



# At your service! The role of tax havens in international trade with services<sup>☆</sup>



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## ABSTRACT

This paper provides the first comprehensive study of profit shifting through 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 profit shifting in service categories such as *intellectual property* (patents and trademarks), *headquarter services* (administration, management and advertising), *information services* (data processing and storage) and *financial services* (investment, lending and money management). In these service categories, trade with affiliates in tax havens is skewed towards imports and the internal service providers in tax havens earn significant excess profits that vary strongly with the value of their internal service sales. These patterns are suggestive that multinational firms operate tax haven entities that sell overpriced services to affiliates in order to erode their taxable profits and reduce the global tax bill. While total service imports from tax havens are very large, our estimates suggest that Germany's loss of government revenue from mispriced service imports from tax havens is relatively modest, less than € 1 billion per year.

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## 1. Introduction

A potentially important mode of tax avoidance—in some cases tax evasion—that has been the subject of very little academic research is mispriced service trade within the multinational firm. Anecdotal evidence suggests that multinational firms operate entities in low tax jurisdictions 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.<sup>1</sup> This service trade can have no or little real substance and serves no other purpose than tax evasion or avoidance. When tax haven entities sell

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<sup>1</sup> For instance, in December 2018, the EU viewed Gibraltar's tax regime for royalties and several advanced pricing agreements as illegal state aid and requested recovering the aid—amounting to about € 100 million—from the beneficiaries. [https://ec.europa.eu/commission/presscorner/detail/en/IP\\_18\\_6889](https://ec.europa.eu/commission/presscorner/detail/en/IP_18_6889). The Amazon case is another example related to intragroup services. In 2017, the EU concluded that the tax ruling that significantly reduced the tax payment

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.<sup>2</sup>

This paper explores the nature of the service trade with tax havens and asks to what extent it reflects profit shifting within multinational firms, providing some of the first empirical evidence specifically on mispricing of intragroup services. We proceed in two steps. First, we use aggregate trade data to document a novel stylized fact: "tax havens"<sup>3</sup> 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 profit shifting 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, some tax havens host some of the largest financial and insurance centers in the world and the competitiveness of these centers ultimately derives from institutions such as secrecy and funds exempt from the income tax; however, they routinely trade services with other firms on global markets and such transactions between non-affiliates cannot reflect profit shifting.

Second, to shed light on the role of taxation in shaping this pattern of service trade, we go beyond aggregate trade statistics and construct a comprehensive firm-level dataset for Germany that contains information about virtually every German firm that engages in service trade and/or foreign direct investment. In particular, 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, allowing us to approximate intra-group trade in a particular service category. While this dataset provides a unique opportunity to analyze profit shifting through mispriced service trade, it is necessary to develop other empirical strategies than those applied by papers on profit shifting through mispriced goods trade (e.g. Cristea and Nguyen, 2016, Davies et al. (2018)). These studies identify profit shifting from variation in the unit prices of traded goods, inferred from information about traded values and quantities; this is extremely challenging (if not impossible) in the context of services, which are inherently uncountable and therefore do not have meaningful unit prices. Instead, we test two implications of the hypothesis that multinational firms shift profits to tax havens through service trade: that service trade with haven affiliates is skewed toward imports and that such imports are associated with high profitability in the haven affiliates.

Our analysis of trade patterns 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 propensity to trade differs between similar non-havens with and without an affiliate and thus approximates affiliate trade propensity with non-havens. The tax haven dummy expresses how a firm's propensity to 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 the propensity to trade with affiliates in havens differs from that with affiliates in non-havens over and above what can be explained by genuine specialization. This *excess propensity to trade* with affiliates in tax havens can be attributed to profit shifting under the identifying assumption that, in a counterfactual state of the world without profit shifting, 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

of a royalty from Amazon EU to Amazon Europe Holding Technologies in Luxembourg as illegal state aid. [https://ec.europa.eu/commission/presscorner/detail/en/IP\\_17\\_3701](https://ec.europa.eu/commission/presscorner/detail/en/IP_17_3701).

<sup>2</sup> Other types of rules targeting tax avoidance by multinational firms are also ineffective in the context of mispriced services: Controlled Foreign Company rules only apply to passive income in tax havens (Clifford, 2019) and Thin Capitalization rules only limit profit shifting through the allocation of debt (Buettner et al., 2012).

<sup>3</sup> The otherwise vague term tax haven is used in this paper to refer to a specific list of jurisdictions used in the literature that is set out in (Hines, 2010). International organizations such as the UN and the IMF do not endorse a list of tax havens.

2.5 percentage points. The finding that trade with affiliates in tax havens is heavily skewed towards imports is suggestive of profit shifting: it is precisely the pattern that should be expected if some firms operate tax haven entities that serve solely to sell mispriced services to affiliates. We find an excess propensity to import from tax haven affiliates in several service categories including *intellectual property* (services related to patents and trademarks), *headquarter services* (such as administration and management), *information services* (such as data processing and storage), *financial services* (services related to investment, lending and money management), and *sea transport* (including passengers and freight transport). In most of these service categories, there is also a negative excess propensity to export to haven affiliates. In some service categories, like *insurance* and *communication*, there is no evidence that tax havens play a distinct role in trade between affiliates.

A particular concern about our empirical design is that identification derives from cross-sectional variation. Although we always compare affiliates belonging to the same multinational firm, we cannot exclude that the results are confounded by unobserved heterogeneity at the affiliate-level. We address this concern by estimating an event-study model that relies exclusively on time variation. We show that the opening of an affiliate in a tax haven is associated with a sharp and persistent increase in the propensity to import services from the haven and a significantly smaller increase in the propensity to export services. The opening of an affiliate in a non-haven is also associated with an increase in the propensity to trade with the country; however, the effect is roughly symmetric across exports and imports. While the smaller sample of firm-country pairs with affiliate openings does not allow us to derive results for specific service categories, the results are important by corroborating, in an empirical framework that accounts for unobserved heterogeneity, that intra-firm service trade with tax havens is skewed towards imports.

Next, we study the *excess profitability* of tax haven affiliates selling services to their German parent directly using two complementary empirical approaches. First, we identify the excess profitability of affiliates in tax havens by comparing their profits per employee to affiliates in non-havens belonging to the same firm and selling the same service to the German parent. In a number of service categories, including *intellectual property*, *headquarter services* and *information services*, affiliates in tax havens earn significant excess profits while in other service categories, including *insurance* and *communication*, we find no evidence that haven affiliates earn higher profits than comparable non-haven affiliates. Second, we identify from a comparison of haven affiliates selling the same service in different amounts to their German parent while exploiting both cross-sectional and temporal variation. Haven affiliates generally have a profit margin of around 5% on their sales whereas the profit margin on intra-firm sales of services is much higher: around 30–35% for sales of *intellectual property*, *headquarter services* and *information services* and close to 100% for *financial services*.

To get a sense of the importance of service trade as a mode of profit shifting, we investigate how patterns of service trade correlate with the overall allocation of profits inside multinational firms. On average, firms with less than 20% of total service imports coming from tax havens realize below 30% of their foreign profits in tax havens whereas firms importing 50% or more from tax havens realize around 50% of their foreign profits in tax havens. This correlation is suggestive that the service trade with tax haven affiliates has a pronounced effect on the allocation of profits within multinational firms, but should be interpreted with caution as it is identified from between-firm comparisons and therefore vulnerable to unobserved firm-level heterogeneity.

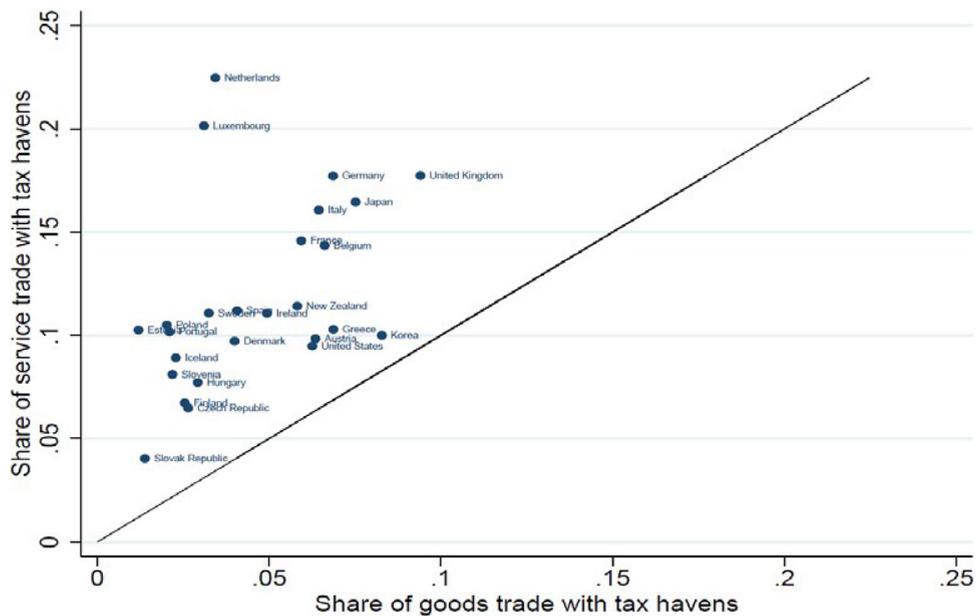
Finally, we draw up the implications for government revenue. This calculation reflects two underlying findings revealed by our detailed micro analysis—which are important to incorporate into the emerging macro-based profit shifting literature that relies on trade statistics (e.g., [Tørsløv et al., 2018](#)). First, about two-third of service imports from tax havens is from unrelated firms. Second, while related-party service trade with tax havens in specific categories—such as intellectual properties and royalties for patents—is associated with profit shifting, the mapping is not one-to-one to the profitability of tax haven affiliates. Overall, around one-quarter of those related-party imports from tax havens reflects mispricing. Thus, while Germany's total service imports from tax havens are large, around € 36 billion in 2011, our results suggest that only around € 3 billion reflect profit shifting. At the German corporate tax rate of 30%, the resulting revenue loss is less than € 1 billion.

Our analysis adds to a large literature that studies other channels of profit shifting to reduce the tax bill of multinational firms. Distinct channels include mispricing of goods ([Clausing, 2003](#); [Bernard et al., 2008](#); [Christea and Nguyen, 2016](#); [Davies et al., 2018](#); [Liu et al., 2019](#)) and the intra-firm allocation of debt ([Desai et al., 2004](#); [Huizinga and Laeven, 2008](#)); business risk ([Becker et al., 2018](#)) and the location of the stock of the stock of intangible assets ([Grubert, 1998](#); [Dieschinger and Riedel, 2011](#); [Karkinsky and Riedel, 2012](#)).<sup>4</sup> Our paper provides the first evidence on profit shifting through intra-firm trade in business services and complements the existing evidence on profit shifting through the allocation of intangible assets by looking directly at intra-firm flows of income (royalties) rather than stocks of assets (patents and trademarks).<sup>5</sup>

Our findings also 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, partner countries and service categories where the risk of mispricing, and thus the potential gains from increasing the audit probability, is especially large.

<sup>4</sup> [Overesch \(2006\)](#) uses the same German foreign affiliate data to show that intra-firm trade (measured as accounts receivable from the parent company on the balance sheet) responds to profit shifting incentives.

