smaller when information on tax agreements between the location of the foreign sales platform and the U.S is included in Column (3). Double taxation agreements have no effect on the country's likelihood of hosting a foreign sales platforms, but treaties that promote the exchange of tax information have a significant negative effect.[26] The negative effect of corporate taxes on the location of foreign sales platforms vanishes when we control for the tax haven dummy variable in column (4). The marginal effect of the tax haven dummy variable is positive and significant at the 95% confidence level. The inclusion of the tax haven dummy variable slightly reduces the effect of information exchange treaties on the likelihood of hosting a foreign sales platform.

[26]This is in line with the study of Blonigen and Davies (2004) which finds no robust effects of double taxation agreements on Foreign Direct Investments.

As tax havens often provide optimization mechanisms other than low tax rates, such as confidentiality with respect to tax authorities, this suggests that the results in column (3) are biased because tax haven status was not controlled for. The correlation between the tax haven and the double taxation treaty dummy variable is about -0.17, and the correlation between the tax haven and the treaty of information exchange dummy variable is around -0.03. As mentioned above, half the tax haven countries in our estimation sample had not signed or enforced a TIEA with the U.S.[27] In line with the prediction of our model, column (4) shows that the location of U.S. MNE's foreign sales platforms is strongly influenced by the tax environment of the host country. This detailed characterization of the host country's tax environment reduces the importance of the foreign market access variable. The marginal effect of the FMA variable is still highly significant but falls in magnitude.

In columns (5) and (6), we estimate the specification in both samples of non-tax haven and tax haven countries to test proposition 2. As predicted by the stylized framework, foreign market access is a strong predictor of the location of foreign sales platforms in non-tax haven countries while it has no influence on the location of foreign sales platforms in tax haven countries. There are several other major differences between the locational determinants in both samples. The level of corporate tax rate is not significantly affecting the likelihood to locate foreign sales platforms in non-tax haven countries while this effect is strong and negative in tax haven countries. The exchange of tax information with the U.S. reduces the likelihood of locating foreign sales platforms in both tax and non-tax haven countries. The effect is yet stronger in tax haven countries. In the sample of non-tax haven countries, the size of the market is not determining the location of sales platforms. In the sample of tax haven, the host market size has a large and significant effect on the location of sales platforms.

The location of U.S foreign sales platforms across sectors in large and in Caribbean tax havens. The sample includes ten tax havens that differ markedly in terms of their

[27]Bermuda, the Bahamas, Panama and the British Virgin Islands are the tax haven countries that had already enforced the exchange of tax information with the U.S. during the analysed period.

economic weight and populations, as noted by Hines and Rice (1994), but also in terms of their degree of transparency. We classify these tax havens into two groups, namely the Caribbean havens–Barbados, Bermuda, the British Virgin Islands and Panama, and larger havens–Hong Kong, Ireland, Luxembourg, Singapore and Switzerland. This splitting of the tax haven dummy variable is based on geographic and technological considerations, rather than just the size of their respective populations as in Hines and Rice (1994). Anecdotal evidence suggests that the tax avoidance strategies of U.S. multinational companies depend on the location of the tax haven country. As we will show later on, the havens in the Caribbean group, which are closer to the U.S., drive the profit shifting strategy of U.S firms in the services industry, while the larger, more distant tax havens help to shift profits in the manufacturing sector. Regarding technology, U.S foreign affiliates in the larger tax havens employ 14 times more people than those in Caribbean havens do, and use about four times more productive equipment.

— Table 3 about here —

To ease comparisons across specifications, the results reported in column (1) of Table 3 reproduces the estimates in column (4) of Table 2 above. In columns (2) and (3), we split the sample into broadly defined industries and study the effects of foreign market access and the tax environment on the manufacturing and services sectors. In these columns, we do not operate a distinction between large and Carribean tax havens. Compared to the aggregate analysis, considering industries separately highlights the specific effects of foreign market access and the tax environment on the location of foreign sales platforms in different sectors. Foreign market access has a positive and significant impact on a country's likelihood of hosting a U.S. multinational's foreign sales platform in the manufacturing and services sector. The significant positive effect of the tax haven dummy in the services sample shows however that the tax environment is an important consideration in this context. Overall, this industry-specific analysis suggests that the tax haven effects described above are driven by the services sector, while foreign market access remains a determinant of the location of

sales platforms for U.S. MNEs in both sectors.

In columns (4) to (6), we use a finer decomposition of the tax haven dummy variable by distinguishing between large and Caribbean tax havens. The results using the full sample in column (4) suggest that the effect of tax haven described above is mostly driven by the group of larger tax haven countries. The effect of the exchange of tax information variable is still negative but statistically insignificant at conventional levels. This suggests that the effect of the exchange of tax information variable is absorbed by the dichotomisation of the tax haven dummy variable into Large and Caribbean havens. In columns (5) and (6), we examine whether the determinants of the location of U.S. multinationals' foreign sales platforms differ between sectors across large and Carribean tax havens. In the manufacturing sector, large havens have a higher likelihood of hosting a U.S. multinational's foreign sales platforms (the point estimate is positive but not significantly different from zero, probably because of the reduced size of the sample), while the likelihood is lower in the Caribbean havens. Both groups of tax haven countries attract U.S. foreign sales platforms in the services sector. This supports previous results about the heterogeneity of uses of tax havens (Desai, Foley and Hines, 2006; Garcia-Bernardo et al., 2017).

Robustness tests. We propose several important robustness tests. We first conduct two important placebo experiments. We construct a tax haven dummy variable which takes the value of one for 9 randomly selected countries among the set of non-haven countries and zero otherwise.[28] We estimate specification (4) of Table 2 using the permuted tax haven variable and repeat the exercise 3000 times in total. This placebo experiment allows us to confirm the specific impact of tax havens on the likelihood of locating a foreign sales platform. We expect the average coefficient of the placebo tax haven variable to be insignificant.

— Figure 6 about here —

Figure 6 displays the distribution of the estimated coefficients and the confidence intervals. The marginal effect is $\bar{\beta}_4 = -0.016$ and is insignificant at conventional level of

[28]The (*real*) tax haven countries are therefore kept in the control group

significance. The effect is slightly negative as we keep the tax haven countries in the control group. The second important placebo experiment concerns the validity of Proposition 2. We again permute the tax haven countries against 9 randomly chosen countries among the set of non-haven countries. We estimate specification (6) of Table 2 using the permuted countries and repeat the exercise 3000 times in total. We expect the average coefficient of the foreign market access variable to be significant contrary to our earlier finding.

— Figure 7 about here —

Figure 7 displays the results. As shown in Figure 7 the marginal effect is positive and statistically significant ($\bar{\beta}_1 = 0.046$). This finding suggests that the absence of significant effect of the market access variable is due to specific characteristics in tax haven countries.

In the supplementary material, we propose other robustness tests. We run an exercise when we exclude sales to the U.S from the foreign to total sales ratio as there might be very different behaviour of sales to the US and sales to other countries. The results are reported in Table A.1. The results are similar to the ones reported in columns (4) to (6) of Table 2. In particular, the tax haven dummy variable explains significantly the likelihood to locate foreign sales platforms. As predicted by our model, their locations are not influenced by the size of the foreign market access in tax haven countries.

We enlarge the specification to address as best as we can withholding taxes. A very recent literature shows that multinational firms use indirect indirect investment routes through countries with favourable tax treaties (see Hong, 2018 and van 't Riet and Lejour, 2018). They can therefore return after-tax profits to their home countries through tax-minimizing indirect routes.[29] We proxy the centrality in the tax treaties network of a country through the number of DTCs the country has signed. This is not a direct measure of actual treaty shopping but it may accurately describe the opportunities of treaty shopping when controlling for GDP and Foreign Market Access, as we do in all the regressions. In Table A.2. of the appendix, we find that the number of DTC positively impacts the likelihood to locate a

[29] OECD (2015) highlights that this so-called *treaty shopping* is one of the most important sources of concerns regarding the Base Erosion and Profit Shifting (BEPS) project.

foreign sales platform. The large and positive sign on the tax haven dummy remains. As a falsification exercise, we control for the number of TIEAs since the number of TIEAs signed does not impact withholding tax rate nor the transparency *vis à vis* the U.S. We do not find any effects of the number of TIEAs signed.

