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TRADE IN SERVICES RELATED TO INTANGIBLES AND THE PROFIT SHIFTING HYPOTHESIS

by Nadia Accoto*, Stefano Federico* and Giacomo Oddo*

Abstract

This paper focuses on the international trade of services related to intangible assets and intellectual property products (IPP), and it explores to what extent they might be used as a channel to shift the profits of multinational firms to tax havens. Using survey data on Italian firms, we first provide a geographical and sectoral analysis of Italy's trade in IPP services. We then estimate the amount of profit shifted abroad by foreign-owned firms in our sample, applying the methodology initially put forward by Tørsløv et al. (2018) at various levels of aggregation. Finally, we look for correlation at the firm level between estimated shifted profits and imports of IPP services. We find that, while the overall correlation is very low, there is a small cluster of firms displaying a positive correlation between the two variables.

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1 Introduction[1]

Intangible capital (i.e. intangible assets and immaterial goods that can be exchanged such as patents, trademarks, copyrights, software, managerial and accounting expertise, algorithms, and other intellectual property products) has been playing an ever-growing role in the balance-sheet of multinational corporations. Its growth is arguably the most distinctive feature of the transition process towards what has been defined by the literature as the "knowledge economy", which begun in the last decade of the last century. As extensively shown by Haskel and Westlake (2018), the effects produced by this structural change are wide and pervasive. Although intellectual property protection is not evenly enforced across jurisdictions, when it comes to buying and selling, intellectual property products (IPP) are easily and cheaply transferable (Dischinger and Riedel, 2011; Beer and Loeprick, 2015). This feature, combined with the expansion of multinational groups characterised by global networks of affiliates in different countries, has opened new possibilities for strategic reallocation of profits and the implementation of tax avoidance schemes (fiscal planning).

In more recent years, the phenomenon of fiscal base erosion and profit shifting (BEPS) went under the spotlight of policy makers, international fora, and economic intelligence, in the attempt of developing solutions to this issue (Tørsløv et al., 2020). The most relevant set of negotiations and policy initiatives was elaborated within the OECD/G20 Inclusive Framework on BEPS, kick-started in 2013.[2] Eventually, in mid-2021 a large group of countries and jurisdictions, representing more than 90% of world GDP, joined a new two-pillar plan to reform international taxation rules, improve the coherence of tax rules around the globe, and ensure that multinational enterprises pay a fair share of tax wherever they operate.[3]

From the point of view of balance of payments statistics, the remuneration of intangible assets (i.e. fees and royalties paid by a user of intellectual property products to the foreign owner of such products) is a flow that qualifies as part of "trade in services". When trade in such services occurs between companies belonging to the same multinational group, it can become a channel for relocating part of the user's profits to the owner's account, in particular when the latter is residing in jurisdictions characterized by more favorable tax regimes. Although multinational companies are not new to practices and behaviors aimed at exploiting opportunities for fiscal arbitration, intangible capital allows to achieve it in a more flexible and economic way, compared to other channels like, for example, transfer pricing on goods

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[2]For an overview see OECD (2013), the dedicated section of the OECD website, and the policy note *Addressing the Tax Challenges of the Digitalisation of the Economy*, approved in early 2019 by the OECD working party on the BEPS initiative.

[3]The implementation of the two-pillar approach is expected in in 2023. Further information on the continuing international tax reform negotiations is also available at: `https://oe.cd/bepsaction1`.

transactions or intra-group finance.[4] The diffusion of these strategies might have a significant impact on official statistics such as balance of payments and economic accounts (Bruner et al., 2018), distorting key macroeconomic aggregates such as gross domestic product and gross national income.[5]

Prompted by these considerations, the aim of our paper is to provide new evidence, based on detailed firm-level data, on the the use of IPP transactions for profit shifting. To this purpose, taking advantage of the richness of survey data collected by the Bank of Italy on a representative sample of Italian firms, we describe the geographical and sectoral analysis of Italy's trade in IPP services, pointing to patterns that are compatible with the hypothesis that such services are used as a profit shifting tool. As a second step, merging service transaction data with balance-sheet data, the paper applies the methodology initially put forward by Tørsløv et al. (2018) for the quantification of profit shifting, based on the comparison of profitability rates between foreign-owned and local firms, at three levels of aggregation: total economy, industry level, and firm level. As a final contribution, the paper compares the estimates of shifted profits with the imports of services related to intangibles at the industry level and at the firm level, in order to offer a preliminary assessment of the role of IPP services in profit shifting.