<sup>5</sup> Moreover, the paper contributes to the literature studying the use of tax havens by firms ([Zucman, 2014](#); [Bennedsen and Zeume, 2018](#); [Hebous and Lipatov, 2014](#); [Hines and Rice, 1994](#); [Huizinga and Laeven, 2008](#); [Heckemayer and Overesch, 2017](#); [Johannesen et al., 2016](#); [Desai et al., 2006](#)); by wealthy individuals ([Alstadsæter et al., 2019](#); [Hanlon et al., 2015](#); [Omartian, 2017](#); [Zucman, 2013, 2014](#)); and by self-serving political elites ([Andersen et al., 2017, 2019](#)).



**Fig. 1.** Tax haven shares in service and goods trade Note: The figure plots the share of tax havens in goods trade against the share of tax havens in service trade for 26 OECD countries for which bilateral service trade data is available. The black line is the 45-degree line. Source: OECD trade data statistics. The list of tax havens is taken from [Hines \(2010\)](#).

The paper proceeds as follows. [Section 2](#) studies trade with tax havens using aggregate data. [Section 3](#) describes the firm-level data. [Section 4](#) discusses the empirical strategy. [Sections 5](#) and [6](#) report the results. [Section 7](#) quantifies tax revenue losses and [Section 8](#) concludes.

## 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. The list of tax havens is taken from [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. Throughout the paper, we choose to rely on the binary tax haven indicator rather than a continuous tax rate variable because of the difficulties associated with measurement of effective taxation in tax havens. Corporate taxation in tax havens often involves an element of ring-fencing whereby a relatively high headline rate is applied to profits from the domestic economy and much lower rates can be achieved on profits shifted from foreign locations. The lower rate for foreign firms is sometimes explicit, but is often negotiated on a case-by-case basis with local tax authorities and therefore not observable to the researcher.<sup>6</sup>

As shown in [Fig. 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.

In a second step, we quantify the extent to which trade with tax havens exceeds trade with comparable non-haven countries by estimating a gravity model augmented with a tax haven indicator:

$$\log(\text{Trade}_{ij}) = \alpha_0 + \alpha_1 \log(\text{GDP}_{ij}) + \alpha_2 \log(\text{Distance}_{ij}) + \alpha_3 \text{Haven}_{ij} + \alpha_4 \text{Controls} + \varepsilon_{ij}, \quad (1)$$

where  $\text{Trade}_{ij}$  is the total trade (sum of imports and exports) between country  $i$  and  $j$  in either services or goods depending on the specification;  $\text{GDP}_{ij}$  is the product of the gross domestic product in the two trading countries;  $\text{Distance}_{ij}$  is the

<sup>6</sup> A case in point is Luxembourg, which had a statutory tax rate of around 30% during our sample period, moderately high by international standards, but at the same time negotiated advance tax agreements with multinational firms that eliminated almost all taxation on mobile profits. A large number of the advance tax agreements were published in the so-called *Lux Leaks* and the specific tax arrangements used to reduce the effective tax rate are described in the academic paper by [Hardeck and Wittenstein \(2018\)](#). The discrepancy between observed headline tax rates and unobserved (and heterogeneous) effective tax rates is very common in tax havens and makes it difficult to exploit variation in tax rates in the context of tax havens.

**Table 1**  
Gravity model of aggregate trade flows.

	Trade		Import		Export			
	(1) Services	(2) Goods	(3) Services	(4) Goods	(5) Services	(6) Goods	(7) Services	(8) Goods
Haven	1.79*** (0.25)	0.15 (0.17)			1.81*** (0.25)	0.12 (0.25)	1.56*** (0.25)	0.60*** (0.20)
One haven			1.67*** (0.23)	0.14 (0.17)				
Two havens			4.21*** (0.61)	0.26 (0.50)				
Product of GDP (in logs)	0.96*** (0.04)	1.03*** (0.03)	0.97*** (0.04)	1.03*** (0.03)	0.91*** (0.05)	1.19*** (0.05)	0.92*** (0.06)	0.97*** (0.04)
Distance (in logs)	-0.82*** (0.10)	-0.93*** (0.08)	-0.82*** (0.10)	-0.93*** (0.08)	-0.87*** (0.11)	-0.91*** (0.10)	-0.84*** (0.12)	-1.02*** (0.09)
Contiguity	0.10 (0.33)	0.52** (0.22)	0.14 (0.32)	0.52** (0.22)	0.23 (0.32)	0.60** (0.27)	0.33 (0.38)	0.57** (0.26)
Common language (official)	1.54*** (0.33)	0.86*** (0.20)	1.48*** (0.36)	0.86*** (0.21)	1.79*** (0.23)	0.74*** (0.25)	2.02*** (0.27)	0.84*** (0.23)
Same country	1.18*** (0.38)	1.02*** (0.33)	1.20*** (0.38)	1.02*** (0.33)	1.18*** (0.38)	1.61*** (0.42)	0.94*** (0.36)	0.97*** (0.35)
Constant	-39.36*** (2.03)	-40.39*** (1.88)	-39.89*** (2.04)	-40.40*** (1.89)	-37.34*** (2.66)	-50.40*** (2.83)	-37.61*** (2.97)	-37.41*** (2.04)
Observations	3,335	4,208	3,335	4,208	2,934	4,470	3,073	4,768
R2	0.73	0.78	0.74	0.78	0.68	0.67	0.67	0.74

Note: "Haven" is a dummy coded one if at least one of the two countries is on the tax haven list of Hines (2010); "One haven" is a dummy coded one if precisely one of the two countries is on the tax haven list of Hines (2010); "Two havens" is a dummy coded one if both countries is on the tax haven list of Hines (2010); "Product of GDP (in logs)" is the log of the product of the Gross Domestic Product of the two countries; "Distance (in logs)" is the log of the geodesic distance between the most important city in each of the two countries; "Contiguity" is a dummy coded one if the two countries share a border; "Common language" is a dummy coded one if the two countries share an official language; "Same country" is a dummy coded one if the two countries have been part of the same country. Trade information is from OECD Trade Statistics; GDP is from World Development Indicators supplemented with information from the CIA World Factbook; All other variables are from the CEPII database. Standard errors clustered at the level of the reporting country and the partner country in parentheses: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

distance between the most important city in the two trading countries;  $Haven_{ij}$  is an indicator that either country  $i$  or  $j$  (or both) is a tax haven; and  $Controls_{ij}$  is a set of bilateral controls for having the same language, sharing a border and having been part of the same country.

The results are reported in Table 1. 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.

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>7</sup>

Distinguishing between imports and exports in Eq. (1) also largely suggests that tax havens are particularly important for trade in services—both imports and exports—compared to goods. In the case of import of goods from tax havens, the coeffi-

<sup>7</sup> The role of chains of entities is studied empirically by Mintz and Weichenrieder (2010) and Lewellen and Robinson (2013).

cient is insignificant. In the case of export of goods, it is positive and significant (contrary to the expected qualitative sign of under-pricing exports to tax havens), but remains lower than the estimates for export of services to tax havens. In contrast, the coefficient on import of services from tax havens is positive—and larger than that on export of services—broadly in line with profit shifting practices. However, this gravity exercise and aggregate trade statistics generally do not allow us to disentangle clear evidence on tax-motivated trade using services because the requirement to i) distinguish between related- and unrelated-party trade; and ii) analyze heterogeneity across service categories (e.g., many tax havens are important tourism destinations leading to high exports of travel and tourism services). While aggregation can potentially mask profit shifting for both goods and services, the question remains as to what explains the disproportionate role of tax havens in service trade.

Thus, this gravity exercise and aggregate trade statistics point to a stylized fact that tax havens play a prominent role in international service trade, and open important avenues for further research to explore the underlying drivers. While there can be several factors that explain the observed pattern of international trade in services (including comparative advantages or other potential theories), in this study, we are interested in exploring the role of taxation. 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 cross-border service trade from the *Statistics on International Trade in Services* (SITS) collected for the purposes of the balance of payments statistics. In this dataset, for each German resident firm, we observe the value of its cross-border imports and exports of services by counterpart country and service category including transport, management services, and R&D.<sup>8</sup> The database is available at a monthly frequency. For each firm-service category, we aggregate the monthly values at the annual level. The data spans through 2001–2011. The cross section analysis uses the last available year (2011) whereas the analysis that requires time variation employs the entire data.

Second, we use information on foreign affiliates from the *Microdatabase Direct Investment (MiDi)*. In this dataset, for each German resident firm, we observe the basic characteristics of its foreign affiliates such as turnover, profits, equity, and the host country. The MiDi contains information on both inward and outward stock of FDI. A particularly valuable feature of the data is that the information is available for both directly and indirectly owned subsidiaries. We merge both directions of FDI (inward and outward) to identify the location of the ultimate parent company in the case of an investment that is channeled through Germany—i.e., the ultimate owner, say, in country A (henceforth we call it “parent”) that owns an affiliate in Germany, which in turn owns an affiliate in country B (henceforth we call it “subsidiary”).

We merge the trade and MiDi data using the numeric identifier of the German reporting party to obtain a firm-level dataset on service trade and foreign affiliates, and then augment it with country-level variables such as GDP (from World Development Indicators complemented with CIA factbook), tax haven status (from [Hines, 2010](#)), distance to Germany and shared language with Germany (from the CEPII database).

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, or if the size of the trading partner is below the threshold that triggers the reporting requirement.<sup>9</sup> Under these caveats, henceforth, we refer to matched MiDi-SITS observations as affiliates trade, and if considered separately on the outward or inward side as subsidiary trade and parent trade, respectively. We refer to unmatched observations as third-party trade.

Note that apart of the service category, we do not observe a “unit” of the traded service, in part reflecting the difficulty of measuring quantity units of services. Typical examples of important intra-group services include a “pooling” arrangement of the sort that one affiliate performs a task “for the entire group”—for instance, marketing activities, legal ownership of the brand or know-how assets, developing a group HR strategy, or maintaining IT and software, to name a few. Yet, it is not clear what the unit and the “correct” value are (cost per unit) that should be attributed for each affiliate, which is exactly what makes services generally more prone to mispricing practices. Moreover, a quantity unit of the same service would not be directly comparable across different groups even in the case of third-party trade (e.g., how comparable is the quantity unit for the selling of a marketing strategy whether to a related or unrelated party?).<sup>10</sup> Our analysis, below, of the descriptive statistics and identification strategies does not rely on a quantity price circumventing the general challenge of analyzing services in any data.

<sup>8</sup> The data cover all transactions exceeding € 12,500 on accrual basis. For a full description of the service trade data, See [Biewen et al. \(2013\)](#).

<sup>9</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 MiDi data, see [Lipponer \(2011\)](#).

<sup>10</sup> Some specific services can have a defined unit price, e.g., per hour. Still, within a narrow definition of services an hour can be a very different thing depending on the exact provided service (e.g., an hour of an IT expert to resolve an outlook issue versus an hour of an IT expert to deal with the most specialized company-specific internal software).

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 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 aggregates bound the magnitude of profit shifting to tax havens through imports of mispriced 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. In Section 7, we combine the aggregate statistics with our estimates of the share of service imports from tax havens that represent profit shifting to produce a more credible estimate of the revenue loss.