We also reproduce the baseline results using the OLS estimator. The results are provided in Table A.3. We show that the choice of the OLS estimator does not change the main results. The tax environment of the host countries and the access to foreign markets influence the location of U.S. foreign sales platforms. The results moreover support the lack of significant market access effect in tax haven countries.

7 Profit shifted through foreign sales platforms

In the previous sections, we have established that tax haven countries have disproportionate foreign-to-total-sales ratio. Using a theoretical model, we have shown that this could be explained by firm's tax planning decisions. This theoretical insights are confirmed by anecdotal evidences as well as our regressions that exhibit the important impact of the tax environment on firms' worldwide organization. This result implies that establishing foreign sales platforms in tax havens are a major strategy to shift profits in these countries. The goal of this section is to propose a quantification of the amount of profits that are shifted through the activities of foreign sales platforms in tax haven countries.

In order to do this, we ask the following question: what would be the profit booked in tax havens if foreign platforms would not concentrate worldwide profits? Our theoretical model delivers insights on this question. From equation 6, we know that the sum of shifted profits (noted PS_i) in a specific tax haven i can be written as :

$$PS_i := \sum_j \Psi_j^* \quad = \quad \Pi_i^{th} - \rho_i^{th}$$

where Π_i^{th},the reported before-tax profit of the tax haven, is observed in the data. ρ_i^{th} is the fixed component of the after-tax profit in tax haven and is not observable. It corresponds to the profit that would have been observed if the tax haven had not channelled profit shifting through foreign sales platforms.

Methodology. In order to estimate ρ_i^{th}, we refer to the frontier methods used in the public finance literature. The most recent examples are Clausing (2016) and Torslov, Wier and Zucman (2018). Despite using slightly different methodologies, the underlying idea of the estimations proposed in these papers is the same. The authors estimate excessive profits in low-tax juridictions based on a benchmark level of profits. Clausing (2016) regresses pre-tax profits on corporate tax rate and labor and capital inputs. The benchmark is therefore determined by computing the elasticity of profits to the host country corporate tax rate. Torslov, Wier and Zucman (2018) compute a benchmark from national account data which is the ratio of pre-tax profits to wages of domestic-controlled firms. In both studies, the amount of profits that is above the benchmark is considered as shifted.

We propose a slightly different methodology which is inspired by both Clausing (2016) and Torslov, Wier and Zucman (2018) studies. From Torslov, Wier and Zucman (2018), we account for tax havens and more generally for the tax environment of the host countries. Our model allows the profit elasticity to differ across low and high tax juridictions. From Clausing (2016), we regress pre-tax profits on observable and unobservable characteristics to determine the profit elasticity. Importantly, we add the possibility for firms in tax havens to use foreign sales platforms to shift profits. To do so, we consider the interaction between the ratio of foreign sales to total sales and the tax haven dummy, $FS_{ikt} \times Haven_i$. The empirical strategy involves estimating the effects of tax havens and the foreign sales ratio on profits for each sector k of country i conditional on other factors that have proved to be important determinants in the literature (see Hines and Rice, 1994; Clausing, 2016; Dowd, Landefeld and Moore, 2017 or Torslov, Wier and Zucman, 2018)

$$\begin{aligned}\Pi_{ikt} &= \alpha_0 + \alpha_1 FMA_{it} + \alpha_2 FS_{ikt} + \alpha_3 Haven_i + \alpha_4 \left(FS_{ikt} \times Haven_i\right) + \alpha_5 Tax_{it} \\ &+ \alpha_6 Treaties_{it} + \alpha_7 X_{ikt} + \alpha_8 DMA_{it} + \nu_{kt} + \xi_{ikt} \end{aligned} \tag{9}$$

Π_{it} is the logarithm of the profits defined before income taxes, which also excludes non-operating items and income from equity investments. The other control variables are defined as before. X_{ikt} is a vector of sector- and country-specific controls that vary over time. It includes total employment and the total productive assets of foreign affiliates. These variables allow us to scale the size of the activity.[30] ν_{kt} is a set of $sector \times year$ fixed effects and ξ_{ikt} is the disturbance term.

We provide different alternative estimators besides the standard OLS log-linear specification which uses positive profits only. The log-transformed model may be biased if the data generating process is the exponential model and the disturbances are heteroskedastic.[31] We therefore provide a generalized linear model with gamma distribution (Gamma GLM) as a first alternative estimator. One advantage of the Gamma GLM estimator is that it allows for zeros; unfortunately, it cannot allow for negative values of profits. We provide a modified cubic-root transformation (CubeR), which modifies the profit data so that the variable is a transformation but allows for zeros and negative profits (Cox, 2011). In all specifications, the standard errors are clustered at the country level.

We use data on profits and the estimated coefficients of 9 to predict $\tilde{\rho_i^{th}}$ which is the amount of profits that would have been observed in the absence of foreign sale platforms activity in tax haven.[32]

[30] Plant, property and equipment assets of the affiliates are less likely to be distorted by the tax-planning strategies of a MNE (Schwarz, 2009).

[31] Santos Silva and Tenreyro (2006) argue that in these cases maximum likelihood methods of estimation are much preferable to OLS. They put forward Poisson and Gamma pseudo-maximum likelihood with an application to bilateral gravity trade regressions.

[32] We therefore set the interaction term to zero and allow the tax haven countries to have excessive profits that are not explained by foreign sales platforms.

Results. Table 4 reports the estimated values of profits that are shifted by the mean of foreign sales platforms in 2013 under different assumptions concerning the estimator (Log-linear, GPML or CubicR). The estimated profits correspond to the overall sum of profits across tax haven countries i and sectors k: $\sum_i \sum_k \tilde{PS}_{ik}$.

– Table 4 about here –

The profit shifted through foreign platforms in 2013 amounts to \$67bn to \$80bn.[33] The lowest estimate shows that it corresponds to 74% of all the profits booked in tax haven countries and to 24% of all U.S. affiliates profits.[34]

A key question concerns the contribution of foreign sales platforms in explaining the excessive profits in tax haven as shown in Figure 5. In Figure 8, we report these contributions computed as the share of excessive profits due to the activities of foreign platforms to total excessive profits.[35] Foreign sales platforms explain a substantial share of Caribbean excessive profits, from 90% in Virgin British Islands to 94% in Bermuda. It also explains a large share of excessive profits of large tax havens. In particular, 75% of Ireland excessive profits are explained by foreign platforms.

– Figure 8 about here –

8 Conclusion and Discussion

In this paper, we document the impact of tax havens on the worldwide organization and trading practices of U.S. multinational companies. We shed light on the concentration of U.S. worldwide sales revenues in tax havens and highlight the relative specialization of these countries in services or manufacturing activities. Our empirical exercise is rationalized by a simple stylized model of the location of affiliates that includes profit shifting incentives.

[33] Our estimates are smaller than the ones of Clausing (2016) and Torslov, Wier and Zucman (2018) as we estimate the contribution of foreign sales platforms in tax havens to total profit shifting.

[34] We find similar results using country specific effects.

[35] The figures for Panama and Luxembourg are not reported. From our computations and as reported in Figure 5, there is no excess profits in these countries.

Econometric analysis confirms that the tax environment has a preponderant impact on the location of U.S. foreign sales platforms. Market access, the factor conventionally considered to be most important in this context, has less of an impact on determining the location of sales platforms when the country's tax haven status and degree of transparency with the U.S are controlled for. We calculate the amount of profit shifted through foreign sales platforms. Our estimate is that $67bn to $80bn of profits is shifted through foreign sales platforms in 2013, a substantial proportion of the total amount shifted by U.S. firms.

