

# At Your Service! The Role of Tax Havens in International Trade with Services\*

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## Abstract

This paper provides the first comprehensive study of profit shifting through mispriced service trade inside multinational firms. The analysis employs a unique firm-level dataset with detailed information about service trade and foreign affiliates for virtually all multinational firms in Germany. We find patterns consistent with mispriced affiliate trade in service categories such as *intellectual property* (patents and trademarks), *headquarter services* (administration, management and advertising) and *sea transport* (shipping). In these service categories, trade with affiliates in tax havens is heavily skewed towards imports and the internal service providers in tax havens earn significant excess returns. These patterns are suggestive that multinational firms operate tax haven entities that sell overpriced or even purely fictitious services to affiliates in order to erode their taxable profits and reduce the global tax bill. While total service imports from tax havens are enormous, our estimates imply that the loss of government revenue associated with mispricing of affiliate service trade is modest.

**Keywords:** Service trade, Profit shifting, Tax Evasion, Multinational firms, Tax havens

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# 1 Introduction

Tax evasion by multinational firms is a growing concern at the highest levels of international governance (G20, 2013; EU Council, 2016) and recent studies show that the annual cost to governments is likely to attain hundreds of billions of dollars (Zucman, 2014; OECD, 2015).

A potentially important mode of tax evasion that has been the object of very little academic research is mispriced service trade within the multinational firm. Anecdotally, multinational firms are known to operate entities in tax havens such as *patent boxes* that own intellectual property and collect royalties and license fees from affiliates; *captive insurance companies* that insure the risks of affiliates in exchange for insurance fees; and *headquarters* that assist affiliates with management, administration or advertising against service fees. This service trade typically has no or little real substance and serves no other purpose than tax evasion. When tax haven entities sell overpriced or purely fictitious services to affiliates elsewhere, taxable profits are effectively shifted to tax havens with low or no taxation, which reduces the firm's global tax bill.

While tax authorities generally attempt to limit the scope for profit shifting with transfer pricing rules that require trade between affiliates to be carried out at *arm's length prices*, the effectiveness of these rules is often contested in the realm of services. The inherent challenge is that services are intangible and therefore, to a much greater extent than goods, possess unobserved qualities that make it difficult to determine the arms' length price. Multinational firms arguably have a large flexibility to manipulate, for instance, the royalty for the use of a unique trademark, the premium for insurance against idiosyncratic risk and the fee for management advice so as to minimize their global tax bill.

Aggregate trade statistics reveal patterns consistent with the theoretical notion that mispriced service trade is an attractive tax evasion strategy. Most strikingly, tax havens play a very prominent role in international trade with services, which is not mirrored in trade with goods. Based on simple gravity models and publicly available trade data for 26 OECD countries, we show that service trade with havens is around six times larger than with non-havens that are comparable in terms of size, distance and other standard trade determinants whereas no difference exists between havens and non-havens in goods trade.

The disproportionate service trade with tax havens, however, does not necessarily reflect mispriced trade flows between affiliates. Alternatively, it may reflect that the distinct institutions developed by tax havens, low effective tax rates combined with lax regulatory standards and a legal framework facilitating secrecy, constitute a real comparative advantage in service production, which drives genuine specialization and large trade flows between non-affiliates. For instance, Luxembourg hosts one of the largest financial centers in the world and while the competitiveness of its banks and fund managers ultimately derive from institutions such as banking secrecy and tax exemption of investment funds, their services are routinely traded with other financial firms on global markets and such transactions cannot be motivated by profit shifting. Similarly, ship management on Cyprus and reinsurance on Bermuda are examples of genuine and highly specialized service industries that have emerged in response to the tax and regulatory incentives offered by tax havens.

This paper explores the nature of the service trade with tax havens and asks to what extent it reflects tax evasion by multinational firms. To address this question, we go beyond aggregate trade statistics and construct a comprehensive firm-level dataset for Germany that contains information about service trade as well as foreign direct investment. For virtually every firm in Germany, we observe the value of its service imports and exports by counterpart country and service category as well as the location and financial characteristics of its foreign affiliates. While this dataset provides a unique opportunity to analyze profit shifting through mispriced service trade, it is necessary to adopt other empirical strategies than most recent papers on profit shifting through mispriced goods trade (e.g. Cristea and Nguyen, forthcoming). These studies use variation in the unit prices of traded goods, inferred from information about traded values and quantities, to identify profit shifting; however, this is impossible in the context of services, which are inherently uncountable and therefore do not have meaningful unit prices.