#### 4. Illustrative framework

Before we present our empirical identification approach, for illustration, consider a parent company (in country  $G$ , for instance Germany) and a wholly-owned affiliate in a tax haven ( $H$ ). The after-tax profit of the multinational group ( $\pi$ ) is:

$$\pi = (1 - \tau^G)\pi^G + (1 - \tau^H)\pi^H, \quad (2)$$

where  $\tau^G$  and  $\tau^H$  are corporate tax rates applied to profits in  $G$  and  $H$  respectively with  $\tau^G > \tau^H$ . Let  $p_{intra}^s$  be the price charged on  $G$ 's import of a (related-party) service category  $s$  from  $H$ —which in the absence of profit shifting is equal to the comparable unrelated party (CUP) price  $P_{CUP}$ , and  $Q$  denotes quantity. Generally, the profits in each country are a function of costs, sales to unrelated parties at price  $P_{CUP}$ , as well as  $P_{intra}^s$ :

$$\pi^H = f(\underbrace{P_{intra}^s Q_{intra}^s}_{+}, Cost, P_{CUP} Q^{other}) \quad \text{and} \quad \pi^G = f(\underbrace{P_{intra}^s Q^s}_{-}, Cost, P_{CUP} Q^{other}). \quad (3)$$

This simple framework illustrates how mispricing of intra-firm service trade affects global after-tax profits of the multinational group. To the extent  $p_{intra}^s$  deviates upward from the  $P_{CUP}$  (i.e.  $p_{intra}^s > P_{CUP}$ ), more service imports (i.e. higher  $Q^s$ ) implies higher revenues in  $H$  (hence higher  $\pi^H$ ) and higher costs in  $G$  (hence lower  $\pi^G$ ). This profit shifting from  $G$  to  $H$  raises global after-tax profits because of the tax differential. For exports, the image is reversed: profits are shifted from  $G$  to  $H$  when the price applying to service exports from the parent to the haven affiliate is below the price charged to unrelated parties (i.e.  $p_{intra}^s < P_{CUP}$ ). The CUP is generally more difficult to determine in the case of services as compared to goods, leaving more leeway for multinationals to defend a wide range of transfer prices. This leeway may, however, depend significantly on the type of service, which highlights the need to go beyond aggregate service trade and study different service categories separately.

Ideally, the empirical analysis would analyze  $P_{intra}^s$  and  $Q_{intra}^s$  separately. For instance, showing that  $P_{intra}^s$  differs across affiliates in havens and non-havens would represent strong evidence of tax-motivated mispricing of service trade in line with recent papers on intra-firm goods trade (e.g., Cristea and Nguyen, 2016; Davies et al. (2018)). However, this approach is not feasible in the context of services because statistics on service trade, unlike those on goods trade, generally do not include information on quantities, which makes it impossible to infer unit prices. This is no coincidence, but follows from the fact that many services are inherently uncountable. In the empirical analysis, we therefore study the two variables that we do observe in the two data sources at our disposal: service trade values  $P_{intra}^s Q_{intra}^s$  from the service trade statistics (in Section 5) and affiliate-level profits  $\pi^G$  and  $\pi^H$  from the foreign investment statistics (in Section 6).

**Table 2**  
Summary statistics for broad service groups (€ million).

	Business Services					Financial services		Transport services				Total
	Construction	Information	Communication	Intellectual property	Other business	Insurance	Financial	Air	Sea	Road	Inland water	
<b>Total imports</b>	<b>5,479</b>	<b>11,717</b>	<b>5,491</b>	<b>14,462</b>	<b>39,492</b>	<b>7,362</b>	<b>6,826</b>	<b>20,895</b>	<b>18,343</b>	<b>12,662</b>	<b>5,415</b>	<b>2,47,170</b>
- from tax havens	452	3,418	893	1,893	7,371	3,314	2,010	1,579	4,419	1,236	535	36,734
- subsidiaries	74	753	145	543	1,957	1,025	1,126	444	565	314	4	8,640
- parent	18	190	38	537	763	357	111	7	551	32	1	2,912
- third parties	359	2,475	710	812	4,651	1,932	774	1,129	3,303	890	530	25,182
- from other countries	5,027	8,298	4,599	12,570	32,121	4,048	4,815	19,316	13,924	824	4,880	2,10,436
- subsidiaries	1,469	3,256	963	3,371	10,889	857	2,996	9,185	4,484	318	254	66,371
- parent	110	1,509	1,270	3,346	4,094	489	336	665	707	10	325	15,904
- third parties	3,448	3,534	2,365	5,853	17,139	2,702	1,483	9,466	8,733	497	4,301	1,28,160
<b>Total exports</b>	<b>8,950</b>	<b>13,915</b>	<b>4,101</b>	<b>20,031</b>	<b>31,443</b>	<b>24,711</b>	<b>10,554</b>	<b>13,412</b>	<b>26,931</b>	<b>855</b>	<b>458</b>	<b>2,21,077</b>
- to tax havens	667	1,671	853	2,592	8,341	2,607	3,517	888	4,706	31	64	40,094
- subsidiaries	108	564	103	619	762	1,345	1,878	400	247	8	0	6,939
- parent	28	148	10	815	450	283	135	0	15	0	0	3,434
- third parties	531	959	739	1,159	7,129	979	1,503	488	4,443	23	64	29,722
- to other countries	8,283	12,244	3,248	17,439	23,102	22,104	7,037	12,524	22,226	11,426	395	1,80,982
- subsidiaries	2,577	7,550	566	5,092	4,910	17,112	2,525	9,771	6,025	1,754	39	61,379
- parent	322	1,012	864	4,088	3,577	809	1,060	11	613	514	4	15,964
- third parties	5,384	3,681	1,818	8,259	14,615	4,183	3,453	2,742	15,588	9,158	352	1,03,639

Source: Microdatabase Statistics on International Trade in Service 2011, Deutsche Bundesbank and Microdatabase Direct Investment 2011, Deutsche Bundesbank, own calculations. The table does not include the following service categories where total trade is below €5 billion: Repairs, Personnel services, Rail transport and Transport by pipeline and electricity transmission. It also omits the residual category Other services. The aggregation of service categories follows the definitions of the Deutsche Bundesbank provided by Biewen et al. (2013) except that we have formed the aggregate category Intellectual Property as the sum of Artistic copyrights (501), Patents (502), Trademarks (503) and Research and Development (511). In Insurance, we only include insurance premiums and not transfers settling claims. The reported categories do not sum to Total because of the omitted categories and the omission of transfers settling claims in Insurance. The list of tax havens is taken from Hines (2010).

**Table 3**

Summary statistics for narrow service groups (€ million).

	Intellectual Property			Other business services						
	Patents	Trademarks	Research & Development	Technical services	Headquarter services	Commission fees	Subsidies	Overhead expenses	Advertising	Operational leasing
<b>Total imports</b>	<b>4,561</b>	<b>1,722</b>	<b>7,679</b>	<b>8,860</b>	<b>15,101</b>	<b>5,237</b>	<b>2,602</b>	<b>461</b>	<b>4,559</b>	<b>2,283</b>
- from tax havens	584	474	799	1,141	2,990	879	185	27	1,133	968
- subsidiaries	94	47	402	412	780	210	91	1	172	288
- parent	229	205	102	35	506	41	2	23	139	16
- third parties	261	222	295	693	1,704	627	92	4	821	664
- from other countries	3,977	1,248	6,880	7,719	12,111	4,359	2,417	434	3,426	1,315
- subsidiaries	598	185	2,581	3,307	3,198	1,245	1,317	5	1,336	455
- parent	2,384	447	486	620	2,732	141	69	301	132	94
- third parties	995	616	3,813	3,792	6,181	2,973	1,031	127	1,957	766
<b>Total exports</b>	<b>6,647</b>	<b>2,072</b>	<b>11,072</b>	<b>9,887</b>	<b>11,060</b>	<b>2,290</b>	<b>904</b>	<b>1,242</b>	<b>3,990</b>	<b>1,730</b>
- to tax havens	803	186	1,549	1,930	2,753	1,288	112	174	1,699	321
- subsidiaries	337	21	260	176	201	63	4	154	143	17
- parent	187	27	601	60	298	29	26	0	24	11
- third parties	279	138	688	1,693	2,254	1,196	82	20	1,531	292
- to other countries	5,843	1,886	9,524	7,957	8,306	1,002	792	1,068	2,291	1,409
- subsidiaries	2,303	668	2,121	1,777	1,521	226	42	884	205	242
- parent	332	161	3,587	1,016	1,841	161	187	36	249	80
- third parties	3,208	1,057	3,816	5,164	4,945	615	563	148	1,838	1,086

Source: Microdatabase Statistics on International Trade in Service 2011, Deutsche Bundesbank and Microdatabase Direct Investment 2011, Deutsche Bundesbank, own calculations. The table does not include the following service categories where total trade is below €1 billion: *Artistic copyrights*, *Payments for entrepreneurial work* and *Disposal services*. The category *Headquarter services* is referred to as *Commercial, organisational and administrative services* in the official nomenclature. The list of tax havens is taken from Hines (2010).

## 5. Micro-analysis: excess propensity to trade

### 5.1. Empirical framework

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

$$Trade_{ics} = \alpha_i + \beta_1 Haven_c + \beta_2 Affiliate_{ic} + \beta_3 (Affiliate_{ic} \times Haven_c) + \theta \mathbf{X}_c + \omega_{ics}, \quad (4)$$

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;  $\alpha_i$  are firm-level fixed effects that absorb all firm unobserved 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 likelihood of trade between a German firm and a tax haven in which there is no affiliate over and above the trade likelihood—in the same service category—with otherwise a similar non-haven, also without the presence of 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 likelihood of trade between a German firm and a non-haven in which there is an affiliate over and above the likelihood of trade—in the same service category—with an otherwise similar non-haven but without the presence of any affiliate. It is natural to interpret this as a measure of trade with non-haven affiliates.<sup>11</sup> Finally, the coefficient on the interaction between  $Haven$  and  $Affiliate$  measures the likelihood of trade between a German firm and a haven in which there is an affiliate over and above the likelihood to trade with an otherwise similar non-haven in which it has an affiliate, after accounting for the genuine specialization of tax havens. This *excess propensity to 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.<sup>12</sup>

Ultimately, we are interested in the marginal effects. Compared to a conditional logit model, the linear probability model (LPM) has the advantage of consistently estimating the marginal effects while taking into account the estimates of the fixed effects and circumventing the logit complications of evaluating marginal effects for the interaction term. For robustness, we estimate a version of Eq. (4) that includes country fixed effects in addition to firm fixed effects. This specification captures all country-specific characteristics—such as EU membership, trade agreements, and the heaven status—, and hence we focus only on the interaction term measuring excess propensity to trade (i.e., the coefficient  $\beta_1$  becomes nested in the set of country fixed effects).