Our paper relates with two vast strands of economic literature: on one side it offers new evidence on the rising role of intangible assets and IPP services in the economic activity of firms: Corrado et al. (2009); Jona Lasinio and Manzocchi (2012); Haskel and Westlake (2018); Jenniges et al. (2019). At the same time it belongs to the growing and diversified group of papers dealing with the methodological challenges of measuring the size of profit shifting made by multinational firms. Dharmapala (2014), Riedel (2018) and Beer et al. (2019) review the empirical papers on this topic.[6] By combining the estimation of profit shifting with the

[4]Dharmapala (2014), Heckemeyer and Overesch (2017) and Beer et al. (2018) provide extensive reviews of empirical studies on different profit shifting strategies of multinational firms. These strategies include a variety of techniques: (i) non-financial transactions, such as merchandise trade or services trade between affiliates where transaction prices are different from market prices (e.g. firms over-report imports and/or under-report exports in order to minimize domestic profits and/or inflate profits generated by affiliated firms abroad); (ii) financial transactions, such as interest payments on infra-group loans (where interest rates are different from market interest rates) or derivatives; (iii) corporate restructuring, such as in the case of transfers of assets to a foreign country or even redomiciliation of the entire company (also known as corporate inversion). This happens when the parent company merges with a foreign company (usually located in a country with favorable taxation) and becomes a subsidiary of the new foreign parent, thus moving its tax residence to the foreign country. Strategies based on IPP services trade, which are the focus of this paper, can be classified under category (i).

[5]The case of Irish GDP was emblematic: in 2016 Irish GDP was revised upwards by 26%, due to the reallocation in Ireland of large stocks of intangible capital from abroad (Tedeschi, 2018). With respect to long-term economic trends, an analysis conducted on US data suggests that the productivity slowdown observed in the last two decades could reflect, to some extent, the accumulation of value added generated by American multinationals in a limited number of tax havens (Guvenen et al., 2017).

[6]Estimation of profit shifting can be attempted following three main approaches: the first one, pioneered by Hines and Rice (1994), is based on the estimation of the sensitivity of the firm's pre-tax profits to the corporate income tax differential existing between the jurisdiction of the reporting firm and the jurisdiction of its affiliate, controlling for a set of production inputs and other relevant variables (see also Clausing (2016)). In a second approach — followed in our paper — profit shifting is inferred from the comparison of profitability rates of

analysis of one of the main potential channels for this activity (trade in IPP services), our paper provides a unique addition to these two lines of research. Indeed, together with the work of Hebous and Johannesen (2021), it is one of the first studies that specifically focus on the role of trade in services (and, in particular, of services related to intellectual property) in profit shifting strategies of multinational firms.[7]

The structure of the paper is as follows: section 2 reports descriptive evidence on trade in IPP services. Section 3 presents the methodology for the estimation of profit shifting and the results of its application to our firm-level data; it also compares our estimates of profit shifting with alternative estimates available in the literature. Section 4 focuses on the relation between IPP services imports and profit shifting. Section 5 concludes.

2 Firms trading in IPP services: micro-data at a glance

The analysis developed in this paper is based on a sample of 2,600 Italian non-financial firms over a five years time span (2013–2017). The sample is taken from firm-level data that the Bank of Italy collects on a quarterly basis in order to compile the "services" item in the current account of the national balance of payments. The dataset contains detailed information on firms' exports and imports of services.[8] Each observation is a vector specifying firm's identity, flow direction, type of traded service, counterpart country, and time.[9] We merge data on trade in services with firms' balance sheet data from *Centrale dei Bilanci*.[10] The original dataset includes more than 30 types of services according to the Extended Balance of Payments Services (EBOPS) classification. With the purpose of separating "high-risk" services (as Tørsløv et al. (2022) call the services that, according to the literature, are more conducive of profit shifting) from other services, we aggregate them into three groups:

IPP services: services related to intellectual property products. This category includes: (i)

foreign and domestic firms in the same economy. Profitability rates can be derived from aggregate macro data, as in Tørsløv et al. (2018), or from firm-level data, using financial statements (Sallusti, 2019) or tax returns data (Bilicka, 2019; Bratta et al., 2021). Finally, a third approach considers specific channels for profit shifting, such as transfer pricing in goods trade (Vicard, 2015; Davies et al., 2018; Liu et al., 2020).