Our main empirical analysis exploits that trade between *non-affiliates*, since it cannot reflect profit shifting, carries information about comparative advantage and industrial specialization, which can help us identify the trade between *affiliates* that is driven by profit shifting. We implement this idea by estimating a regression model that explains the extensive margin of service

trade with three key variables: a dummy indicating whether the partner country is a tax haven; a dummy indicating whether the firm has an affiliate in the partner country; and the interaction between the tax haven dummy and the affiliate dummy. The model also includes standard gravity controls and firm fixed effects, which implies that the key variables are identified from within-firm comparisons of trade with economically and geographically similar countries. The affiliate dummy expresses how a firm's trade differs between similar non-havens with and without an affiliate and thus approximates affiliate trade with non-havens. The tax haven dummy expresses how a firm's trade differs between similar havens and non-havens without an affiliate and thus captures the genuine specialization of havens. The main variable of interest is the interaction between the two, which expresses how trade with affiliates in havens differs from trade with affiliates in non-havens over and above what can be explained by genuine specialization. This *excess trade* with affiliates in tax havens can be attributed to profit shifting under the identifying assumption that - in a counterfactual world without a profit shifting motive - trade with affiliates in havens and non-havens would only differ to the same extent as trade with non-affiliates in havens and non-havens.

The model reveals trade patterns consistent with profit shifting in some, but not all service categories. For example, if a firm has an affiliate in a foreign country, the probability of observing trade flows related to intellectual property between the firm and the foreign country generally increases by around 5 percentage points for both imports and exports. If the foreign country is a tax haven, however, the effect on imports is around 7.5 percentage points and the effect on exports around 2.5 percentage points. The finding that trade with affiliates in tax havens is heavily skewed towards imports is clearly suggestive of profit shifting: it is precisely the pattern that should be expected if multinational firms operate tax haven entities that serve solely to sell mispriced services to affiliates. This pattern emerges in four major service categories: *intellectual property* (such as services related to patents and trademarks), *headquarter services* (such as administration and management), *information services* (such as information technology) and *sea transport* (such as shipping of goods). In other service categories, like *insurance* and *communication*, there is no evidence that tax havens play a distinct role in trade between affiliates.

To establish the link between service trade and profit shifting more firmly, we go beyond the analysis of *excess trade* with affiliates in tax havens and study the *excess profitability* of these entities directly. We estimate a model that explains the pre-tax profitability of foreign affiliates with a tax haven dummy and a set of firm fixed effects. By restricting the sample to foreign affiliates that sell a specific service to their German parent, the model effectively identifies the excess profitability of affiliates in tax havens by comparing to affiliates in non-tax havens belonging to the same firm and selling the same service inside the firm. In a number of service categories, including *intellectual property*, *headquarter services* and *sea transport*, affiliates in tax havens earn significant excess profits. The excess returns vary between 4 and 8 percentage points, which compares to baseline returns between 10 and 15 percent in the comparison group of affiliates in non-tax havens. In other service categories, like *insurance* and *communication*, there is no evidence that tax haven entities earn excess returns.

To get a sense of the importance of service trade as a mode of profit shifting, we also investigate how patterns of service trade correlate with the overall allocation of profits inside the multinational firms. Our results show that firms with less than 20% of total service imports coming from tax havens realize below 30% of their foreign profits in tax havens on average whereas firms importing 50% or more from tax havens realize around 50% of their foreign profits in tax havens on average. This correlation is suggestive that the mispricing of service trade with tax haven affiliates is sufficiently strong to have a pronounced effect on the global allocation of profits within multinational firms. However, the results should be interpreted with caution as they, unlike the previous results, are identified from between-firm rather than within-firm comparisons and are therefore more likely to be biased by unobserved heterogeneity.

Finally, we present results suggesting that service trade between German firms and their tax haven affiliates is funneled through entities in third countries; in particular the Netherlands, which has been identified by other studies as the conduit country typically used by German firms for holding purposes (e.g. Mintz and Weichenrieder, 2010). Specifically, we show that excess imports from tax haven affiliates in service categories such as *intellectual property* and *headquarter services* are significantly lower for firms that have an affiliate in the Netherlands.

This is consistent with services flowing from tax havens through the Netherlands to Germany, which decreases observed imports from tax haven affiliates. The conduit trade may serve to circumvent withholding taxes or other anti-avoidance measures that apply only to transactions with tax havens (Johannesen, 2012).