Studying the extensive margin of trade in the context of profit shifting through service trade is particularly important for two main reasons. First, the statistics in Tables 2 and 3 revealed that large amounts of trade in various service categories (including those that are anecdotally associated with profit shifting) are not with related-parties and not with tax havens. These observations suggest that the extensive margin is a crucial component of the evidence on tax avoidance calling for estimating—at the firm level—whether or not there is a significant difference in the probabilities of trade with havens depending on the presence of affiliates. This is precisely what  $\beta_3$  in Eq. (4) gives us—the excess propensity to trade. Second, trade is concentrated within a few firms trading large values and many firms not trading at all in some services.<sup>13</sup> Thus, looking only at the intensive margin would exclude a large number of observations with the value of zero, thereby compromising valuable information for the analysis (because these observation have meanings as discussed above). This potentially leads to severely biased results due to selection on the extensive margin.<sup>14</sup>

Moreover, explaining variation in the intensive margin of trade over time, in connection to tax avoidance, requires significant country-level variation in the taxation of profits *over time*. Recall, there is little variation in tax rates over time especially for tax havens. Additionally, in many tax havens, preferential tax treatments with publicly unknown details have played a key role in profit shifting arrangements. For example, one mode of providing a preferential tax treatment is an advanced pricing agreement (APA) between tax authorities and specific taxpayers, which offers the latter not only a tax

<sup>11</sup> Some 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.

<sup>12</sup> 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. Also, note that to the extent that comparative advantages i) exist only for intra-firm trade, ii) at the same time exist for affiliates in tax havens (but only tax havens), and iii) are totally unrelated to low taxation of profits in tax havens, our identifying assumption will be weakened. However, there is no evidence suggesting that this is a common possibility.

<sup>13</sup> See Biewen et al. (2013). The high concentration of firm trade is not only observed in Germany but also in other countries (Bernard et al., 2018).

<sup>14</sup> While a poisson model can perform well in macro-data—typically with a moderate number of zeroes reflecting country-pairs not trading with each other (Silva and Tenreyro, 2006)—, we are not aware of papers that have applied this estimator (or analyzed its properties) in the context of micro-data with large sets of zeros, fixed effects, and a computationally demanding structure.

deal but also tax certainty during the period of the agreement (i.e., the tax treatment of the arrangement will not change over the time of the agreement, which is typically several years). This does not only complicate the reliance on changes in tax rates over time but also the choice of the tax rate itself, which is often not directly observed (because of APAs or possibly other preferential tax treatments) and is ultimately very low for foreign firms in tax havens offering extremely little variation even cross-sectionally. Still, studying the intensive margin of service trade remains an important avenue for future research.

Although the cross-sectional model in Eq. (4) compares affiliates belonging to the same multinational firm that are trading the same service, we cannot exclude that potentially the results could be confounded by unobserved heterogeneity at the affiliate-level. We address this concern by designing an event-study that relies on time-variation within a multinational firm. In particular, we estimate the following model identified exclusively from time variation:

$$Trade_{ict} = \mu_{ic} + \gamma_{ct} + \sum_{\tau} \phi_{\tau} Eventtime_{ic\tau} + \varepsilon_{ict}, \quad (5)$$

where  $Trade_{ict}$  is a measure of trade in services between firm  $i$  and country  $c$  in year  $t$ ;  $\mu_{ic}$  is a set of country-firm fixed effects that absorbs all cross-sectional variation;  $\gamma_{ct}$  is a set of country-year fixed effects that absorbs all country-level shocks (the equivalent of the country fixed effects in the cross-sectional specification). The main variables of interest are  $Eventtime_{ic\tau}$  indicating year  $\tau$  relative to the year in which firm  $i$  opens an affiliate in country  $c$ . The estimating sample is limited to firm-country combinations where the firm opens their first affiliate in the country at some point during the period 2001–2011. We estimate the model separately for havens and non-havens and with two different outcomes:  $Import_{ict}$ , a dummy indicating whether firm  $i$  imports services from country  $c$  in year  $t$ , and  $Export_{ict}$ , a dummy variable indicating whether firm  $i$  exports services to country  $c$  in year  $t$ .

## 5.2. Main results

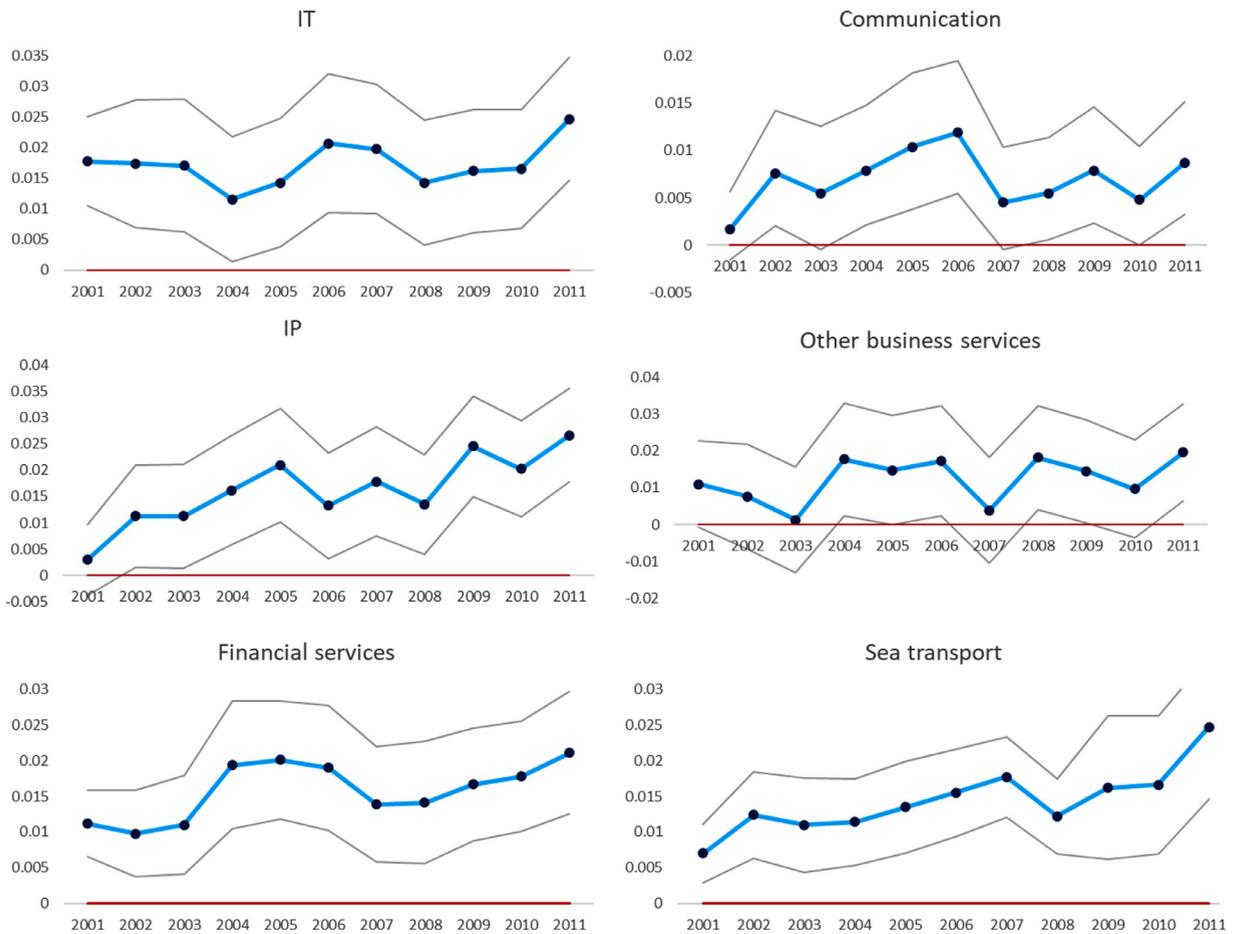
In the first set of regressions, we estimate equation (4) for each of the 11 broad service categories and each of the two trade variables. Firms are included in the sample if they trade the specific service category under investigation from at least one foreign country, which implies that the sample size differs 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 first reports the results from estimating Eq. (5) with *Imports* as dependent variable in Panel A. 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. 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 the excess propensity to import from affiliates in tax havens ranges from 10% of the baseline propensity, in *Other business services*, to more than 60%, in *Financial services*. The results remain qualitatively unchanged when we add country fixed effects in Panel B.

In Table 5, we report the results from the baseline specification with *Exports* as the dependent variable in Panel A. 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 is a negative excess propensity to export to affiliates in tax havens. This is consistent with the notion that some tax haven entities serve profit shifting purposes through mispriced service sales to 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. Again, the results remain qualitatively unchanged when we add country fixed effects in Panel B.



**Fig. 2.** Repeated cross-section estimation Note: The plots display the estimated coefficients on the interaction term *aven Affiliate* from repeated cross-sectional (2001–2011) OLS estimation with firm and country fixed effects including all controls exactly as in Table 4. The dependent variable is "Import" which is a dummy coded one if the German firm imports the service from the foreign country; "Haven" is a dummy coded one if the foreign country is on the tax haven list of Hines (2010); "Affiliate" is a dummy coded one if the German firm has a subsidiary or a parent in the foreign country. The gray lines represent the confidence bands based on: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

### 5.3. Time dimension

**Repeated cross-section:** We estimate specification 4 for each year during 2001–2011. Fig. 2 presents estimates of the coefficient on the interaction between *Haven* and *Affiliate* for the six service categories that, based on the main results, are found to exhibit excess propensity to import from haven-affiliates. Fig. 2 reveals that these services show excess propensity to import from haven-affiliates throughout the sample period, with the interaction term being significant in most years and showing an upward trend for *IP* services, *financial services* (both with the magnitude of the coefficients doubled between 2001 and 2011), and *sea transport* (for which the coefficient quadruples between 2001 and 2011). Estimates for *IT*, *communication*, and *other business services* show no clear trend over time, but remain significant and close to the benchmark results. The remaining services, as in the benchmark results, show no significantly different trade patterns with haven affiliates during the entire sample period, except for insurance services which, interestingly, were exhibiting excess propensity to trade with haven affiliates in the last decade until the global financial crisis (results are in the appendix). On the export side, estimates are also consistent with those in Table 5 (results are not reported).