Our results support the evidence that a large share of profit shifting occurs through foreign sales platforms. One of our contributions is to outline a potential channel for profit shifting. Our results suggest that firms organize their worldwide activities to register sales where it is optimal to do this and regardless of the production location. This result is important both for international trade and public economics. It supports the previous evidence that tax avoidance affects trade patterns and alters the design of global value chains at the firm level. The use of contract manufacturing agreements allows production, sales and exports to be disconnected as well as the strategic reallocation of intangible assets to tax havens (see for instance Dischinger and Riedel, 2011).

This study provides new insights on how best to organize profit taxes worldwide. Formulary apportionment is an option for international taxation that is highly present in the public debate. Both institutions (the European Commission with the Common Consolidated Corporate Tax Base – CCCTB hereafter) and researchers in law and economics (see for instance Avi-Yonah, Clausing and Durst, 2009; Avi-Yonah and Benshalom, 2010; Zucman, 2014) are proposing to apply it to reform the international tax system. Under formulary apportionment, the total profits of an MNE are apportioned to its different countries of activity according to a formula based on factors that are easy to measure and hard to manipulate. Generally, the formula contains 3 factors: the capital, the wages and the sales.[36] Suppose a

[36]In the case of the CCCTB, the tax bill of firm f in country i would be calculated as follows: $Tax\ Bill_i^f = t_i^f \times \pi_W^f \times \left(\frac{1}{3}\frac{K_i^f}{K_W^f} + \frac{1}{3}\frac{L_i^f}{L_W^f} + \frac{1}{3}\frac{S_i^f}{S_W^f}\right)$ with t_i being the tax rate in country i, K^f, the level of capital, L^f, the number of employees, and S^f, the firms' total sales. Subscript W refers to the worldwide value of the variable for firm f.

multinational A make 100 of total profits. 50% of its employees, 50% of its capital and 50% of its sales are recorded in country 1 where the tax rate in 20%. Independently of the profits reported in country 1, firm A pays $0.2 \times (0.5 \times 100) = 10$ in taxes to country 1. Such taxation system is currently in force in the U.S. and in Canada to apportion the local profits to states and provinces.[37] The factors that enters the apportionment formula are therefore crucial to limit firm's aggressive tax planning. Avi-Yonah, Clausing and Durst (2009) and Zucman (2014) propose to use sales as a single-factor to allocate profits. They argue that sales are less subject to manipulation: if profits can be shifted, consumers cannot. They also propose for instance to limit sales as retail sales in order to exclude intra-firm transaction that could be subject to manipulation. The very interesting contribution of Avi-Yonah, Clausing and Durst (2009) documents other juridical aspects that can help limiting sales manipulation. Fleming, Peroni and Shay (2014) claim however that Avi-Yonah, Clausing and Durst (2009) propositions are not applicable, or that they would not hinder sales manipulation.

Our paper shows that sales are highly manipulated by U.S. firms in the current international taxation system. Tax havens concentrate most of U.S. worldwide sales. This does not mean that formulary apportionment based on sales should be discarded for the future of international taxation but that the law should target precisely the type of sales that will be the factor of allocation. CCCTB has for instance excluded intangible capital from its formula due to its high mobility. The question on how to target sales is actually not new in legal debates about formulary apportionment. For instance, it is important to understand how to treat electronic transactions when sales are registered in tax haven countries and when the seller is a *post-box* firm located outside of the scope of consolidation of the tax base.

[37] The fact that formulary apportionment is the current way to allocate profits across states and provinces in the U.S. and Canada led to concrete discussion about the technical details of applications. However, as explained by Avi-Yonah and Benshalom (2010), the unitary taxation in the U.S. is still different from the formulary apportionment and the small difference in tax rates across U.S. states limits the profitability of tax planning strategies.

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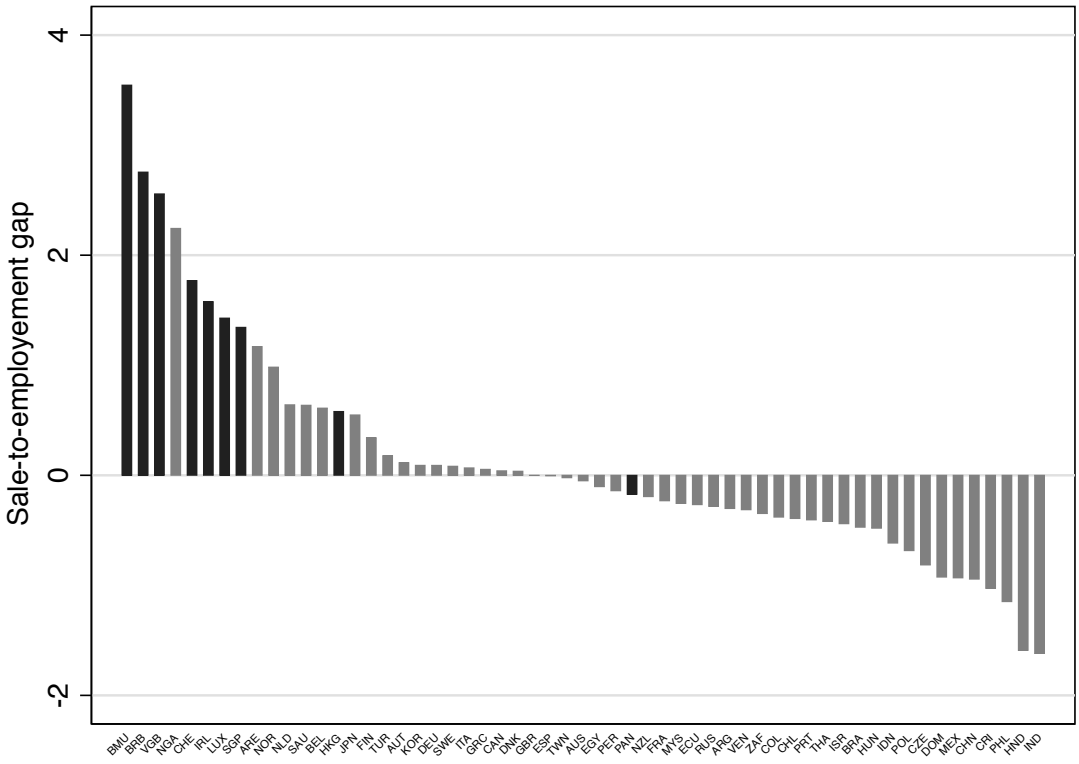
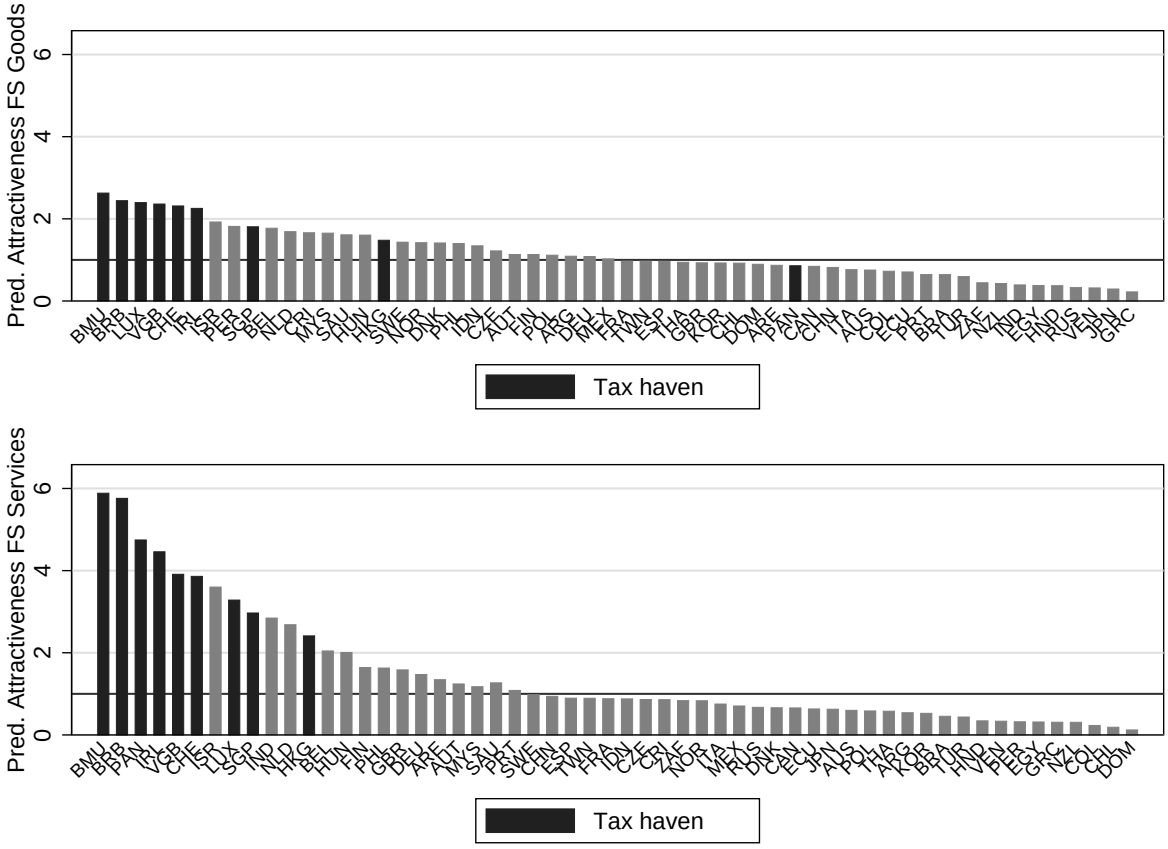
Figures and Tables