Our analysis adds to a large literature studying how multinational firms shift profits between jurisdictions with the aim of reducing their global tax bill. A large number of papers show that the transformation of productive inputs into taxable profits by multinational firms correlates with tax rates in ways that are suggestive of tax motivated profit shifting (e.g. Hines and Rice, 1994; Huizinga and Laeven, 2008). Other papers study the distinct channels through which profits are shifted such as mispricing of goods traded inside the firm (e.g. Clausing, 2003; Bernard, Jensen and Schott, 2008; Christea and Nguyen, forthcoming); the allocation of debt within the firm (e.g. Desai, Foley and Hines, 2004; Huizinga, Laeven and Nicodeme, 2008); and the allocation of patents and other intangible assets within the firm (e.g. Grubert, 1998; Dieschinger and Riedel, 2011; Karkinsky and Riedel, 2012). We are not aware of any existing papers that study trade in services as a mode of profit shifting.

The paper also contributes to a growing body of literature attempting to shed light on the use of tax havens by multinational firms (Hines and Rice, 1994; Desai, Foley and Hines, 2006; Hebous and Lipatov, 2014; Zucman, 2014; Bennedsen and Zeume, 2015); by wealthy individuals (Zucman, 2013; Zucman and Johannesen, 2014; Johannesen, 2014; Hanlon, Maydew and Thornock, 2014); and by self-serving political elites (Andersen et al., 2014).

Finally, our findings have practical relevance for tax authorities that are optimizing the allocation of scarce audit resources and limited regulatory capacity. The analysis provides a sense of the overall magnitude of profit shifting through mispricing of service trade and points to industries and narrow service categories where the risk of mispricing, and thus the potential gains from audits, are especially large.

The paper proceeds in the following way. Section 2 studies trade with tax havens using aggregate data. Section 3 describes the firm-level data. Section 4 discusses the empirical strategy. Section 5 reports the results. Section 6 provides some concluding remarks.

## 2 Aggregate trade patterns

This section analyzes the role of tax havens in international trade using publicly available data from OECD trade statistics. Specifically, we rely on bilateral trade information from 2011, which is available for 34 reporting countries for goods and 26 reporting countries for services.

In a first step, we show that tax havens play a far more prominent role in service trade than goods trade by plotting the share of service trade that is conducted with tax havens against the corresponding share in goods trade. Our list of tax havens follows Hines (2010) and includes 50 countries ranging from well-known tax havens like Switzerland, Singapore and Bermuda to more unknown jurisdictions like Anguilla, Andorra and Vanuatu. As shown in Figure 1, tax havens are more important partners in service trade than goods trade for all countries in the sample. In Germany and France, for instance, tax havens account for around 15% of the service trade but only a little more than 5% of goods trade; in the UK, tax havens account for almost 20% of the service trade and roughly 10% of the goods trade; and, most extremely, in the Netherlands, tax havens account for almost 25% of the service trade and a mere 5% of the goods trade.

Figure 1 somewhere around here

In a second step, we quantify the extent to which trade with tax havens exceeds trade with comparable non-haven countries by estimating a standard gravity model augmented with tax variables. The results are reported in Table 1; all standard errors are clustered by reporting country and by partner country. Column (1) shows that conditional on economic size, geography and other standard controls, a dummy for being a tax haven is a very strong predictor of service trade. The coefficient of 1.79 implies that service trade is around 500% percent larger for country pairs where at least one of the countries is a tax haven than for otherwise comparable country pairs. Column (2) shows that this result does not extend to goods trade. The point estimate suggests tax havens trade around 16% more goods than comparable non-havens, which is not statistically distinguishable from zero.

Table 1 somewhere around here

These patterns are very robust. For instance, the coefficient on the tax haven dummy barely changes when we include higher-order terms of the GDP and distance variables to address the concern that tax havens are systematically smaller than other countries, which could lead to a biased coefficient on the tax haven dummy if trade is not log-linear in GDP conditional on any tax effects. The point estimate drops somewhat when the gravity equation is estimated on its multiplicative form as suggested by Silva and Tenreyro (2006), but still implies excess trade with tax havens in services above 200%. By comparison, point estimates are consistently small and statistically insignificant in the goods equation.

In the baseline regression, we lumped together country pairs where only one country is a tax haven and those where both countries are tax havens in a single tax haven dummy. Column (3) shows that the service trade effect is markedly different in the two cases: the coefficient of 1.67 for country pairs with only one tax haven corresponds to a trade effect of around 430% whereas the coefficient of 4.21 for country pairs with two tax havens corresponds to a trade effect of a staggering 6600%. Column (4) shows that there is no significant effect on goods trade in any of the two cases.