[7] Our approach differs from Hebous and Johannesen (2021) mainly in terms of the derivation of profit shifting estimates. While they compare the profitability of affiliates of German groups located in tax havens with affiliates located in non-havens, we compare the profitability of foreign versus that of local firms.

[8] The survey scheme defines a threshold corresponding to about 70 million euros of turnover. There are approximately 3,800 non-financial firms above this threshold, accounting for 45% of total sales in the reference population, which is made up by approximately 1.5 million firms whose center of economic interest is in Italy. The survey does not include banks, non-insurance financial intermediaries, and public administration entities. In our analysis however we consider a smaller sub-sample of about 2,600 firms, as we had to exclude firms for which we could not cross-validate balance sheet information and/or firms which were not actively involved in service trade in the period under scrutiny.

[9] In our analysis we use firm-level data as reported by respondents, i.e. sample data were *not* expanded to the universe. The sample by construction includes only firms with non-zero exports or imports of services.

[10] *Centrale dei Bilanci* is a private registry containing balance-sheet information of incorporated companies in Italy. See the company's website `www.centraledeibilanci.it` for more details.

royalties and users' fees related to intellectual property rights; (ii) software and computer services; (iii) research & development.

HQ services: headquarter services, i.e. services related to accounting and managerial expertise or to other intra-group functions. This category includes: (i) accounting, auditing and tax advisory services; (ii) managerial and entrepreneurial consultancy, and public relations services; (iii) other services between associated companies not included elsewhere.

Other services: a residual group containing all other services in the dataset that are not included in the previous two groups.[11]

This breakdown is closely related to the classification proposed by Corrado et al. (2005) and O'Mahony et al. (2021), according to whom there are three main categories of intangible assets: (a) computerised information, (b) innovative property, and (c) economic competencies.[12] IPP services are related to asset categories (a) and (b). The second group (HQ services) is to a large extent related to asset category (c), although it also includes miscellaneous *infra-group* services transactions that do not specifically fall under the concept of economic competencies. Our motivation for singling out this group of services is that, as they are largely exchanged within the multinational group, they can become a tool to shift profits across affiliates in different jurisdictions (Hebous and Johannesen, 2021; Tørsløv et al., 2022). Finally, the third group (other services) represents the complement to total services included in the sample,[13] and it is not typically related to the above-mentioned classification of intangible assets. Since this group includes services that, according to the literature, are less conducive of profit shifting, it is a useful term of comparison when analysing trade patterns in the previous two groups.

For each of these three groups of services, we look at exports and imports along various dimensions (partner country, industry, firm size and ownership structure). This exploratory analysis aims at detecting specific features and differences between IPP, HQ, and other services that might suggest the use of IPP services for profit shifting purposes.

Table 1 provides a geographical breakdown of trade in services, where partner countries were grouped into (i) low taxation countries or "tax havens" and (ii) standard taxation coun-

[11] Since our data are taken from a business survey that does not include (i) banking and financial services, (ii) travel services, and (iii) transport services, these three kinds of service are excluded altogether from the analysis and never appear in any aggregate nor in totals. According to the evidence found by Hebous and Johannesen (2021) on German firm-level data, financial services and sea transport services appear to be used for profit shifting strategies. However, due to data limitations, we cannot include them in our analysis.

[12] Following the work of the *OECD Task Force on R&D and Other Intellectual Property Products*, categories (a) and (b) were included in the concept of capital in the new System of National Accounts (SNA, 2008), while category (c), which is closer to the concept of "human capital", was not. Hence, the products of intellectual property are fully recognised as an intangible form of *capital* and are treated as such in macroeconomic statistics. According to this notion, IPP are defined as intangible fixed assets, whether purchased or produced for own use, used in the production process, and include software, research & development, patents, entertainment and artistic originals (SNA, 10.98–10.102).