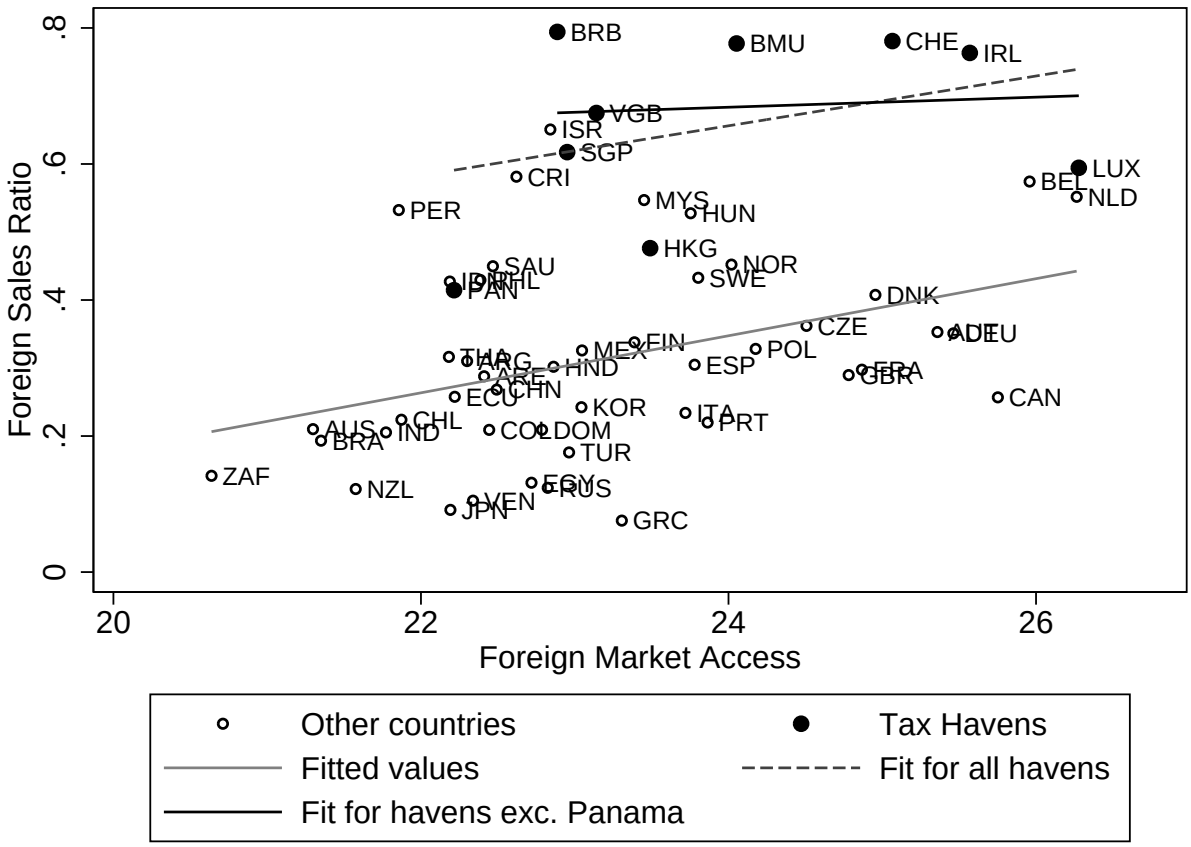
Note: Figure 1 represents the worldwide distribution of U.S. multinational firms sales and employment. Each bar is a country's sales-to-employment gap, defined as the average log difference between the share of total sales and the share of total employees of U.S. affiliates over the period 1999–2013. Large discrepancies remain after accounting for country-level productivity differences. This suggests that U.S. multinationals register their worldwide sales in low-tax jurisdictions (the black bars correspond to tax havens) but produce in other countries (on the right-hand side of the figure)

Figure 1 – The worldwide structure of U.S. firms



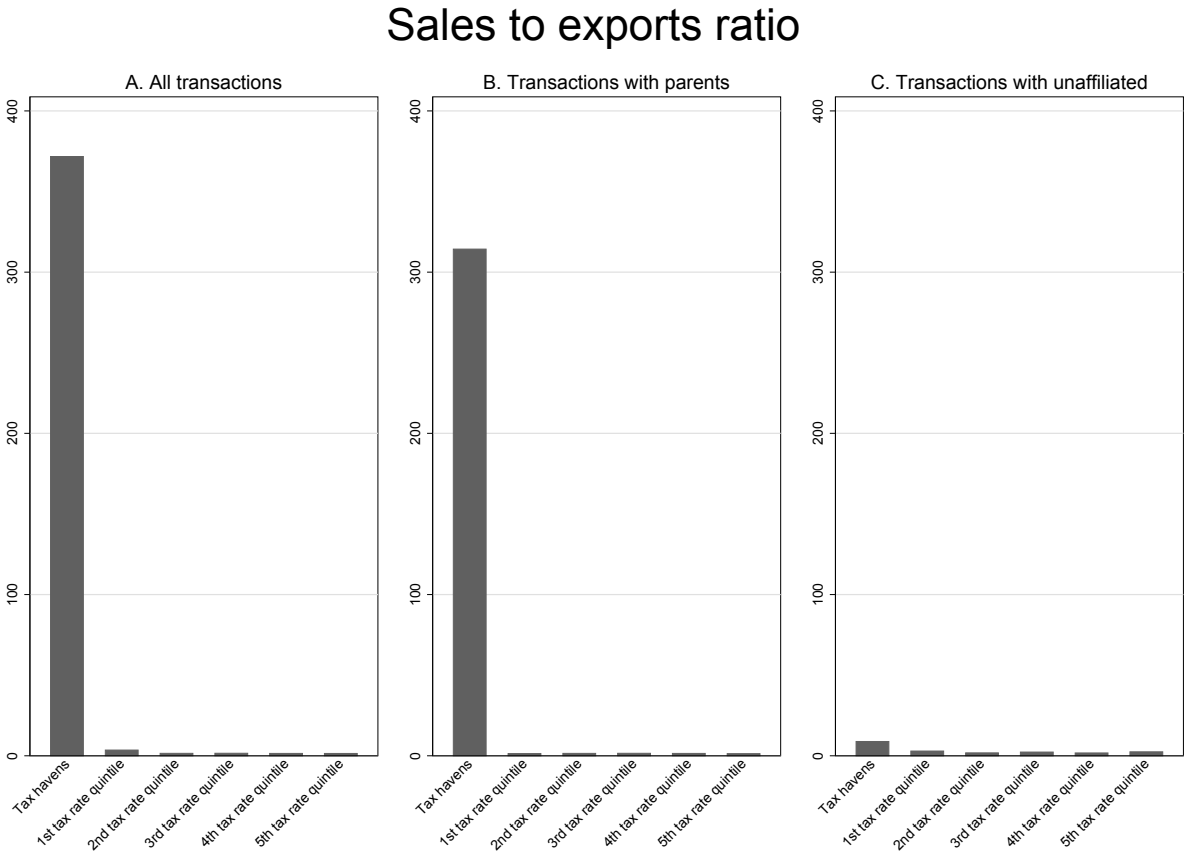
Note: This figure shows the relative attractiveness for foreign sales platforms of each country in our sample, in the upper panel for the trade of goods and in the lower panel, for the trade of services. The black line corresponds to the non-haven average, normalized to one. Sectors are pooled. Tax havens are in black.