The very sizable trade in services *between* tax havens may reflect that services are traded through chains of entities belonging to the same firm. In the tax planning employed by Microsoft, Google and other global firms, for instance, the right to exploit the firm's intellectual property is licensed from a shell corporation in Bermuda to another shell corporation in the Netherlands, on to a corporation in Ireland and finally on to sales offices in a number of different countries (Kleinbard, 2011).<sup>1</sup> We investigate the role of such conduit structures later in the paper.

While the aggregate trade statistics point to a prominent role of tax havens in international service trade, they do not allow us to investigate this role further by considering trade between

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<sup>1</sup>The role of chains of entities is studied empirically by Mintz and Weichenrieder (2010) and Lewellen and Robinson (2013).

affiliates and non-affiliates entities separately or analyzing individual service categories. In the remainder of the paper, we therefore turn to more disaggregated data.

### 3 Firm-level data

We combine information from two firm-level datasets compiled by the Deutsche Bundesbank. First, we use information on service trade from the *Statistics on international trade in services* collected for the purposes of the balance of payments statistics. In this dataset, we observe for each German corporation the value of its service imports and exports by counterpart country and service category.<sup>2</sup> Second, we use information on foreign affiliates from the *Microdatabase Direct Investment (MIDI)*. In this dataset, we observe for each German corporation the basic characteristics of its foreign affiliates, such as their turnover, profits, equity and location, both directly and indirectly owned subsidiaries and parent companies.<sup>3</sup> Merging these two data sources, we obtain a firm-level dataset on service trade and foreign affiliates, which is augmented with country-level variables such as GDP, tax haven status, distance to Germany and shared language with Germany<sup>4</sup>.

It should be emphasized that the data do not allow us to distinguish trade between affiliates and non-affiliates without error. First, when a firm trades with a country in which we observe an affiliate, this could very well be trade with the affiliate, but might also be trade with another unrelated entity. Second, trade with a country in which we do not observe an affiliate is most likely trade with a non-affiliate, but could in principle be trade with an affiliate that we do not observe in our dataset. That could happen if the trading partner is a subsidiary of a foreign parent (i.e., a foreign sister) for which there is no reporting requirement to the Deutsche Bundesbank.

In Table 2, we provide an overview of the aggregate patterns in our firm-level dataset. For each of the 11 broad service categories with aggregate trade exceeding €5 billion, we report

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<sup>2</sup>The data cover all transactions exceeding €12,500

<sup>3</sup>Foreign subsidiaries are included if (i) the value of their total assets exceeds €3 million and (ii) the German parent holds a direct ownership share exceeding 10% or one of its subsidiaries holds a direct ownership share exceeding 50%. For a detailed description of the data, see Biewen et al. (2013) and Lipponer (2011).

<sup>4</sup>Information on GDP from World Development Indicators complemented with CIA factbook; on tax haven status from Hines (2010); and on geography, shared language and shared borders from the CEPII database.

the total value of German firms' imports and exports with breakdowns on whether the partner country is a tax haven or not and whether an affiliate is present in the partner country or not. The table establishes a number of interesting facts. First, Germany has a considerable trade deficit in services with imports around €250 billion and exports around €220 billion. The largest service categories in terms of total trade are *sea transport*, *intellectual property*, *air transport* and, most importantly, *other business services*. Second, Germany has a small trade surplus against tax havens with exports around €40 billion and imports slightly below that. The share of tax havens in the service trade, however, varies widely across categories with particularly high tax haven shares in *financial services*, *sea transport*, *information services* and *other business services* (20-30%) and low tax haven shares in *air transport* and *road transport* (5-7%). Third, trade with tax havens in which the trading firm has an affiliate and which is therefore plausibly intra-firm amounts to around €11 billion of imports and €8 of exports. The intra-firm share of tax haven imports also differs significantly across services with high intra-firm shares in *intellectual property* and *other business services* (30-50%) and a low share in *financial services* and *construction* (15-20%).

In Table 3, we report a breakdown of the two aggregate categories *intellectual property* and *other business services*, which are of particular interest in the context of profit shifting. The former can be decomposed into *patents*, *trademarks* and *research and development* whereas the latter most prominently contains *headquarter services*, *technical services* and *advertising* as well as a number of smaller subcategories. The term *headquarter services* is used for brevity and covers commercial, organizational, administrative and management services.