[13] As mentioned in footnote 11, "total services" in this context does not correspond to the balance of payments "total services" aggregate, but rather to a subset of it.

tries or "non-havens".[14] IPP account for slightly more than a quarter of total services exports and about one fifth of imports (bottom line of table 1). The proportion of IPP *exports* to tax havens (32%) is broadly in line with other services, and significantly lower than HQ services. However, IPP *imports* come in a much larger proportion from tax havens than other services (43% vs 23%), a feature which is broadly consistent with the evidence found by Hebous and Johannesen (2021) on German data. Among tax haven countries, EU members have a very relevant weight, with Ireland and Netherlands being the two most important partners. The other main group of counterpart countries for IPP import flows is represented by European non-EU tax havens, Switzerland being the most relevant among them.

Table 1: Distribution of trade in services by counterpart area

	Export				Import			
Counterpart Area	IPP	HQ	Other	Total	IPP	HQ	Other	Total
World	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Non-havens	68.1	56.1	68.6	66.6	57.0	66.4	77.4	71.5
Tax-havens	31.9	43.9	31.4	33.4	43.0	33.6	22.6	28.5
of which:								
Asian Tax-havens	1.3	2.4	1.2	1.4	0.1	1.8	2.5	1.9
EU Tax-havens*	13.3	19.0	16.5	16.0	36.8	22.6	13.1	19.6
European non-EU Tax-havens	17.1	22.2	13.1	15.5	6.1	9.2	6.3	6.6
Other tax-havens	0.3	0.3	0.5	0.4	0.0	0.1	0.7	0.4
% on total services	26.6	15.3	58.1	100.0	22.1	12.9	65.0	100.0

All values are in percentage terms, calculated as average on the 2013–2017 interval.
(*) See footnote 14 for the list of "tax-havens".

In the following step, we look at the sector of economic activity of the firms active in services trade. Consistently with what was found by Federico and Tosti (2017) and Moro and Tosti (2019), table 2 shows that manufacturing firms play a very important role in the international trade of services, and an even larger role when considering IPP services, as manufacturing firms account for two thirds of exports and about 39% of imports of such services (table 2, bottom line). This evidence is compatible with the claims of Tørsløv et al. (2018), according to whom profit shifting seems to be an across-the-board phenomenon, observable even in industries with lower intensity in intangibles, such as manufacturing. Outside of manufacturing, the most important firms' sectors for IPP services trade are Information & computer services, and Telecommunications & media; together with manufacturing, these

[14]The list of countries considered as *tax havens* is taken from Tørsløv et al. (2022), which in turn is based on Hines and Rice (1994) and Hines (2010). We list here the 40 countries that are relevant for our dataset (in **bold** type the countries that are also members of the European Union): Andorra, Anguilla, Antigua and Barbuda, Aruba, Bahamas, Bahrain, Barbados, **Belgium**, Belize, Bermuda, Bonaire , British Virgin Islands, Cayman Islands, Curaçao, **Cyprus**, Gibraltar, Grenada, Guernsey, Hong-Kong, **Ireland**, Isle of Man, Jersey, Lebanon, Liechtenstein, **Luxembourg**, Macao, **Malta**, Marshall Islands, Mauritius, Monaco, **Netherlands**, Panama, Puerto Rico, Seychelles, Singapore, Sint Maarten, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Switzerland. Following their definition, we give here to "tax haven" a broader meaning, i.e. not necessarily a country that has a lower corporate tax rate, but more generally a country that has special fiscal provisions and/or regulatory institutions to attract foreign capital in general and intangible capital and IPP-related activities in particular.

sectors account for 80% of IPP services trade. Within manufacturing, there are significant differences between exports and imports of IPP services. The majority of exports are due to three sectors only: electronics, transport equipment, and pharmaceuticals. Conversely, imports are associated with a wider sectoral variety of importing firms, including (together with the above-mentioned three sectors) also chemicals, machinery, electrical equipment, food, and beverages. This finding might be interpreted as an indication that IPP services are an important production input for many branches of manufacturing industry; on the other side, exports of IPP services are more concentrated in those manufacturing branches characterised by economies of scale, larger average firm's size, and high-tech intensity, all features that are usually associated with the production process of intangible goods and of services related to intellectual property (Haskel and Westlake, 2018).[15]

The latter interpretation is supported also by the upper panel of table 3, which breaks down services trade into four classes based on firms' size; the role of large companies (i.e. those with over a thousand employees) in IPP services trade is significantly greater than in other types of services, and their role is larger on the export than on the import side.