**Event study:** The results from the event study specification (5), illustrated in Figs. 3 and 4, are in line with the main finding from the cross-sectional model that trade with affiliates in tax havens is skewed towards imports. When a multinational firm opens an affiliate in a haven, the propensity that the German parent imports services from the haven increases sharply by around 5 percentage points and persists at this higher level for all the seven years that the time dimension of our dataset allows us to estimate the effect. The propensity to export to the tax haven also increases, but only by around 2 percentage points. The difference remains throughout the event window. By comparison, when a multinational firm opens an affiliate in a non-haven, the propensity to import and export services to the non-haven increases by roughly the same

**Table 4**  
Imports.

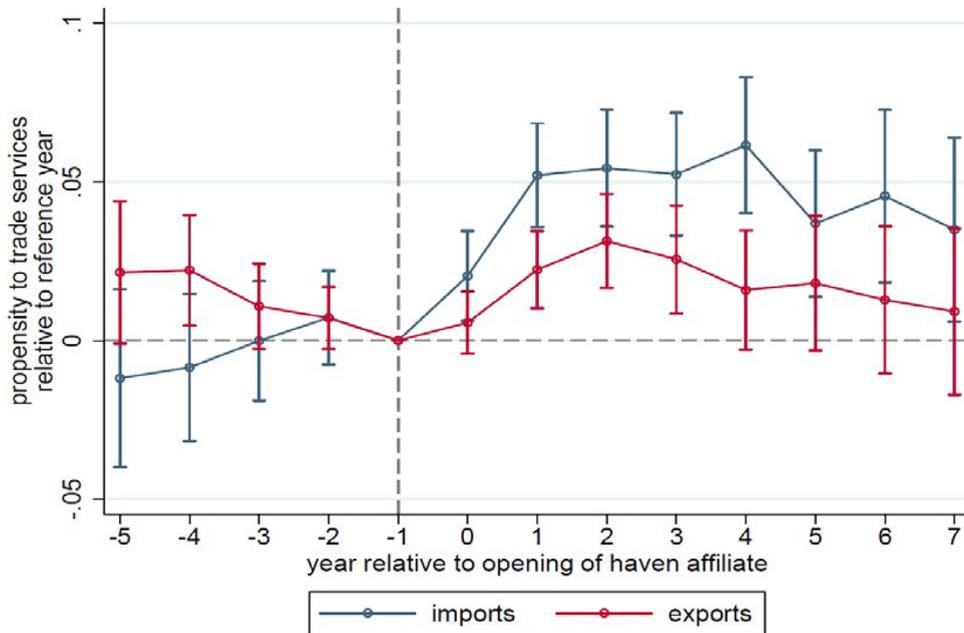
	Business Services					Financial services		Transport services			
	Construction	Information	Communication	Intellectual property	Other business	Insurance	Financial	Air	Sea	Road	Inland water
<b>Panel A: country covariates</b>											
Haven	0.001*** (0.000)	0.005*** (0.000)	0.001*** (0.000)	0.003*** (0.000)	0.009*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.013*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Affiliate	0.014*** (0.003)	0.056*** (0.004)	0.014*** (0.002)	0.050*** (0.004)	0.193*** (0.006)	0.026*** (0.002)	0.023*** (0.002)	0.006*** (0.002)	-0.013*** (0.002)	0.026*** (0.003)	0.004*** (0.001)
Haven × Affiliate	-0.008*** (0.003)	0.028*** (0.006)	0.005* (0.003)	0.025*** (0.005)	0.023*** (0.008)	-0.002 (0.004)	0.020*** (0.005)	0.000 (0.003)	0.009*** (0.003)	-0.004 (0.004)	-0.002 (0.002)
Distance (log)	-0.001*** (0.000)	-0.003*** (0.000)	-0.001*** (0.000)	-0.002*** (0.000)	-0.003*** (0.000)	-0.002*** (0.000)	-0.001*** (0.000)	-0.000*** (0.000)	-0.005*** (0.000)	-0.004*** (0.000)	-0.001*** (0.000)
GDP (log)	0.001*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.006*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.005*** (0.000)	0.002*** (0.000)	0.001*** (0.000)
Contiguity	0.018*** (0.001)	0.010*** (0.001)	0.002*** (0.001)	0.016*** (0.001)	0.039*** (0.001)	0.004*** (0.001)	0.003*** (0.001)	0.007*** (0.001)	0.037*** (0.001)	0.037*** (0.001)	0.011*** (0.001)
Common language	0.007*** (0.001)	0.022*** (0.001)	0.006*** (0.001)	0.011*** (0.001)	0.027*** (0.001)	0.006*** (0.001)	0.014*** (0.001)	0.001 (0.001)	-0.039*** (0.001)	0.001 (0.001)	0.000 (0.001)
R-squared	0.014	0.029	0.008	0.025	0.058	0.013	0.014	0.007	0.026	0.029	0.008
<b>Panel B: country fixed effects</b>											
Affiliate	0.0084*** (0.0026)	0.0392*** (0.0037)	0.0060*** (0.0016)	0.0322*** (0.0037)	0.1604*** (0.0058)	0.0204*** (0.0017)	0.0175*** (0.0021)	0.0002 (0.0017)	-0.0351*** (0.0021)	0.0135*** (0.0031)	-0.0004 (0.0011)
Haven × Affiliate	-0.0064** (0.0032)	0.0246*** (0.0061)	0.0087*** (0.0033)	0.0266*** (0.0054)	0.0194** (0.0080)	0.0002 (0.0041)	0.0212*** (0.0052)	0.0030 (0.0027)	0.0216*** (0.0034)	0.0045 (0.0044)	0.0005 (0.0025)
R-squared	0.020	0.059	0.021	0.047	0.087	0.028	0.024	0.012	0.058	0.040	0.012
Observations	1,746,694	2,131,672	1,491,000	1,951,488	4,541,160	1,656,277	1,707,800	1,527,200	2,017,405	1,884,000	1,488,950
Number of firms	8,647	10,988	7,455	9,856	22,152	7,942	8,539	7,636	9,841	9,420	7,675

Note: The table reports the results from OLS regressions with firm fixed effects for the year 2011. The dependent variable is "Import" which is a dummy coded one if the German firm imports the service from the foreign country; "Haven" is a dummy coded one if the foreign country is on the tax haven list of Hines (2010); "Affiliate" is a dummy coded one if the German firm has a subsidiary or a parent in the foreign country; "GDP (in logs)" is the log of the Gross Domestic Product of the foreign country; "Distance (in logs)" is the log of the geodesic distance between Berlin and the most important city of the foreign country; "Contiguity" is a dummy coded one if the foreign country shares a border with Germany; "Common language" is a dummy coded one if the foreign country has German as official language. Trade information is from Statistics on International Trade in Service (SITS) provided by the Deutsche Bundesbank (see Biewen et al., 2013); Affiliate information is from Microdatabase Direct Investment (MiDi) provided by the Deutsche Bundesbank (see Lipponer, 2011); GDP is from World Development Indicators supplemented with information from the CIA World Factbook; All other variables are from the CEPII database. The regressions in Panel B differ from those in Panel A by including country fixed effects. Standard errors clustered at the firm-level in parentheses (\*\*\*) p<0.01, \*\* p<0.05, \* p<0.1).

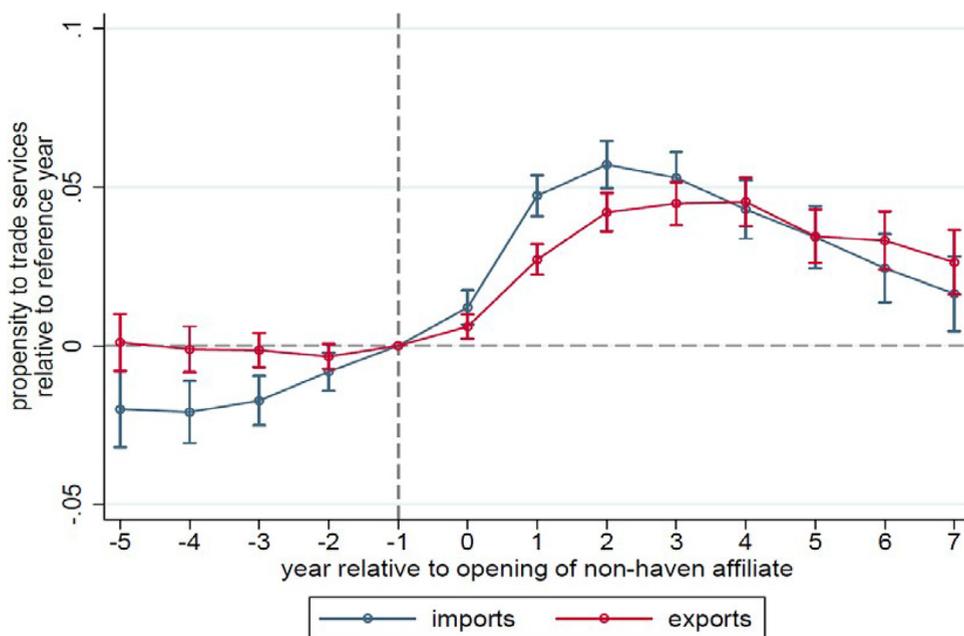
**Table 5**  
Exports.

	Business Services					Financial services		Transport services			
	Construction	Information	Communication	Intellectual property	Other business	Insurance	Financial	Air	Sea	Road	Inland water
<b>Panel A: country covariates</b>											
Haven	0.001*** (0.000)	0.002*** (0.000)	0.000*** (0.000)	0.002*** (0.000)	0.003*** (0.000)	0.001*** (0.000)	0.004*** (0.000)	0.000*** (0.000)	0.003*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Affiliate	0.013*** (0.003)	0.051*** (0.005)	0.007*** (0.002)	0.048*** (0.005)	0.132*** (0.006)	0.011*** (0.002)	0.013*** (0.002)	0.000 (0.001)	-0.003*** (0.001)	0.001 (0.001)	-0.001*** (0.000)
Haven × Affiliate	-0.015*** (0.003)	-0.011** (0.005)	-0.001 (0.002)	-0.022*** (0.005)	-0.015** (0.007)	0.003 (0.003)	0.003 (0.005)	-0.001** (0.000)	-0.005*** (0.001)	-0.001** (0.000)	-0.002*** (0.000)
Distance (log)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.002*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.000*** (0.000)	-0.001*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
GDP (log)	0.001*** (0.000)	0.002*** (0.000)	0.000*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.000*** (0.000)	0.001*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Contiguity	0.015*** (0.001)	0.013*** (0.001)	0.002*** (0.000)	0.011*** (0.001)	0.021*** (0.001)	0.006*** (0.001)	0.010*** (0.001)	0.001*** (0.000)	0.012*** (0.001)	0.001*** (0.000)	0.003*** (0.000)
Common language	0.008*** (0.001)	0.011*** (0.001)	0.002*** (0.000)	0.003*** (0.001)	0.010*** (0.001)	0.005*** (0.001)	0.026*** (0.001)	0.001*** (0.000)	-0.004*** (0.001)	0.000 (0.000)	0.000 (0.000)
R-squared	0.013	0.021	0.004	0.018	0.036	0.008	0.019	0.001	0.008	0.001	0.003
<b>Panel B: country fixed effects</b>											
Affiliate	0.0061** (0.0027)	0.0415*** (0.0051)	0.0055** (0.0022)	0.0387*** (0.0047)	0.1182*** (0.0062)	0.0085*** (0.0022)	0.0045* (0.0024)	-0.0006 (0.0008)	-0.0074*** (0.0011)	0.0003 (0.0008)	-0.0014*** (0.0003)
Haven × Affiliate	-0.0098*** (0.0032)	-0.0110** (0.0052)	-0.0011 (0.0021)	-0.0181*** (0.0047)	-0.0114 (0.0070)	0.0049 (0.0031)	0.0006 (0.0050)	-0.0010* (0.0005)	-0.0087*** (0.0013)	-0.0010** (0.0005)	-0.0019*** (0.0005)
R-squared	0.018	0.029	0.005	0.026	0.046	0.009	0.030	0.002	0.014	0.002	0.005
Observations	1,746,694	2,131,672	1,491,000	1,951,488	4,541,160	1,424,654	1,707,800	1,527,200	2,017,405	1,884,000	1,488,950
Number of firms	8,647	10,988	7,455	9,856	22,152	7,018	8,539	7,636	9,841	9,420	7,675

Note: The table reports the results from OLS regressions with firm fixed effects for the year 2011. The dependent variable is "Export" which is a dummy coded one if the German firm exports the service to the foreign country; "Haven" is a dummy coded one if the foreign country is on the tax haven list of Hines (2010); "Affiliate" is a dummy coded one if the German firm has a subsidiary or a parent in the foreign country; "GDP (in logs)" is the log of the Gross Domestic Product of the foreign country; "Distance (in logs)" is the log of the geodesic distance between Berlin and the most important city of the foreign country; "Contiguity" is a dummy coded one if the foreign country shares a border with Germany; "Common language" is a dummy coded one if the foreign country has German as official language. Trade information is from Statistics on International Trade in Service (SITS) provided by the Deutsche Bundesbank (see Biewen et al., 2013); Affiliate information is from Microdatabase Direct Investment (MiDi) provided by the Deutsche Bundesbank (see Lipponer, 2011); GDP is from World Development Indicators supplemented with information from the CIA World Factbook; All other variables are from the CEPII database. The regressions in Panel B differ from those in Panel A by including country fixed effects. Standard errors clustered at the firm-level in parentheses (\*\*\*)  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ ).