The aggregate patterns reported in Tables 2 and 3 can be used to gauge the magnitude of profit shifting to tax havens occurring through trade in services. Under the extreme assumption that all service imports from tax havens in which the importing firm has an affiliate are purely fictitious transactions where the acquired service has no actual value, these imports shift €11 billion of corporate tax base out of Germany. With a corporate tax rate around 30%, this gives an upper bound on the revenue loss due to intra-firm service imports from tax havens of around €3 billion. To the extent that some of these imports represent genuine services with a positive arm's

length price, the revenue loss is proportionately smaller. This computation does not account for the possibility that imports from tax havens are funneled through conduit countries and thus concealed as imports from other countries. Note, however, that even if a large share of affiliate imports from tax havens is completely fictitious and a significant share of total affiliate imports from tax havens pass through conduit entities outside tax havens, the total revenue loss is likely to be quite modest relative to the total German corporate tax revenue of around €45 billion in 2011.<sup>5</sup>

## 4 Empirical model

The baseline model used to study trade patterns is a linear probability model specified in the following way:

$$Trade_{ics} = \alpha + \beta_1 Haven_c + \beta_2 Affiliate_{ic} + \beta_3 (Affiliate_{ic} \times Haven_c) + \mu_i + \gamma \mathbf{X}_c + \varepsilon_{ics} \quad (1)$$

where  $Trade_{ics}$  is a measure of trade in service  $s$  between firm  $i$  and country  $c$ ;  $Affiliate_{ic}$  is a dummy indicating whether firm  $i$  has an affiliate in country  $c$ ;  $Haven_c$  is a dummy indicating whether country  $c$  is a tax haven;  $\mu_i$  are firm-level fixed effects that absorb all firm characteristics such as size, sector and overall propensity to engage in cross-border transactions; and  $\mathbf{X}_c$  is a vector of country-level gravity controls such as GDP and distance to Germany. We study the two external margins of trade by varying the dependent variable:  $Import_{ics}$  is a dummy indicating whether firm  $i$  imports service  $s$  from country  $c$  and  $Export_{ics}$  is a dummy variable indicating whether firm  $i$  exports service  $s$  to country  $c$ . The model is estimated for each of the two trade measures and for each service category separately.

We interpret the coefficients on the three key variables in the following way. First, the coefficient on  $Haven$  measures the average trade of a German firm with a tax haven in which it has no affiliates over and above its trade with an otherwise similar non-haven in which it has no

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<sup>5</sup>Dhamarpala (2014) surveys the empirical literature on profit shifting and concludes that recent studies employing rich firm-level data tend to find less profit shifting than earlier studies.

affiliates. Since trade with non-affiliates cannot reflect profit shifting, this variable captures the genuine specialization of tax havens in the specific service category under examination. Second, the coefficient on *Affiliate* measures the average trade of a German firm with a non-haven in which it has an affiliate over and above its trade with an otherwise similar non-haven in which it has no affiliates. It is natural to interpret this as a measure of trade with non-haven affiliates, but caution is warranted because the presence of a foreign affiliate could also affect trade with non-affiliates. For instance, a foreign affiliate could promote transactions between its German parent and non-affiliates, in which case  $\beta_2$  overestimates affiliate trade, or replace the German parent in transactions with non-affiliates, in which case it underestimates affiliate trade. Finally, the coefficient on the interaction between *Haven* and *Affiliate* measures the average trade of a German firm with a haven in which it has an affiliate over and above its trade with an otherwise similar non-haven in which it has an affiliate after accounting for the genuine specialization of tax havens. This *excess trade* with affiliates in tax havens can be attributed to profit shifting under the identifying assumption that - in a counterfactual world without a profit shifting motive - trade with affiliates in havens and non-havens would only differ to the same extent as trade with non-affiliates in havens and non-havens. Note that even if  $\beta_2$  does not correctly identify trade with non-haven affiliates because of the confounding effect of affiliates on trade with non-affiliates,  $\beta_3$  correctly identifies excess trade with haven affiliates provided that the confounding effect is the same in havens and non-havens.

It should be emphasized that the presence of firm fixed effects in the model implies that the variables of interest are identified exclusively from within-firm comparisons. Effectively, we are comparing a firm's trade with havens to the same firm's trade with non-havens and a firm's trade with countries, in which it has an affiliate, to the same firm's trade with countries, in which it has no affiliates, while holding constant country characteristics such as GDP and distance to Germany.