Figure 2 – Relative attractiveness of potential host countries for U.S. foreign sales platforms.



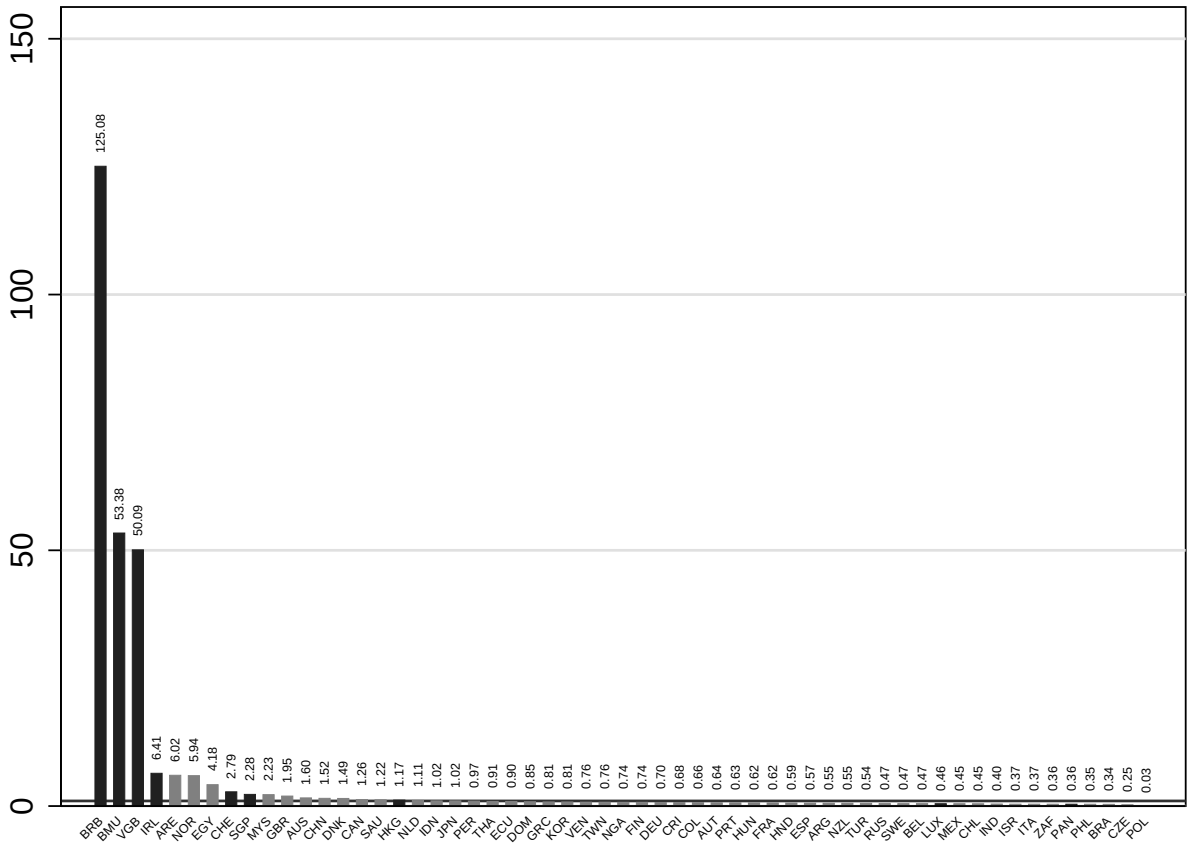
Note: This figure displays the foreign market access and the foreign sales ratio of all the countries in the sample. Sectors are pooled. Tax havens are in black.

Figure 3 – Foreign market access and foreign sales ratio for the countries in the sample.



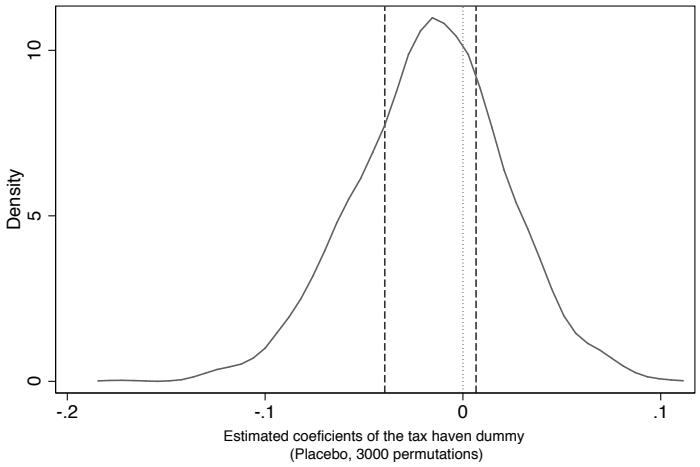
Note: This figure displays the foreign sales to export ratio for transactions with the U.S. On the x-axis, the first bar corresponds to tax havens and the other bars correspond to tax rate quintiles, excluding tax havens. The left panel considers all transactions, the middle panel, relations with the parent company, and the right panel, transactions with unaffiliated companies. Sectors are pooled.

Figure 4 – Evidence of contract manufacturing.



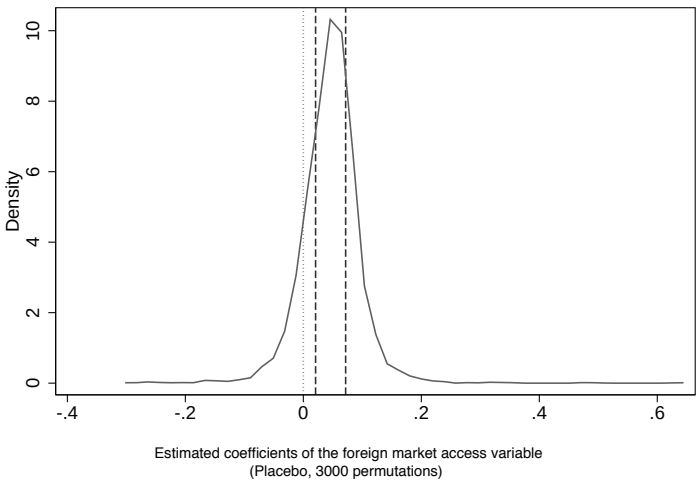
Note: This figure displays the relative attractiveness of each country in the sample in terms of profits per employee. The black line corresponds to the non-haven average, normalized to one. Tax haven countries are in black.

Figure 5 – Profits of U.S. foreign affiliates in different countries.