Additional insights on the nature of IPP services can be gained considering the ownership status of trading firms. The lower panel of Table 3 considers three sets of firms: (i) foreign-owned firms, i.e. firms whose parent company is located abroad;[16] (ii) firms belonging to a domestic group (i.e. firms that are part of a multinational network of affiliates whose parent company is located in Italy); (iii) firms that do not belong to any group (independent firms).

Foreign-owned firms are responsible for almost half of international trade in services in our sample.[17] There are significant differences across exports and imports as well as across the three categories of services: the share accounted for by foreign firms ranges from about 40% for exports of other services to more than 70% for imports of HQ services. In the case of IPP services, the share accounted for by foreign firms is larger for imports than for exports (60% versus 51%, approximately).

As a final step for this section, we run a series of regressions of trade in services on selected firms' characteristics: size (measured both in terms of employees and balance-sheet assets),

[15]Table A1 reports the percentage share of trade in services on firms' sales. For IPP services, shares are relatively low in the vast majority of sectors, with the main exception being information and computer services (for both exports and imports).

[16]With the term "parent company" we mean here the ultimate controlling investor, rather than the immediate counterpart. The information on the location of the parent company is provided by the respondent Italian firm in the *Direct Reporting* questionnaire.

[17]Our dataset does not allow to disentangle intra-group trade flows from total flows. A proxy indicator for the aforementioned distinction can be obtained by joining two pieces of available information: the location of the parent company and the counterpart-country of the transaction. If the transaction takes place with the parent company (intra-group trade), then the counterpart-country coincides with the parent company's country of residence. Hence, the share of trade occurring vis-à-vis the country where the importer's parent company is located can be thought of as a proxy for intra-group trade. We find that about a third of IPP services and HQ services are imported from countries where the parent companies of importing firms are located, while for other services such a share is less than 10%. These numbers ought to be considered more as a lower bound estimate, since the proxy indicator presented above does not deal with intra-group trade between affiliates, which may be also relevant.

Table 2: Distribution of trade in services by firms' economic activity

		Export				Import			
Economic activity	NACE code	IPP	HQ	Other	Total	IPP	HQ	Other	Total
Food	[10]	3.4	3.1	1.8	2.4	2.3	3.5	1.3	1.8
Beverages	[11]	0.2	0.3	0.5	0.4	0.7	0.9	0.5	0.6
Textiles	[13]	0.0	0.2	0.0	0.0	0.0	0.2	0.3	0.2
Wearing apparel	[14]	2.1	0.1	0.1	0.6	0.7	1.8	1.8	1.5
Leather	[15]	3.8	7.7	0.4	2.4	2.0	4.9	1.5	2.0
Paper & print	[17 + 18]	0.3	0.2	2.0	1.3	0.5	0.9	0.3	0.4
Coke & ref. petroleum	[19]	0.3	0.1	0.7	0.5	1.9	1.1	2.8	2.4
Chemicals	[20]	2.7	4.6	1.8	2.5	5.1	4.3	1.7	2.8
Pharmaceuticals	[21]	6.7	5.7	2.3	4.0	5.3	7.5	1.6	3.1
Plastics & rubber	[22]	3.2	2.5	0.7	1.6	1.6	3.1	1.1	1.5
Non-metallic mineral prod.	[23]	0.6	4.3	1.6	1.7	0.5	0.6	0.8	0.7
Basic metals	[24]	0.0	0.5	0.7	0.5	0.3	0.9	0.7	0.7
Metal products	[25]	0.1	1.7	5.6	3.6	0.5	1.1	0.8	0.8
Electronics	[26]	17.4	6.5	7.1	9.7	1.9	1.9	3.7	3.1
Electrical equipment	[27]	5.3	3.7	0.6	2.3	3.3	2.5	3.3	3.2
Machinery	[28]	3.7	5.5	4.8	4.6	3.2	5.9	4.7	4.5
Transport equipment	[29 + 30]	16.5	9.1	9.3	11.1	8.0	8.4	6.3	6.9
Other manuf. products	[32]	0.2	0.2	0.1	0.1	0.8	0.4	0.2	0.3
Energy & gas	[D]	0.1	2.9	2.9	2.2	0.8	0.8	2.7	2.0
Construction	[F]	0.3	2.6	1.3	1.2	0.3	1.4	1.0	0.9
Wholesale & retail trade	[G]	4.7	11.6	12.4	10.2	8.3	13.8	12.5	11.8
Transportation services & storage	[H]	0.1	1.5	9.9	6.1	1.4	1.9	21.8	14.8
Accommodation & catering	[I]	0.1	0.1	0.1	0.1	0.3	0.5	0.1	0.2
Telecommunications & media	[J58 …J61]	0.5	2.2	20.5	12.5	12.1	8.0	18.1	15.5
Information & computer serv.	[J62 + J63]	15.6	11.4	0.4	6.1	28.9	10.9	0.8	8.2
Finance & insurance	[K]	0.8	0.7	2.0	1.5	1.2	1.6	0.8	1.0
Business services	[M + N]	9.3	10.5	8.0	8.8	7.3	8.3	4.2	5.4
Residual activities	(*)	1.9	0.4	2.6	2.1	0.8	2.7	4.7	3.6
Total economy		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Memo item: Manufacturing	[C]	67.4	56.3	41.1	50.3	38.8	51.6	35.8	38.5