Moreover, we specify the following model to estimate the excess profitability of tax haven entities selling services to affiliates:

$$Profitability_{ics} = \alpha + \theta_1 Haven_c + \mu_i + \varepsilon_{ics} \quad (2)$$

where  $Profitability_{ics}$  is the book return on equity of an affiliate belonging to firm  $i$  located in country  $c$  from which the firm imports service  $s$ ;  $Haven_c$  is a dummy indicating whether country  $c$  is a tax haven; and  $\mu_i$  are firm-level fixed effects. The book return is winsorized conservatively at the 5% and 95% level. The model is estimated for each service category separately. In each regression, the sample includes all foreign affiliates located in a country from which the German affiliate imports a given service. The fixed effects absorb firm-level differences in profitability, so we are effectively identifying the excess profitability of tax haven entities selling services to their German affiliates by comparing to entities in other countries belonging to the same firm selling the same service to their German affiliates.

Under the hypothesis that multinational firms operate tax haven entities with the purpose of selling mispriced or fictitious services to other affiliates, we should expect: a higher probability of observing imports from affiliates in havens than from affiliates in comparable non-havens ( $\beta_3 > 0$  in the import equation); a lower probability of observing exports to affiliates in havens than to affiliates in comparable non-havens ( $\beta_3 < 0$  in the export equation); and a higher profitability in haven entities selling services to their German affiliates than in non-haven entities selling the same services to their German affiliates ( $\theta_1 > 0$  in the profitability equation).

## 5 Results

### 5.1 Excess trade with haven affiliates

In the first set of regressions, we estimate equation (1) for each of the 11 broad service categories and each of the two trade variables. Firms are included in the sample if they trade the specific service category under investigation from at least one foreign country, which implies that the sample size differs somewhat across service categories. All regressions use a cross-section for the year 2011. Standard errors are clustered at the firm-level unless reported otherwise.

Table 4 reports the results from estimating equation (1) with *Imports* as dependent variable. For the service categories *Information services*, *Intellectual property*, *Other business services*, *Financial services* and *Sea transport*, there is a positive and statistically significant coefficient

on the interaction between *Haven* and *Affiliate* suggesting excess imports from affiliates in tax havens. The point estimates range from just below 1 percentage point to almost 3 percentage points. In the remaining categories the coefficient on the interaction term is indistinguishable from zero, except for *Construction* where the coefficient is significantly negative.

In terms of control variables, there are positive and statistically significant coefficients on *Haven* in all service categories. This suggests that an important part of the reason why firms import more services from affiliates in havens than from comparable affiliates in non-havens is genuine specialization in service industries and highlights the need to control for observed patterns of non-affiliate trade when we attempt to identify affiliate trade driven by profit shifting. Moreover, in all service categories, except *Sea transport*, there are positive and statistically significant coefficients on *Affiliate*, which provides a rough measure of affiliate imports from non-havens (recall the caveat discussed in the previous section). The coefficients on the economic and geographic controls are as expected: imports are more likely when the foreign country is closer, larger and shares a border or an official language with Germany.

To get a sense of the magnitude of affiliate trade driven by profit shifting, it is instructive to compare the coefficients on the interaction between *Haven* and *Affiliate* to those on *Affiliate*. The comparison suggests that excess imports from affiliates in tax havens range from 10% of normal affiliate imports, in *Other business services*, to more than 60%, in *Financial services*.

Table 4 somewhere around here

In Table 5, we report the results from the same model with *Exports* as the dependent variable. In all service categories except *Communication*, *Insurance services* and *Financial services*, there is a negative and statistically significant coefficient on the interaction between *Haven* and *Affiliate* suggesting that there are negative excess exports to affiliates in tax havens. This is consistent with the notion that some tax haven entities simply serve to sell mispriced or fictitious services to other affiliates.

As for the control variables, there are positive and statistically significant coefficients on *Haven* in all service categories. This seems to suggest that local service sectors in tax havens tend to rely on intra-industry inputs from foreign firms. For instance, Germany may have disproportionately large non-affiliate exports of financial services to Luxembourg because the vast financial sector of the latter country relies strongly on financial service inputs, some of which are purchased abroad. Moreover, in all service categories, except *Sea transport*, there are positive and statistically significant coefficients on *Affiliate*, which are suggestive of the magnitude of exports by German firms to affiliates outside tax havens. The coefficients on the economic and geographic controls suggest that exports, just like imports, are more likely when the foreign country is closer, larger and shares a border or an official language with Germany.

Table 5 somewhere around here

In the remainder of the paper, we focus on the extensive import margin due to space constraints and the fact that imports from tax havens provide clearer and more easily interpretable evidence on both specialization and profit shifting.