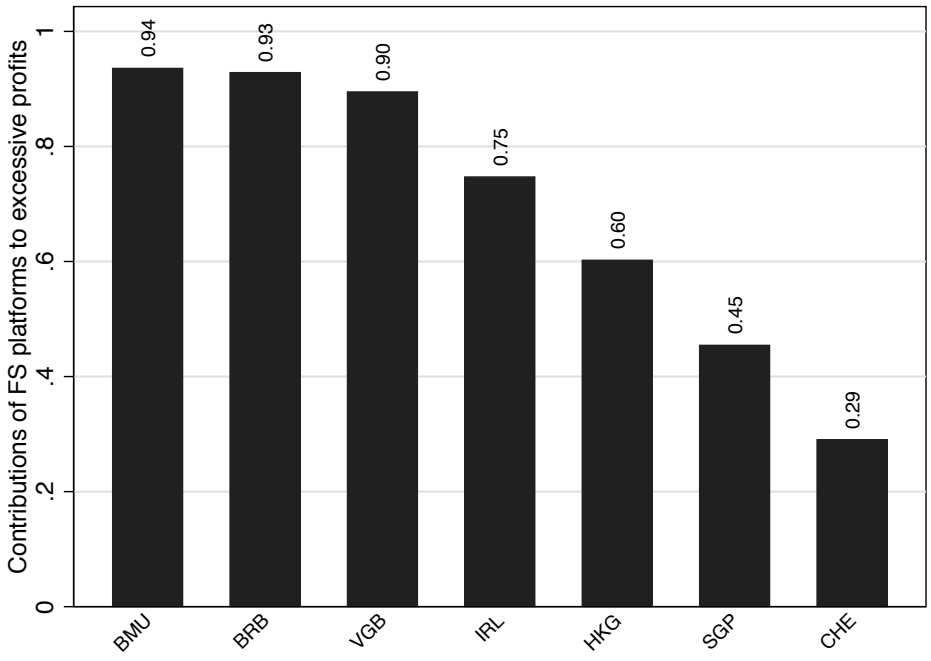
Note: estimation of specification (4) of Table 2 using the permuted tax haven variable.

Figure 6 – Tax haven dummy estimated coefficients with 9 randomly selected countries (3000 permutations)



Note: estimation of specification (6) of Table **??** using the permuted countries.

Figure 7 – Market access coefficients in the sample of permuted tax haven countries (3000 permutations)



Note: OLS estimates. Panama and Luxembourg excluded from this figure.

Figure 8 – Share of excessive profits explained by foreign sales platforms.

Table 1 – Descriptive Statistics

	Sample (56 countries, 5,740 obs.)	
	Mean	Std. Dev.
Foreign sales ratio	0.285	0.264
ln(Foreign Market Acc.)	23.48	1.375
Tax rate	0.284	0.081
Tax Haven	0.140	0.347
Treaty of info. exchange	0.243	0.429
Double tax. agreement	0.702	0.457
ln(GDP)	13.08	1.553
ln(1+ Employment)	1.747	1.246
ln(1 + Productive Assets)	5.000	2.436

Table 2 – The Location of U.S. Foreign Platforms - (GLM – Aggregate Results)

Dep. Variable	Foreign To Total Sales Ratio					
	(1)	(2)	(3)	(4)	(5)	(6)
ln(Foreign Market Acc.)	0.057***	0.056***	0.062***	0.055***	0.055***	-0.035
	(0.010)	(0.010)	(0.009)	(0.010)	(0.008)	(0.049)
Tax rate		-0.534**	-0.466**	-0.220	0.046	-0.940***
		(0.233)	(0.212)	(0.231)	(0.204)	(0.216)
Tax haven				0.132**		
				(0.059)		
Treaty of info. exchange			-0.072**	-0.058**	-0.058**	-0.281**
			(0.030)	(0.027)	(0.028)	(0.139)
Double tax. agreement			-0.014	0.004	0.036	0.172
			(0.038)	(0.031)	(0.031)	(0.105)
ln(GDP)	0.009	0.023***	0.019*	0.028**	0.006	0.063**
	(0.008)	(0.009)	(0.010)	(0.011)	(0.010)	(0.025)
Sector × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Full	Full	Full	Full	Non-tax haven	Tax haven
Observations	5,740	5,740	5,740	5,740	4,938	802
R^2	0.228	0.248	0.263	0.280	0.317	0.505
Corr.Obs/Pred	0.477	0.498	0.513	0.529	0.563	0.711

The dependent variable, FS_{ikt}, is the foreign to total sales ratio in sector k of country i in year t. Panel data (yearly) 1999–2013. GLM estimates with robust standard errors adjusted for clustering by country. Marginal effects at the sample mean are displayed. Standard errors are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels, respectively.

Table 3 – The Location of U.S. Foreign Platforms: Large or Caribbean Tax Havens - (GLM – Aggregate and Sector Results)

Dep. Variable	Foreign To Total Sales Ratio					
	(1)	(2)	(3)	(4)	(5)	(6)
ln(Foreign Market Acc.)	0.055***	0.066***	0.029**	0.048***	0.054***	0.033**
	(0.010)	(0.012)	(0.015)	(0.010)	(0.011)	(0.014)
Tax rate	-0.220	-0.311	-0.018	-0.274	-0.458	0.000
	(0.231)	(0.310)	(0.208)	(0.231)	(0.311)	(0.209)
Tax haven	0.132**	0.047	0.246***			
	(0.059)	(0.086)	(0.038)			
Large haven				0.163***	0.104	0.232***
				(0.059)	(0.082)	(0.037)
Caribbean haven				-0.029	-0.418***	0.312***
				(0.063)	(0.126)	(0.086)
Treaty of info. exchange	-0.058**	-0.082**	-0.016	-0.036	-0.042	-0.028
	(0.027)	(0.038)	(0.027)	(0.028)	(0.035)	(0.028)
Double tax. agreement	0.004	-0.010	0.033	0.013	0.005	0.029
	(0.031)	(0.041)	(0.033)	(0.031)	(0.039)	(0.032)
ln(GDP)	0.028**	0.041***	-0.006	0.019	0.027	-0.001
	(0.011)	(0.015)	(0.011)	(0.013)	(0.016)	(0.012)
Sector × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Full	Manuf.	Services	Full	Manuf.	Services
Observations	5,740	3,947	1,793	5,740	3,947	1,793
R^2	0.280	0.261	0.465	0.297	0.303	0.468
Corr.Obs/Pred	0.529	0.511	0.682	0.545	0.550	0.684

The dependent variable, FS_{ikt}, is the foreign to total sales ratio in sector k of country i in year t. Panel data (yearly) 1999–2013. GLM estimates with robust standard errors adjusted for clustering by country. Marginal effects at the sample mean are displayed. **Manufacturing:** (1) Mining, (2) Food, (3) Chemicals, (4) Primary and Fabricated Metals, (5) Machinery & Equipment, (6) Computer and Electronic products, (7) Electrical Equipment, Appliance and Components (8) Transportation Equipment. **Services:** (9) Wholesale trade, (10) Information, (11) Professional, Scientific and technical Services. **Large havens:** Hong Kong, Ireland, Luxembourg, Singapore and Switzerland. **Caribbean havens:** Barbados, Bermuda, Panama, the British Virgin Islands. Standard errors are in parentheses. ***, **, * significantly different from 0 at the 1%, 5%, and 10% levels, respectively.

Table 4 – Profit shifted through sales platforms in tax havens.

Estimation Method	OLS	Gamma	CubeR
Sample	Profit > 0	Profit ≥ 0	All Profits
Profit Shifted (in billion $)	66,9	79,6	80
% of haven profits ($90598bn)	74%	88%	88%
% of total profits ($273360bn)	24%	29%	29%

Note: Underlying regressions available in Table B.1 in the appendix.

A Data Description

Sectors: *Manufacturing:* (1) Mining, (2) Food, (3) Chemicals, (4) Primary and Fabricated Metals, (5) Machinery & Equipment, (6) Computer and Electronic products, (7) Electrical Equipment, Appliance and Components (8) Transportation Equipment. *Services:* (9) Wholesale trade, (10) Information, (11) Professional, Scientific and technical Services.

Countries (tax havens in bold): Argentina, Australia, Austria, **Barbados**, Belgium, **Bermuda**, Brazil, Canada, Chile, China, Colombia, Costa Rica, the Czech Republic, Denmark, the Dominican Republic, Ecuador, Egypt, Finland, France, Germany, Greece, Honduras, **Hong Kong**, Hungary, India, Indonesia, **Ireland**, Israel, Italy, Japan, the Republic of Korea, **Luxembourg**, Malaysia, Mexico, the Netherlands, New Zealand, Norway, **Panama**, Peru, the Philippines, Poland, Portugal, Russia, **Singapore**, South Africa, Spain, Sweden, **Switzerland**, Taiwan, Thailand, Turkey, the United Arab Emirates, the United Kingdom, **British Islands, Caribbean**, Venezuela.