All values are in percentage terms, calculated as average on the 2013–2017 interval.
In squared brackets the NACE (Rev.2) code of the economic sector of the trading firms.
(*) Includes activities with the following NACE codes: A, B, E, L, P, Q, R, S, U, 12, 16, and 33.

sector, and ownership status.[18] Table 4 shows that the status of being foreign-controlled is always positively associated with IPP trade intensity (both on the import and the export side), even after controlling for size, sector, and year fixed effects. On the other side, the role of size *per se* is reduced after controlling for sector effects: it affects positively IPP trade, but only on the export side, while it is not significant or negatively affecting IPP imports and other kinds of service trade. When we split IPP service imports between those originating from tax

[18]The dependent variable is the share of imports (or exports) of a given service type on pre-tax profits. Independent variables include logarithm of employees, logarithm of total assets, and a dichotomous variable identifying foreign ownership, controlling for year and sector fixed effects. Standard errors are clustered according to sector-size groups. Sectors are 28 and defined as in table 2. Size groups are defined as in table 3.

Table 3: Distribution of trade in services by firm size and ownership

	Export				Import			
	IPP	HQ	Other	Total	IPP	HQ	Other	Total
Panel A: Distribution by firm size								
1–99	4.4	2.7	11.8	8.5	2.3	4.6	6.7	5.5
100–499	10.2	22.7	27.1	21.9	20.1	24.7	25.8	24.4
500–999	14.8	23.9	22.4	20.6	14.8	25.7	20.1	19.7
1000 and above	70.7	50.6	38.7	49.0	62.8	45.0	47.4	50.5
All firms	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Panel B: Distribution by firm ownership								
Foreign parent	51.5	68.5	40.2	47.5	59.2	71.6	37.0	46.4
Italian parent	47.1	26.8	58.2	50.5	34.0	25.8	60.0	49.8
No group	1.5	4.7	1.5	2.0	6.8	2.6	3.0	3.8
All firms	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

All values are in percentage terms, as average on the 2013–2017 interval

havens and those from non-havens, as done in table 5, size *does* affect imports too, but only those coming from tax havens.

Table 4: Trade in services and firms' characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
		Exports			Imports	
	IPP	HQ	Other	IPP	HQ	Other
Foreign control	0.299**	0.881***	0.659**	0.755***	1.100***	0.480**
	(0.105)	(0.140)	(0.219)	(0.180)	(0.139)	(0.160)
Log employees	0.0211	0.0436	-0.00369	-0.0496	0.0787	-0.210**
	(0.0364)	(0.0470)	(0.0781)	(0.0594)	(0.0458)	(0.0718)
Log assets	0.128***	-0.0322	-0.135	0.0965	-0.137*	0.117
	(0.0368)	(0.0663)	(0.0945)	(0.0680)	(0.0624)	(0.103)
Year FE	yes	yes	yes	yes	yes	yes
Sector FE	yes	yes	yes	yes	yes	yes
adj. R^2	0.073	0.040	0.050	0.114	0.069	0.068
N	8562	8549	8427	8577	8575	8506