In Table 6, we split the sample of firms into 3 industrial sectors and provide regression results for each sector separately. Interestingly, the excess imports from affiliates in tax havens is concentrated among manufacturing firms. Here, the interaction between *Haven* and *Affiliate* is positive in more than half of the service categories and the estimated coefficients are considerably larger than in the full sample, both in absolute terms and relative to the coefficient on *Affiliate*. The latter comparison implies that excess affiliate imports approaches or exceeds 100% of normal affiliate imports in the categories *information services*, *communication services*, *intellectual property* and *sea transport*. By contrast, there is little evidence of excess imports from affiliates in tax havens among service firms. The main exception to this broad pattern is financial services where excess imports from tax haven affiliates in the full sample appears to be driven primarily by service firms.

These results are important for two reasons. First, the fact that excess service imports from tax haven affiliates mainly occurs within manufacturers, and thus do not form part of the firms' core operations, lends further credence to the interpretation that these trade flows are motivated by profit shifting rather than the competitiveness of tax haven producers. For example, it seems much more unlikely that textile producers should have disproportionately large imports of advertisement services from tax haven affiliates, for reasons unrelated to profit shifting, than advertising agencies. Second, the results provide additional guidance to the audit decision inside tax authorities by pointing to specific combinations of service categories and industries where the risk of mispriced service trade with tax haven affiliates, and thus the potential gains from audits, are largest.

Table 6 somewhere around here

Finally, in Table 7, we provide regression results for the narrow service categories underlying the broader categories *intellectual property* and *other business services*. These categories are especially interesting in this context, firstly because we have found evidence of trade with tax haven affiliates being skewed toward imports throughout all the specifications and, secondly, because they are both among the broad service categories that contain the most aggregate trade. The coefficients on the interaction term between *Haven* and *Affiliate* indicate that excess imports from affiliates in tax havens are concentrated in trade with *patents* and *trademarks* within *intellectual property*, and in trade with *headquarter services* and *advertising* within *other business services*.

Table 7 somewhere around here

## 5.2 Excess profits of haven affiliates

While the patterns of affiliate trade are consistent with profit shifting to tax havens through the sale of mispriced services, patterns of profitability across foreign affiliates can potentially provide more direct evidence on profit shifting. We therefore estimate equation (2) for each of the 11 broad service categories.

Table 8 shows that tax haven entities selling services to their German affiliates have significantly higher returns than other entities belonging to the same firm and selling the same services to German affiliates in 5 of the service categories. The excess returns range from around 4 percentage points for *Intellectual property* to around 8 percentage points for *Construction*. By comparison, the mean return of non-tax haven entities selling services to German affiliates (reported at the bottom of the table) ranges from around 8 percent to around 15 percent.

Table 8 somewhere around here

The finding that tax haven entities engaged in service trade with affiliates earn excess returns is highly suggestive that these transactions involve a significant element of profit shifting. The regressions, however, do not inform us about the effect of affiliate service trade on the global allocation of profits within the firm.

To shed light on this issue, Figure 2 displays a binned scatterplot of the ratio of tax haven service imports to total service imports against the ratio of tax haven profits to total foreign profits. Each blue dot represents the average ratio of tax haven profits to total foreign profits within a narrow range of ratios of tax haven service imports to total service imports. The figure documents a strong correlation between service trade and the allocation of profits with the firm. Specifically, firms with less than 20% of service imports coming from tax havens on average allocate below 30% of their foreign profits to tax havens whereas firms with 50% or more of service imports coming from tax havens on average allocate around 50% of their foreign profits to tax havens. These results are suggestive that affiliate trade in services is a quantitatively important

channel through which firm profits are shifted to tax havens. Note, however, that these results are identified from between-firm rather than within-firm comparisons and are therefore more likely to be biased by unobserved heterogeneity. For instance, we cannot exclude that firms with large service imports from tax havens are also more aggressive in other modes of tax evasion and that this partly accounts for the large share of their profits realized in tax havens.

Figure 2 somewhere around here

### 5.3 Conduit trade in services

Our analysis may underestimate excess imports from affiliates in tax havens if services are funneled through conduit entities in third countries. Firms may use conduit structures to avoid withholding taxes on royalty payments applying to tax havens but not other countries or to make service charges look more legitimate by letting the provider be affiliates in respectable non-tax havens. Tax motivated conduit structures to eliminate withholding taxes on dividend payments have been analyzed empirically (Mintz and Weichenrieder, 2010) and discussed theoretically in the context of interest payments (Johannesen, 2012) and hybrid financial instruments (Johannesen, 2014).