**Fig. 3.** Propensity to trade services around opening of haven affiliate of service trade around the opening of a new affiliate in a tax haven. The sample period is 2001–2011. The red line is the trend in the propensity to export services from Germany. The blue line is the trend in the propensity to import services to Germany. Besides event time dummies (coefficients displayed), the regression also includes firm-country dummies and country-time dummies. The list of tax havens is taken from [Hines \(2010\)](#). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)



**Fig. 4.** Propensity to trade services around opening of non-haven affiliate Note: The figure plots the estimated coefficients and 95% confidence bounds from an event-study model of the intensive margins of service trade around the opening of a new affiliate in a non-haven. The sample period is 2001–2011. The red line is the trend in the propensity to export services from Germany. The blue line is the trend in the propensity to import services to Germany. Besides event time dummies (coefficients displayed), the regression also includes firm-country dummies and country-time dummies. The list of tax havens is taken from [Hines \(2010\)](#). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

amount. While the increase in imports occurs sooner after the affiliate opening than the increase in exports, the increase in exports is more persistent and it is larger than the increase in imports after four years.

Establishing an affiliate opens the door for “legitimate” intra-group trade (import and exports), in principle whether in havens or non-havens. Yet, the finding that the increase in trade is skewed towards imports only in the case of tax havens squares with the benchmark results (from Eq. (4)), lending further support to the obtained excess propensity to service import from tax havens. To reassuringly attribute the results to profit shifting, extra analysis of profitability of affiliates is presented in Section 6. Before presenting this analysis, in the next section, we check the robustness of the benchmark results by modifying the estimation along various aspects.

#### 5.4. Further results

We explore the heterogeneity in the excess propensity to import services in a number of dimensions. In Table 6, we first show how it varies across tax havens. Specifically, we distinguish between the three main jurisdictions in Europe – Luxembourg, Switzerland and Ireland (“Big 3”) – and all the other low tax jurisdictions in the world (“Others”). The results suggest that most of the tax motivated service trade with tax haven affiliates derive from the big European tax havens. Next, we show how the excess propensity to import services varies by the location of the ultimate parent company. The results suggest that multinational firms ultimately owned in Germany engage less in tax motivated service trade with tax haven affiliates than multinational firms ultimately owned elsewhere. In Table A1 in the Appendix, we provide a sectoral breakdown. The excess propensity to import from affiliates in tax havens is concentrated among manufacturing firms. By contrast, there is little evidence of profit shifting to tax havens through service trade among service firms except in financial services where excess imports from tax haven affiliates appears to be driven primarily by service firms. In Table A2 in the Appendix, we investigate heterogeneity within the broader categories *intellectual property* and *other business services*. The results suggest 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*. These latter two sets of results patterns provide additional guidance to the audit decision inside tax authorities by pointing to very specific service categories and combinations with industries where the risk of mispriced service trade with tax haven affiliates, and thus the potential gains from increasing the audit probability, is largest.<sup>15</sup>

Next, we probe the robustness of our main results in a number of ways. First, we allow the effect of the presence of an affiliate on the propensity to trade to vary by the size of the affiliate. The baseline model may suffer from an omitted variable bias if affiliate size correlates with the propensity to trade and affiliate size differs systematically between havens and non-havens. The results reported in Table 6 show that interacting *Affiliate* with dummies capturing the deciles of the affiliate size distribution (in terms of number of employees) does not have a large impact on its interaction with *Haven*. As reported in Table A3 in the Appendix, the coefficients on the size controls are as expected: the bigger the foreign affiliate the larger the probability of service imports. We also test how standard errors change when error terms are allowed to correlate not only across affiliates belonging to the same firm, but also across affiliates located in the same country (two-dimensional clustering). This clustering is very aggressive given that service trade in many categories takes place with a relatively small number of partner countries. As shown in Table A4 in the Appendix, standard errors widen considerably under this clustering scheme. Furthermore, we replicate Tables 4 and 5 after adding the Netherlands to the list of havens and obtain similar results (not reported here for brevity).

Finally, we investigate whether there is also excess service trade in services to affiliates in non-havens with low tax rates. We exclude tax havens from the sample due to the difficulty of measuring their effective tax rate and replace the *Haven* indicator with the continuous variable *TaxDifferential* which measures the differential in statutory corporate tax rates relative to Germany (lower tax rates imply larger differentials). The results, reported in Table A4 in the Appendix, indicate that low corporate tax rates tend to be associated with a negative excess propensity to import services from affiliates. This is suggestive of a stark non-linearity: tax-motivated intra-firm trade in services is concentrated in tax havens with near-zero tax rates. Put it differently, small differences in the tax rates—above or below the German rate—do not provide tax sparing that comes close to that offered by tax havens, making the excess propensity to trade skewed towards tax havens.

## 6. Micro-analysis: excess profits of haven affiliates

### 6.1. Empirical framework

To estimate the excess profitability of haven entities selling services to German affiliates, we first employ the following cross-sectional specification:

$$\frac{Profits_{ics}}{\#Employees_{ics}} = \sigma_i + \sigma_1 Haven_c + \varepsilon_{ics} \quad (6)$$

where  $Profits_{ics}$  is the after-tax profits of an affiliate belonging to firm  $i$  located in country  $c$  from which the firm imports service  $s$  to Germany;  $\#Employees_{ics}$  is the number of employees of an affiliate belonging to firm  $i$  located in country  $c$  from

<sup>15</sup> However, it should be borne in mind that observed patterns of tax evasion are themselves endogenous to existing audit strategies.

**Table 6**  
Heterogeneity and robustness.

	Business Services					Financial services		Transport services			
	Construction	Information	Communication	Intellectual property	Other business	Insurance	Financial	Air	Sea	Road	Inland water
<b>Tax Havens: Big3 vs Others</b>											
Affiliate	0.0085*** (0.0026)	0.0392*** (0.0037)	0.0060*** (0.0016)	0.0322*** (0.0037)	0.1603*** (0.0058)	0.0204*** (0.0017)	0.0175*** (0.0021)	0.0002 (0.0017)	-0.0351*** (0.0021)	0.0135*** (0.0031)	-0.0004 (0.0011)
Big3 Havens × Affiliate	-0.0122*** (0.0044)	0.0419*** (0.0088)	0.0099** (0.0045)	0.0385*** (0.0077)	0.0327*** (0.0102)	0.0063 (0.0055)	0.0325*** (0.0070)	0.0004 (0.0034)	0.0292*** (0.0040)	0.0036 (0.0060)	-0.0018 (0.0032)
Other Havens × Affiliate	0.0036 (0.0033)	-0.0080 (0.0062)	0.0066 (0.0040)	0.0044 (0.0070)	-0.0099 (0.0119)	-0.0106*** (0.0040)	0.0012 (0.0063)	0.0075* (0.0040)	0.0083 (0.0057)	0.0061 (0.0054)	0.0043 (0.0030)
R-squared	0.020	0.060	0.021	0.047	0.087	0.028	0.024	0.012	0.058	0.040	0.012
Observations	1,746,694	2,131,672	1,491,000	1,951,488	4,541,160	1,656,277	1,707,800	1,527,200	2,017,405	1,884,000	1,488,950
Number of firms	8,647	10,988	7,455	9,856	22,152	8,159	8,539	7,636	9,841	9,420	7,675
<b>Firms: German vs Foreign</b>											
Affiliate × German	0.002 (0.003)	0.017*** (0.005)	0.001 (0.002)	0.018*** (0.005)	0.116*** (0.008)	0.001 (0.002)	0.010*** (0.003)	-0.003 (0.002)	-0.036*** (0.003)	0.005 (0.004)	-0.004*** (0.001)
Affiliate × Foreign	0.025*** (0.005)	0.091*** (0.005)	0.020*** (0.003)	0.067*** (0.005)	0.240*** (0.008)	0.068*** (0.004)	0.038*** (0.003)	0.008*** (0.003)	-0.032*** (0.003)	0.034*** (0.005)	0.010*** (0.003)
Haven × Affiliate × German	-0.009*** (0.003)	0.008 (0.006)	0.006* (0.003)	0.000 (0.005)	-0.010 (0.009)	0.003 (0.004)	0.020*** (0.006)	0.001 (0.002)	0.018*** (0.004)	-0.003 (0.004)	-0.000 (0.002)
Haven × Affiliate × Foreign	0.003 (0.009)	0.066*** (0.014)	0.018** (0.009)	0.092*** (0.014)	0.061*** (0.015)	-0.004 (0.011)	0.028** (0.011)	0.009 (0.008)	0.032*** (0.008)	0.025** (0.011)	0.004 (0.007)
R-squared	1,746,694	2,131,672	1,491,000	1,951,488	4,541,160	1,656,277	1,707,800	1,527,200	2,017,405	1,884,000	1,488,950
Observations	0.020	0.062	0.022	0.049	0.088	0.034	0.025	0.012	0.058	0.041	0.012
Number of firms	8,647	10,988	7,455	9,856	22,152	8,159	8,539	7,636	9,841	9,420	7,675
<b>Affiliate Size Controls</b>											
Haven × Affiliate	-0.007* (0.003)	0.028*** (0.007)	0.013*** (0.004)	0.017*** (0.006)	0.025** (0.010)	0.003 (0.004)	0.018*** (0.006)	0.005 (0.003)	0.018*** (0.004)	0.009* (0.005)	0.002 (0.003)
R-squared	0.019	0.054	0.020	0.043	0.077	0.022	0.020	0.012	0.059	0.040	0.012
Observations	1,743,124	2,127,321	1,487,411	1,947,309	4,534,790	1,652,382	1,704,083	1,523,690	2,013,772	1,880,050	1,485,449
Number of firms	8,647	10,988	7,455	9,856	22,152	8,159	8,539	7,636	9,841	9,420	7,675
Parent-FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: The table reports the results from OLS regressions with firm and country fixed effects for the year 2011. The dependent variable is "Import" which is a dummy coded one if the German firm imports the service from the foreign country; "Haven" is a dummy coded one if the foreign country is on the tax haven list of Hines (2010); "Big3" is a dummy coded one if the foreign country is one of the 3 major European tax havens: Luxembourg, Switzerland and Ireland; "Other Havens" is a dummy coded one if the foreign country is a tax haven list but not one of the 3 major European tax havens. "Affiliate" is a dummy coded one if the German firm has a subsidiary or a parent in the foreign country; "German" is a dummy coded one if the firm's ultimate owner is in Germany and "Foreign" is a dummy coded one if it is not in Germany. The bottom panel includes affiliate size controls: interactions between "Affiliate" and ten dummies indicating the deciles of the size distribution of affiliates (in terms of number of employees). Standard errors clustered at the firm-level in parentheses (\*\*\*) p<0.01, \*\* p<0.05, \* p<0.1).

which the firm imports service  $s$  to Germany;  $Haven$  is a dummy indicating whether country  $c$  is a tax haven; and  $\sigma_i$  are firm fixed effects. The dependent variable 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 haven entities selling services to their German affiliates by comparing to non-haven entities belonging to the same firm selling the same service to their German affiliates.