Regression of log exports (or imports) of a given service type by firm i in year t on foreign control dummy, log employees, log assets, year and sector FE.
Sectors defined as in table 2. Clustered standard errors in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Imports of services and firms' characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
	Imports from non-havens			Imports from tax-havens		
	IPP	HQ	Other	IPP	HQ	Other
Foreign control	0.587***	0.786***	0.309	0.191**	0.313***	0.289**
	(0.151)	(0.118)	(0.158)	(0.0667)	(0.0678)	(0.0963)
Log employees	-0.0103	0.0390	-0.120	-0.0464	0.0394	-0.166***
	(0.0479)	(0.0291)	(0.0659)	(0.0344)	(0.0272)	(0.0463)
Log assets	-0.00607	-0.0829*	0.0754	0.108*	-0.0543	0.0494
	(0.0503)	(0.0382)	(0.0903)	(0.0423)	(0.0402)	(0.0514)
Year FE	yes	yes	yes	yes	yes	yes
Sector FE	yes	yes	yes	yes	yes	yes
adj. R^2	0.093	0.058	0.060	0.040	0.027	0.050
N	8579	8576	8528	8584	8582	8559

Regression of log imports of a given service type from non-havens or tax-havens by firm i in year t on foreign control dummy, log employees, log assets, year and sector FE.
Sectors defined as in table 2. Clustered standard errors in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

3 Profit shifting estimation

In this section we present the methodology initially proposed by Tørsløv et al. (2018) for the quantification of profits shifted to tax havens by multinational firms. We then apply this methodology to our sample of Italian firms, following three alternative approaches, which differ according to the aggregation level: a) total economy (aggregate level); b) industry level (sum of sectors); c) firm level (using a synthetic control approach in which each foreign firm is matched to a weighted average of local firms with similar characteristics).

3.1 Methodology

The approach initially proposed by Tørsløv et al. (2018) moves its first step from an empirical finding: foreign firms display on average lower profitability than local firms in high-taxation countries (non-haven countries), while the opposite is found in countries where taxation is relatively low (tax havens). Local firms, instead, display similar profitability both in tax havens and non-haven countries. They interpret the profitability gap between foreign and local firms as the effect of profit shifting activities implemented by cross-border multinational groups, relocating profits from non-haven to tax havens. As an index of firm's profitability, they consider the ratio z of pre-tax corporate profits (π) to wages (w):

$$z = \pi / w \tag{1}$$

Using the above notation to summarize their empirical finding, we have:

$$z_f^h > z_l^h \quad ; \quad z_f^n < z_l^n \tag{2}$$

where subscripts *f* and *l* refer to foreign and local firms respectively, and superscripts *h* and *n* indicate their location: tax haven and non-haven countries, respectively.[19] Pre-tax corporate profits π are defined as the difference between gross operating surplus, and the sum of net interest payments and depreciation.[20] Wages w include not only salaries but also non-wage employee compensation (such as retirement benefits, health benefits, payroll taxes, etc.).

Tørsløv et al. (2018) then compute the "hypothetical" profits that foreign firms would display if they had the same observed profitability of local firms ($z_f = z_l$). The difference between "hypothetical" or "adjusted" profits and reported profits can be thought of as a measure of shifted profits:

$$\text{Shifted profits} = \pi_f^* - \pi_f = z_l w_f - z_f w_f = (z_l - z_f) w_f \tag{3}$$

where adjusted foreign firms profits (π_f^*) are obtained under the assumption of foreign and local firms having the same z, so that shifted profits are given algebraically by foreign firms' cost

[19] For details on the set of tax haven countries, recall note 14.

[20] According to National Accounts definitions, value-added is made up by (i) cost of employees and (ii) gross operating surplus, which in turn can be split into (ii.a) net operating surplus and (ii.b) depreciation. Net operating surplus is made up by (ii.a.1) net interest paid and (ii.a.2) corporate profits. It is the latter component which is the taxable revenue of firms, as both depreciation and interest paid are tax-deductible.

of employees (w_f), multiplied by the profitability ratio differential ($z_l - z_f$).[21] The underlying assumption is that in all countries foreign and local firms in each sector have a Cobb-Douglas production function. Under this assumption, any observed difference between z_l and z_f must be due to profit shifting, since in this case different capital intensities do not reflect into profit shares. This result holds under more general production functions, to the extent that there are not significant differences in terms of capital intensity between foreign and local firms.[22]

There are two main limitations of this methodology. First, the assumption of similar capital intensities in foreign and domestic firms may not always hold empirically. Tørsløv et al. (2018) find that in the United States such a difference in capital intensities is modest and it can explain only a fraction (less than 10%) of the observed profitability gap between foreign and local firms.[23] In Section 3.3 we apply a sensitivity analysis that takes into account a variety of assumptions on relative capital intensity and on the elasticity of substitution between labor and capital.