British Islands, Caribbean, includes the British Virgin Islands, the Cayman Islands, Montserrat and the Turks and Caicos Islands.

B Empirical Definition(s) of Tax Havens

There is no commonly accepted definition of what constitutes a tax haven. According to Geoffrey Colin Powell (former economic adviser to Jersey cited in *The Economist*, 2002): "What identifies an area as a tax haven is the existence of a composite tax structure established deliberately to take advantage of, and exploit, a worldwide demand for opportunities to engage in tax avoidance." Chavagneux and Palan (2012) propose a list of criteria that encompass many definitions of tax havens: low or zero taxes, reinforced bank secrecy, extended professional secrecy, easy and fast registration procedure for firms, total free movement of capital, political and economic stability, and a network of bilateral agreements with other countries. We add to this definition the central idea that a tax haven is used as a fictive location for the individuals and firms that use it. An important point is that tax havens are not just low-tax and/or opaque countries.

The OECD (OECD, 2000) also outlines some of the features that characterize a tax haven. It is a country with no or only nominal taxes, no effective exchange of information[38] and no substantial activities (meaning that investment and transactions are mainly driven by tax incentives). Ireland, Luxembourg, Hong-Kong and Singapore do not appear in the OECD's list of tax havens.

In the academic literature, the definition of Hines and Rice (1994), based the U.S Internal Revenue Service's (IRS), is close to the OECD's definition: low tax rate, business and banking secrecy, a good communication network and self-promotion as a tax haven. In this paper we use the list compiled by Dharmapala and Hines (2009), which fills in the gaps in the OECD's by including countries considered tax havens by Hines and Rice (1994). This list corresponds to a *de jure* classification and may suffer from a construction bias.

A first argument to justify our list is that the countries included appear in many other lists of tax havens. According to Chavagneux, Palan and Murphy (2010), our tax havens appear in at least 8 other lists (among eleven): Bermuda (11), Panama (11), Barbados (10),

[38]There is a growing body of evidence in the literature showing that tax agreements are ineffective at hindering harmful tax practices, see Bilicka and Fuest (2014) or Johannesen and Zucman (2014).

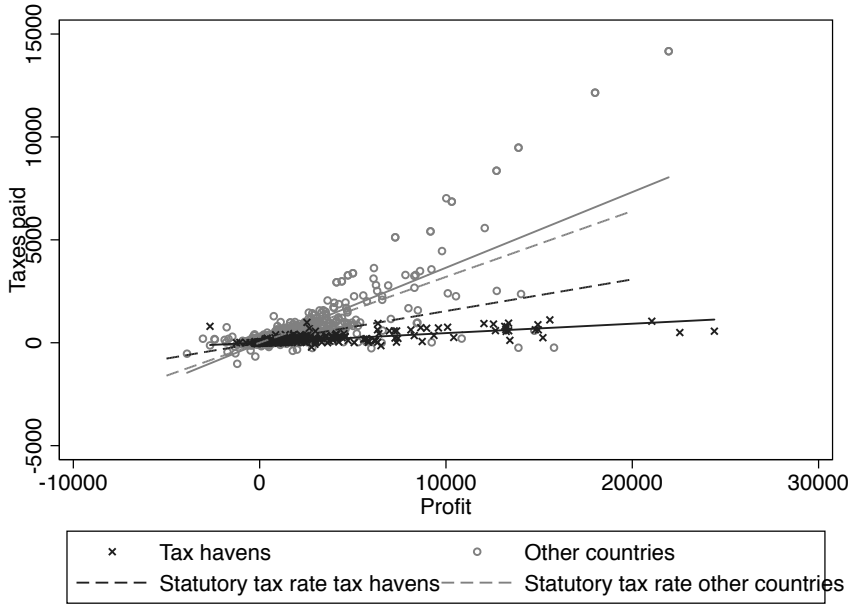


Figure 9 – Statutory and effective tax rate.

the British Virgin Islands (10), Hong-Kong (9), Singapore (9), Switzerland (9), Ireland (8), Luxembourg (8).

We can also justify this list empirically by simply looking at the tax bills of US affiliates in foreign countries. As noted by Kleinbard (2011), the ability to generate stateless income affects the US tax bill as well as the local tax bill. This explains why Google only paid 2.9% of its 2009 profits in taxes, which is much lower than the average statutory tax rate that should have applied. In figure 9, we plot the effective tax rate paid by US MNEs in tax havens and non-tax-havens and we compare it to the (weighted) statutory tax rate. In countries that are not tax havens, the average effective tax rate is almost equal to the weighted statutory tax rate. There is nonetheless a large dispersion around this average. In tax havens, the effective foreign tax rate line is almost flat and substantially lower than the statutory line, suggesting specific legislative arrangements that allow firms to lower their tax bills. The points are less dispersed and more cluster around the effective tax rate line.

C Descriptive statistics

Table 5 shows further descriptive statistics. We present basic indicators of economic activity and compare them between tax havens and other countries.

Tax havens as a whole have, as expected, a low number of employees compared to other countries. They only represent 4.4% of the total number of employees in the sample of sectors in 2013. This observation is confirmed when looking at the average per country over the period. On average, U.S. MNE in tax havens have less employees than in other countries. This is in line with the fact that according to the OECD definition tax havens have no real activities.

We perform a similar exercise for the level of sales and (non-financial) profits. Tax havens represent 26% of total sales in 2013. This contrasts with the low share of total employees discussed before. This pattern of large sale activity of tax is even more striking when we look at the average sales per country and when we compare the level of sales to the number of employees. On average U.S. affiliates in a given tax haven sale more than U.S. affiliates in other countries. Besides, the average volume of sales for 1000 employees in tax havens is \$4201 million while it is only \$444 million in other countries (a factor of 9.5 difference).

Similarly for (non-financial) profits, for which the amount generated per 1000 employees is 12.6 times larger in tax havens than in other countries. Besides, profits in tax havens represent 32.4% of all U.S. profits in the sample in 2013. It is noteworthy that all these statistics are calculated using the regression sample, i.e. excluding financial affiliates.

Table 5 – Descriptive Statistics (56 countries)

	Tax Haven	Other countries
Employees:		
Total employees in 2013	270851	5864877
Share employees in 2013 (%)	4.4	95.6
Average yearly number of employees	2579	9785
Sales (millions of $):		
Total sales in 2013	1012807	2887299
Share sales in 2013 (%)	26	74
Average yearly sales	7644	4744
Average sales per 1000 employees	4201	444
Profits (millions of $):		
Total profits in 2013	90897	189478
Share profits in 2013 (%)	32.4	67.6
Average yearly profit	653	320
Profits per 1000 employees	843	67

Average values are given at the country level. All years and sectors in the sample are pooled. Profits are shown pre-tax and excluding financial items.

D Apple Tax Avoidance Strategy in Ireland

The case of Apple is a good example of how an actual foreign sales platform works. The declarations of Apple's representative to the Permanent Subcommittee on Investigations of the U.S. Senate reveal how Apple Inc. organizes its activities to register 64% of its profits in Ireland despite having only 3% of its employees there and 1% of its consumers (in 2011). According to the representative's declarations, this scheme allowed the firm to avoid $12.5bn of taxes in 2011 and 2012.