The main challenge associated with the study of conduit structures in service trade is that while we observe trade flows between Germany and any partner country, we do not observe trade flows between other country pairs. Hence, we are constrained to base our inference on the correlation between trade flows in and out of Germany and the location of foreign affiliates of German firms. We focus on conduit trade flows through the Netherlands, which has anecdotally been linked to conduit flows related to intellectual property (Kleinbard, 2011) and which has been identified as the main conduit country used by German firms for holding purposes by existing academic studies (e.g. Mintz and Weichenrieder, 2010). Specifically, we re-estimate our baseline model while allowing excess imports from affiliates in tax havens to differ between firms

that have an affiliate in the Netherlands and firms that do not. If firms funnel service imports from tax havens through affiliates in the Netherlands, we should expect these firms to have less excess imports directly from tax havens. We apply the model to each of the narrow service categories within *Intellectual property* and *Other business services* where we have consistently found evidence of mispriced trade.

Table 9 reports the results from the baseline specification where the coefficients of interest are interacted with *NL affiliate*, which is a dummy variable indicating whether the firm has an entity in the Netherlands. The coefficient on the interaction between *Haven* and *Affiliates* measures excess imports from tax haven affiliates for firms that are not present in the Netherlands. The point estimates are qualitatively similar to the baseline estimates reported in Table 7, but the estimated effects are larger. The coefficient on the triple interaction between *Haven*, *Affiliate* and *NL affiliate* measures how excess imports from tax haven affiliates differs between firms that are and firms that are not present in the Netherlands. In seven service categories, including *Patents* and *Trademarks* within *Intellectual property* and *Headquarter services* and *Advertising* within *Other business services*, excess imports from tax haven affiliates are significantly smaller when firms have an affiliate in Netherlands. Interestingly, in most of these categories, excess imports from tax haven affiliates are close to zero for firms with a presence in the Netherlands. In none of the service categories are excess imports from tax haven affiliates larger for firms that are present in Netherlands than for those that are not.

Table 9 somewhere around here

## 5.4 Robustness

Table 10 reports two robustness tests of the model estimated above. First, we estimate the baseline specification for imports with a logit model. As shown in Panel A, the results are very similar to the baseline results estimated with a linear probability model (reported in Table 4).

With the logit model, we find excess trade with affiliates in tax havens in the service categories *Information services*, *Intellectual property*, *Other business services*, *Insurance services* and *Financial services*. The main differences are that excess trade with affiliates in tax havens becomes statistically significant for *Insurance services* in the logit model whereas it drops to borderline statistical significance for *Sea transport*.

Table 10 somewhere around here

Second, we add country fixed effects to the baseline linear probability model to account for all country characteristics that affect patterns of service trade. In this specification, the tax haven dummy as well as the country covariates are unidentified, but we can still estimate the excess probability of trade with tax haven affiliates. As shown in Panel B, the results are again very similar to the baseline results. The main difference is that excess trade with affiliates in tax havens becomes statistically significant at the 1% level rather than at the 10% level for *Communication services*.

## 6 Conclusion

This paper has used aggregate trade data for a large number of OECD countries to show that tax havens generally play a prominent role in international trade with service trade and micro data from Germany to explore to what extent this reflect profit shifting by multinational firms through transfer mispricing. We showed that observed patterns in trade, foreign investment and profitability support the notion that affiliate trade in service categories such as *intellectual property* (patents and trademarks), *headquarter services* (administration, management and advertising) and *sea transport* (shipping) serves to shift profits to tax havens. However, we also found evidence that tax havens are genuinely specialized in services, which implies that a naive comparison of affiliate trade flows with havens and comparable non-havens will tend to overstate

excess trade with havens.

While our results confirm the anecdotal evidence that service imports from tax haven affiliates play a role in corporate tax evasion, we argued that the implications for government revenue are likely to be modest. Even under the extreme assumption that all service imports from tax haven affiliates are purely fictitious transactions where the acquired service has no actual value, the implied revenue loss would be around €3 billion or, equivalently, around 7% of the total German corporate tax revenue. Our regression results suggested that excess service imports from haven affiliates are rarely above 100% of normal imports and often much less than that. Taken at face value these results imply that not more than half of the service imports from tax havens are tax motivated and, hence, that the government revenue loss is considerably smaller than the upper bound of €3 billion.

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