A particular concern about the identification strategy underlying (6) is that haven affiliates may be more profitable than non-haven affiliates for many other reasons than mispriced service trade. To address this concern, we also employ an alternative specification that adds a panel dimension to the model while limiting the sample to haven affiliates that sell services in a given category to German affiliates:

$$\frac{Profits_{icst}}{\#Employees_{icst}} = \chi_0 + \chi_1 \frac{Revenue_{icst}}{\#Employees_{icst}} + \chi_2 \frac{Services_{icst}}{\#Employees_{icst}} + \varepsilon_{icst} \quad (7)$$

where  $Revenue_{icst}$  is the revenue in year  $t$  of the affiliate belonging to firm  $i$  located in country  $c$  from which the firm imports service  $s$  to Germany; and  $Services_{icst}$  is the imports of service  $s$  from country  $c$  by firm  $i$  in year  $t$ . The parameter on the revenue variable expresses the average profit margin on sales whereas the parameter on the service variable expresses the excess profit margin on services sales. Identification derives from a comparison of haven affiliates, in the cross-section and over time, selling the same service in different amounts.

## 6.2. Main results

We first show the results from Eq. (6) for each of 11 service categories in Table 7. In most categories, haven entities selling services to their German affiliates have significantly higher profits per employee than non-haven entities belonging to the same firm and selling the same services to German affiliates. Across all categories the excess profitability ranges from around € 10,000 to around € 50,000 per employee suggesting that service sales to affiliates is associated with significant excess profits. The precision of the estimates vary with the sample size, but the estimates are statistically significant in most service categories. The results are qualitatively similar when profits are measured relative to equity rather than the number of employees, as shown in Table A5 in the Appendix.

We estimate a variant of Eq. (6) that replaces  $Haven$  with a set of country fixed effects that capture country-specific characteristics including the corporate tax rate. This analysis allows us to investigate how profits per employee varies across service trading affiliates in specific countries and thus to enter the black box of the tax haven dummy. To the extent that tax-unrelated genuine specialization in tax havens exists and at the same time—within the specific service category under analysis—firm trades with non-specialized non-haven countries,  $\sigma_1$  picks up also a specialization effect. Recall, a priori, there are no reasons for the size of the country fixed effects to correlate with the tax haven status. The 50 largest country fixed effects for the service categories *Intellectual property* and *Other business services* are plotted in Fig. 5. With few exceptions, service trading affiliates in tax havens are the most profitable ones. In particular, the most profitable affiliates are located in Panama, Bermuda and Luxembourg in the former service category and in Bermuda and Malta in the latter category: in all six cases average profits exceed € 100,000 per employee. Overall, this implies that there is excess profitability in these countries associated with these service categories (after controlling for all country-specific characteristics, including tax rate, and the German group characteristics) for firms that trade that same categories of services with other countries, which indicates that the excess profitability in tax havens affiliates is associated with mispricing of these services.

We next turn to the results from the alternative model (7) in Table 8. As shown in Panel A, the average profit margin on sales (per employee) is generally around 5% for haven affiliates across all service categories whereas the profit margin on related-party imports of service from tax havens tends to be much higher. The excess profit margin is fairly precisely estimated at around 25–30% in service categories like *Information services*, *Intellectual property*, *Other business services* and *Construction* but generally varies from around -50% in *Air transport* (with very large errors) to around 95% in *Financial services*. The results are qualitatively similar when profits are measured relative to equity rather than the number of employees, as shown in Table A6 in the Appendix.

The two empirical approaches largely agree on the set of the service categories with significant excess profitability. The main exception is *Financial service*, in which excess profitability in haven affiliates is insignificant when identified from a comparison with non-haven affiliates (Table 7) and highly significant when identified from a comparison within haven affiliates (Table 8, Panel A). One possible explanation is that also non-haven affiliates appear to earn very considerable excess profits on sales of financial services to affiliates (Table 8, Panel B).

## 6.3. Further results

The finding that tax haven entities selling services to foreign 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, Fig. 6 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

**Table 7**  
Profitability of foreign affiliates (cross-section).

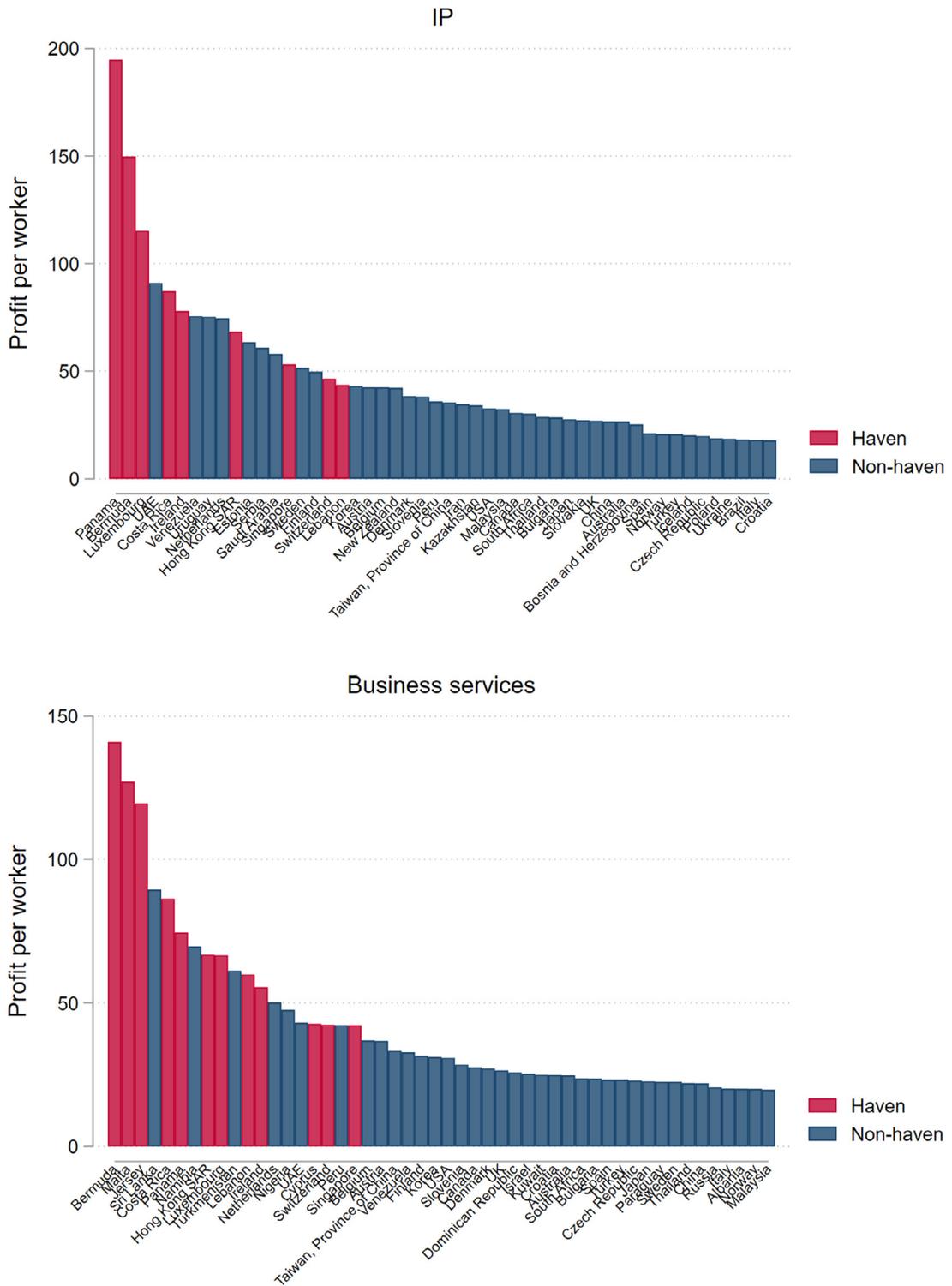
	<b>Business services</b>					<b>Financial services</b>		<b>Transport services</b>			
	<i>Construction</i>	<i>Information</i>	<i>Communication</i>	<i>Intellectual property</i>	<i>Other business</i>	<i>Insurance</i>	<i>Financial</i>	<i>Air</i>	<i>Sea</i>	<i>Road</i>	<i>Inland water</i>
Haven	25.054*** (8.803)	20.986*** (5.148)	15.121 (12.295)	31.189*** (6.490)	26.192*** (3.568)	22.647 (15.243)	12.160 (10.477)	25.247* (13.504)	19.229 (11.743)	24.887*** (6.612)	52.154* (28.389)
R-squared	0.026	0.018	0.010	0.040	0.028	0.015	0.004	0.026	0.014	0.032	0.092
Number of observations	660	1,725	350	1,662	4,972	303	608	255	343	849	166
Number of firms	193	476	134	455	1,440	145	226	98	149	331	104

Note: The table reports the results from OLS regressions with firm fixed effects for the year 2011. The dependent variable is gross profits in the foreign affiliate divided by the number of employees in the foreign affiliate; "Haven" is a dummy coded one if the foreign country is on the tax haven list of Hines (2010); The sample consists of entities in foreign countries from which the German affiliate imports the service. Affiliate information is from Microdatabase Direct Investment (MiDi) provided by the Deutsche Bundesbank (see Lipponer, 2011); Standard errors clustered at the firm-level in parentheses (\*\*\*)  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

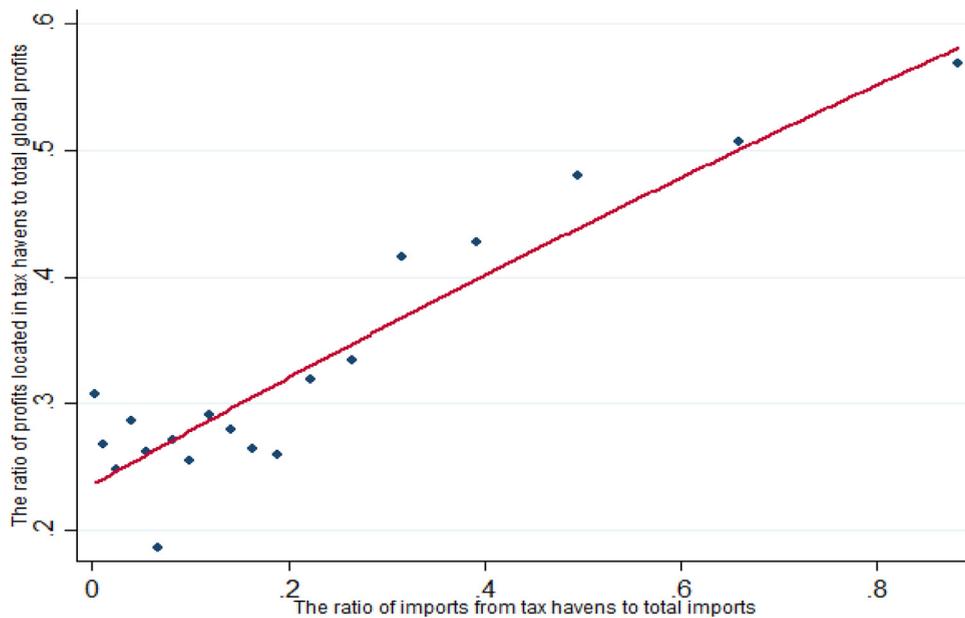
**Table 8**  
Profitability of foreign affiliates.