Figure 10 shows a simplified version of the structure used by Apple in Ireland. Apple Operations International (AOI) is owned (100%) by Apple Inc. and is the ultimate owner of most of the offshore affiliates of Apple. It has no employees. Despite being incorporated in Ireland, it has no tax residence. Apple uses loopholes in the Irish and U.S. tax laws that lead to both countries considering Apple resident in the other. [39] Because of the different definitions of residency, AOI is a *stateless* entity (Kleinbard, 2011). AOI owns Apple Operations Europe (AOE) that owns Apple Sales International (ASI). While the first two entities are holding companies, ASI is the affiliate that acts as a sales platform. Just like AOI, it has no tax residency. ASI and AOE have a cost-sharing agreement with Apple Inc. According to the Senate report, Apple applies two main strategies to shift its profits to Ireland. The first is the cost-sharing agreement between ASI and Apple Inc. This agreement, according to which Apple Inc. and ASI share the development of Apple products, helps to locate a large share of Apple's intangible assets in Ireland. The Senate report insists on the fact that this agreement is not economically justified and is only motivated by aggressive tax optimization. Most importantly, ASI acts as a foreign sales platform by concentrating the worldwide sales of the whole group.

The structure chosen by Apple is at the heart of its profit shifting strategy. ASI, the foreign sales platform, engages in contract manufacturing. In practice, it contracts with a manufacturing affiliate in China to outsource production. The goods are produced by

[39] Irish tax residency is based on where management and control is performed. For ASI this is the U.S. On the contrary, residency in U.S. tax law is the place of incorporation, in this case, Ireland.

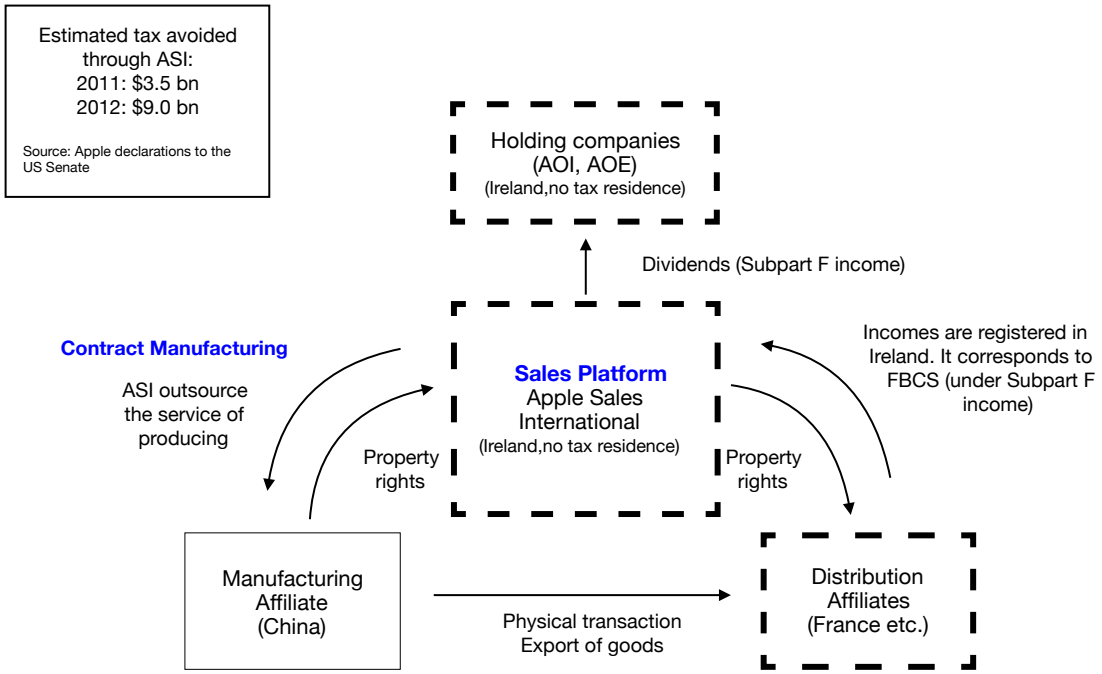


Figure 10 – Simplified structure of Apple in Ireland

the manufacturing affiliate but are always owned by ASI. In terms of trade statistics, these transactions are registered as an import of services by ASI. When a customer buys an Apple product in a store or over the internet, the product is directly sent from China to the customer. Thus, although the owner of these products is ASI in Ireland, the goods generally never cross the Irish border. However, the financial transaction occurs between the owner of the goods and the final customer, in this case, between the retailer and Ireland. Note the discrepancy between the physical transaction and the financial transaction. Usually, it is almost impossible to identify the two types of transactions. However the BEA data allow us to do this for certain transactions. In terms of trade statistics, customs will register an export of goods from China to the retailer's country, while the balance of payments will register an export from Ireland to the retailer's country.[40] Finally, the revenues from the sales are sent through dividends to the upper-tier subsidiaries AOE and AOI.

To avoid this transfer of revenue to tax havens, the U.S. enacted a law (the Subpart F

[40]The customs register trade based on the crossing of national borders while the balance of payments measures trade based on change of ownership.

rules) in 1962 to ensure that passive income (income that results from a passive activity e.g. dividends, interest, royalties, etc.) is always taxed. The objective of this law is to prevent income being relocated and conserved in tax havens to avoid paying taxes. Passive income is a common component of firms' tax avoidance strategies. The transactions between the retail affiliate and ASI and the transactions between ASI and the upper-tier affiliates should have been taxed under Subpart F. The first transaction is a Foreign Base Company Sale (FBCS, sales of products that have been produced by an affiliate in an other country) and in the second corresponds to Foreign Personal Holding Company income (FPHC, which includes dividends, interest, rents and royalties).

However, the check-the-box regulations enacted in 1997 can be used to circumvent the Subpart F rules. These regulations allow Apple to make the IRS disregard the lower-tier affiliates (AOE, ASI and the distribution and retail affiliates) for tax purposes. The three entities in dashed boxes in the figure are thus considered a single firm by the IRS. Because the IRS does not look at what happens within a firm, it cannot tax the transactions of passive income.

Overall, ASI plays the role of a foreign sales platform since it concentrates and manages Apple's worldwide sales.

E Optimal profit shifting

This proof is based on Gumpert, Hines and Schnitzer (2016). The maximisation problem at the firm level, given that it has a tax-haven affiliate is

$$\max_{d_i,\Psi_i} \sum_{i=1}^{n} d_i \Big[\Psi_i + (1-T_i)\Big(\rho_i - \Psi_i - \frac{a^{1/\gamma_i}}{2}\frac{\Psi_i^2}{\rho_i}\Big)\Big]$$

with $d_i \in \{0,1\}$, s.t

$$\rho_i - \Psi_i - \frac{a^{1/\gamma_i}}{2}\frac{\Psi_i^2}{\rho_i} \geq 0, \forall i = 1,\ldots,n$$

Following Gumpert, Hines and Schnitzer (2016) and assuming that the constraint is fulfilled, the first-order condition for Ψ_i is

$$1 - (1-T_i) - (1-T_i)\frac{a^{1/\gamma_i}\Psi_i}{\rho_i} = 0$$

It implies

$$\Psi_i^* = \frac{T_i}{1-T_i}\frac{\rho_i}{a^{1/\gamma_i}}$$

We insert Ψ_i^* into our constraint in order to produce a condition under which the constraint holds

$$\rho_i - \frac{T_i}{1-T_i}\frac{\rho_i}{a^{1/\gamma_i}} - \frac{T_i^2}{(1-T_i)^2}\frac{\rho_i}{2a^{1/\gamma_i}} \geq 0 \tag{10}$$

$$\Leftrightarrow \quad T_i \leq 1 - \sqrt{\frac{1}{2a^{1/\gamma_i}+1}} \tag{11}$$

F Proof of Proposition 1

Without loss of generality, we assume $M_j^{nth} = \eta M_i^{th}$ to show that the elasticity of profit with respect to market access in the tax haven country is smaller than one and decreases with

the size of the incoming profit shifted. Given equation 6, the elasticity can be written:

$$\frac{\partial \Pi_i^{th}}{\partial M_i^{th}} \frac{M_i^{th}}{\Pi_i^{th}} = \frac{1}{\eta \sum_j \frac{1}{a^{1/\gamma_j}} \frac{c_j^{1-\sigma}}{\sigma} t_j} = \frac{1}{\eta \sum_j \Psi_j *} < 1$$

This elasticity decreases as $\sum_j \Psi_j *$ increases.