	Business services					Financial	Transport services			
	Construction	Information	Communication	Intellectual property	Other business	Financial	Air	Sea	Road	Inland water
<b>Panel A: Havens</b>										
imports per employee	0.322997** (0.130296)	0.304041*** (0.092318)	-0.083050 (0.136831)	0.280679*** (0.105308)	0.251353*** (0.044859)	0.945085*** (0.116254)	-0.482757** (0.203098)	-0.072197 (0.114214)	0.159079* (0.094997)	0.584601 (0.431548)
revenue per employee	0.054812*** (0.003434)	0.053700*** (0.001750)	0.056114*** (0.003442)	0.052423*** (0.002011)	0.046039*** (0.001209)	0.050518*** (0.002889)	0.041859*** (0.005171)	0.048840*** (0.004108)	0.051948*** (0.002705)	0.055542*** (0.005431)
Observations	597	1,742	448	1,388	4,821	828	220	305	792	60
R-squared	0.519833	0.476892	0.434990	0.476045	0.410128	0.422146	0.332291	0.434483	0.555606	0.775718
<b>Panel B: Non-havens</b>										
imports per employee	0.014725 (0.030305)	0.187544*** (0.044370)	0.060397 (0.075111)	0.087625** (0.038059)	0.119118*** (0.018478)	0.710357*** (0.082606)	-0.267098*** (0.058273)	0.097631** (0.039113)	0.032016 (0.039477)	0.102498 (0.105390)
revenue per employee	0.034662*** (0.001392)	0.035574*** (0.000823)	0.034175*** (0.001720)	0.038590*** (0.000757)	0.031823*** (0.000471)	0.037929*** (0.001585)	0.026145*** (0.002071)	0.033611*** (0.001361)	0.030494*** (0.000947)	0.028090*** (0.002549)
Observations	6,255	11,767	2,518	13,911	40,967	3,504	1,676	2,625	7,561	620
R-squared	0.276112	0.289386	0.267395	0.339444	0.272554	0.311515	0.193566	0.333847	0.281040	0.263252

Note: The table reports the results from OLS regressions for the sample period 2001-2011. The sample consists of entities in foreign countries (Havens in Panel A and Non-havens in Panel B) from which the German affiliate imports the service. The dependent variable is gross profits in the foreign affiliate divided by the number of employees in the foreign affiliate; "imports per employee" is the value of service imports from the foreign country by the German affiliate divided by the number of employees at the foreign affiliate; "revenue per employee" is total sales in the foreign affiliate divided by the number of employees at the foreign affiliate. Affiliate information is from Microdatabase Direct Investment (MiDi) provided by the Deutsche Bundesbank (see Lipponer, 2011); The list of tax havens is taken from Hines (2010); Standard errors clustered at the firm-level in parentheses (\*\* p<0.01, \* p<0.05, \* p<0.1).



**Fig. 5.** Country fixed effects in the profitability of service providers Note: The figure plots the estimated country fixed effects from an OLS regression for 2011. The dependent variable is gross profits in the foreign affiliate divided by the number of employees in the foreign affiliate. The independent variables are country and firm fixed effects. The sample consists of entities in foreign jurisdictions from which the German affiliate imports the service. The service category is "intellectual property" in the upper panel and "Other business services" in the lower panel Red bars are havens and Blue bars are non-havens. The list of tax havens is taken from [Hines \(2010\)](#).



**Fig. 6.** Service imports and profits in tax havens Note: The figure plots the average ratio of profits realized in tax havens to total global profits for firms within narrow ranges of the ratio of imports from tax havens to total imports. Sources: Trade information from Statistics on International Trade in Service (SITS) provided by the Deutsche Bundesbank (see [Biewen et al., 2013](#)) and affiliate information from Microdatabase Direct Investment (MiDi) provided by the Deutsche Bundesbank (see [Lipponer, 2011](#)). The list of tax havens is taken from [Hines \(2010\)](#).

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.

## 7. Implications for government revenue

Combining the aggregate statistics from [Section 3](#) and the estimates of excess profitability from [Section 6](#), we can roughly gauge the magnitude of profit shifting to tax havens and the resulting loss of tax revenue. Ideally, we should attribute the excess profitability of affiliates in havens to the combination of over-pricing of imports and under-pricing of exports. As an approximation, however, we attribute the excess profitability entirely to mispricing of imports as, overall, our findings suggest that German trade with affiliates in tax havens is skewed towards imports. As a caveat, this computation does not take into account mispricing of goods or other tax avoidance strategies such as debt shifting, because it would require estimating excess profitability in tax havens affiliates resulting from these strategies, which is beyond the scope of this paper.

For each service category, [Table 9](#) reiterates the aggregate amount of service imports from tax havens in which the importer has an affiliate: this amounts to around € 11 billion across all service categories. It also reiterates the estimated excess profits in tax havens per unit of intra-firm sales of services to Germany: the weighted average is 27% across all service categories (ignoring the negative coefficients). These two elements imply that the magnitude of profit shifting is around € 3.1 billion and, at the German corporate tax rate of 30%, that the implied revenue loss is around € 0.9 billion. The estimate is modest relative to the total German corporate tax revenue of around € 45 billion in 2011 (2 percent).

These estimates are obviously associated with considerable uncertainty. We may underestimate the amount of imports from tax haven affiliates for at least three reasons. First, some of these imports may be funneled through conduit countries and thus concealed as imports from non-havens. Second, our dataset does not allow us to identify the “sisters” of German firms owned by foreign parents and we wrongly classify trade with such entities as non-affiliate trade. Third, the reporting threshold implies that trade with small foreign affiliates is misclassified as non-affiliate trade. Moreover, our point estimates of excess profits in tax havens per unit of intra-firm sales of services have non-negligible standard errors

**Table 9**  
Loss of government revenue (€ million).

	<b>Business Services</b>					<b>Financial services</b>		<b>Transport services</b>				<b>Total</b>
	<i>Construction</i>	<i>Information</i>	<i>Communication</i>	<i>Intellectual property</i>	<i>Other business</i>	<i>Insurance</i>	<i>Financial</i>	<i>Air</i>	<i>Sea</i>	<i>Road</i>	<i>Inland water</i>	
Imports from tax haven affiliates	92	944	183	1,080	2,720	1,382	1,237	451	1,115	346	5	11,552
Excess profits in tax havens per euro of service sales to affiliates	32%	30%	-8%	28%	25%	-	95%	-48%	-7%	16%	58%	27%
<b>Loss of tax base:</b>	30	287	-15	303	684	375	1,169	-218	-81	55	3	3,134
<b>Loss of revenue:</b>	9	86	-5	91	205	112	351	-65	-24	16	1	940

Note: The table documents the estimation of the government revenue loss resulting from service trade with tax havens. The first line "Imports from tax haven affiliates" is from [Table 3](#). The second line "Excess profits in tax havens" is from [Table 8](#). The third line multiplies the two first lines within each category; however, some service trade is not assigned to a service category, the weighted average across specified service categories is applied to the total in the last column. The last line multiplies the third line with the German corporate tax rate of 30%. The list of tax havens is taken from Hines (2010).

Despite these uncertainties, our micro-based analysis may be useful for an emerging literature that estimates profit shifting to tax havens based on macro-information from national accounts and balance of payment statistics (e.g. Tørrsløv et al., 2018). In particular, it seems necessary for future work to account for two findings emerging from our analysis. First, a large share of service imports from tax havens is between unrelated firms and therefore cannot reflect profit shifting. This is true for around two thirds of service imports in the aggregate and more than half even in service categories often considered to have a high content of profit shifting such as *intellectual property* and *headquarter services*. Second, imports from affiliates in tax havens do not exclusively reflect profit shifting. While our estimates of excess profits are somewhat noisy, we can firmly reject that imports from tax haven affiliates are associated with a one-to-one increase in the profits of those affiliates. Even in service categories such as *intellectual property* and *headquarter services* the upper bound of our confidence interval is below 50%. The main exception is *financial services* where the point estimate is close to 100%.

Finally, while this estimated revenue impact may sound small, it is largely in line with existing micro-studies that tend to generally report lower magnitudes of profit shifting than macro-based studies.<sup>16</sup> Clearly, the macro-based literature covers all tax avoidance strategies whereas our paper looks at one specific strategy. From a country perspective, the impacts of the various profit shifting strategies add up to a non-negligible amount. It is also important to emphasize that from a *company* standpoint, these are significant amounts at stake. Eventually, globally, a few thousand multinational firms engage in profit shifting in multiple countries and their tax savings—amounting to fractions of the corporate tax from various countries—can end up being a large company-specific worldwide sum. Ultimately, macro and micro studies complement each other to provide full evidence. Macro papers endeavor to estimate aggregate effects while micro-based studies shed light on underlying detailed mechanisms. Since profit shifting is by definition unobservable, macro-based—just like micro-based—papers require their own assumptions to estimate aggregate revenue impact.<sup>17</sup>

## 8. 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 services and micro data from Germany to investigate to what extent this reflects 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* (services related to patents and trademarks), *headquarter services* (such as administration and management), *information services* (such as data processing and storage) and *financial services* (services related to investment, lending and money management) 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 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 avoidance or evasion, we found that the implications of mispricing for government revenue in Germany are likely to be modest, but not negligible—approximately 2 percent of the corporate income tax revenue.

Our results, it should be stressed, relate to a period before the recent G20-OECD Base Erosion and Profit Shifting (BEPS) initiative, which currently with more than 126 committed countries (the Inclusive Framework Members) includes a set of measures ranging from common approaches to minimum standards to combat tax avoidance. One avenue for future research is to study the impacts of the new transfer pricing documentation and country-by-country reporting requirements for large MNEs on the pricing of intragroup trade.

## Supplementary material

Supplementary material associated with this article can be found, in the online version, at [10.1016/j.euroecorev.2021.103737](https://doi.org/10.1016/j.euroecorev.2021.103737)

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<sup>16</sup> For example, Davies et al. (2018) report a loss of about 1 percent of French corporate income tax revenues due to mispricing of goods. Flaaen (2017) finds even a lower impact of 0.73% for the USA.

<sup>17</sup> Dharmapala (2014, 2019) discusses potential factors that can explain the difference in the findings between macro and micro papers. Moreover, recently, Blouin and Robinson (2020) point out that macro data on foreign affiliates statistics are subject to double counting of equity income—because of indirect ownerships of foreign affiliates—, which appears to explain the large macro estimates of profit shifting.

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### ***Furhter reading***

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