The second limitation reflects the implicit assumption that local firms do not shift profits abroad, so that their profitability can be taken as a benchmark for calculating the profitability gap of foreign-control firms and, from that, estimating shifted profits. Indeed, this assumption may be reasonable to the extent that local firms are *not* multinational firms. However, some local firms, while controlled by an Italian parent, could well be part of a group that has some other foreign affiliates located abroad. Since these "local" firms may also implement profit shifting strategies with the help of their foreign affiliates (intra-group transactions), the assumption of no profit shifting for local firms holds only to a limited extent. In the light of this caveat, we ought to consider shifted profits estimated with this methodology more as a lower bound, rather than a point estimate.

3.2 Estimating profit shifting in our sample of firms

We now adapt the methodology initially proposed by Tørsløv et al. (2018) and apply it to firm-level data, i.e. to our sample of Italian companies that are active in services trade. As a preliminary step, we check whether our data provide support for the hypothesis that there is

[21] In the working paper version this methodology was applied both to tax-haven countries and to non-havens (Tørsløv et al. (2018)). In the published version, this methodology was applied only to tax-haven countries, in order to derive a worldwide estimate of shifted profits (Tørsløv et al. (2022)). The allocation of shifted profits to non-tax-havens is based on excess exports of high-risk services (exports of the specific types of service found in the literature to be most conducive of profit shifting) from each tax haven to a specific non-haven country; excess exports are computed as the the difference between the recorded and the predicted value of such exports, where predicted exports are projected based on the gross national income of a given tax haven.

[22] If we drop the hypothesis of Cobb-Douglas production function and allow for elasticity of substitution σ between capital and labor to differ from one, then a difference between capital intensities of foreign and local firms *does* reflect into profit shares, and hence into $z_l - z_f$ and estimates of profit shifting. The larger the distance of σ from one, the larger the impact of capital intensities differential on profit shifting estimates (see discussion in Section 3.3).

[23] This issue may be particularly relevant in the case of developing countries, where foreign-owned firms typically display much higher labor productivity, wages, and capital intensity with respect to local firms (Willmore, 1986).

an actual profitability gap between foreign and local firms.[24] Table A2 in the Appendix reports the results of a simple regression model for firms' profitability: the dummy variable denoting foreign-control firms is always strictly negative and statistically significant, indicating that foreign firms display indeed lower profitability with respect to local firms. This result is robust to the inclusion of controls for size (measured by the log of employees and/or the log of assets) and sector of economic activity. This systematical difference in profitability between foreign and local firms is surprising, given that the two groups of firms are largely balanced across several characteristics in our sample (Table A3). Except for being larger (in terms of revenues and employment, but not in terms of total assets), foreign firms indeed have a similar level of labor productivity (in terms of revenues per employee or value added per employee) and a similar level of vertical integration (as measured by the ratio of value added on sales) as those of local firms.[25]

We estimate profit shifting according to equation 3, following three alternative approaches, which differ in terms of the level of aggregation. First, we compare profitability of foreign and local firms across the entire sample of foreign firms, irrespective of their sector of activity: this yields a "direct" or "aggregate" estimate of shifted profits for the total economy. In the second approach, we compare profitability rates of local and foreign firms on a sector-by-sector basis, and then sum up our estimates of shifted profits across sectors to get a value for the entire economy ("industry-level" or "sum across sectors"). Finally, we compare profitability at the firm level through a synthetic control approach ("firm-level" or "synthetic control"), where each foreign firm is matched to a weighted average of local firms in the same sector. The following variables are used in the matching procedure: revenues, assets, productivity (revenues per employed person) and capital intensity (assets per employed person). The matching procedure is implemented within each sector, so that each foreign firm can only be matched to one or more local firms in the same sector.

3.3 Results

Table 6 reports our estimates of profit shifting in our sample of firms, based on 2015 data.[26] The direct approach (aggregate estimate for the entire economy; column 1) indicates that the size of shifted profits in our sample of Italian firms would amount to EUR 4.5 billion, equal to 30% of adjusted profits (i.e. sum of booked profits and shifted profits).

The industry-level approach (column 2), which derives profit shifting for the entire econ-

[24] The definition of "foreign" and "local" firms adheres to what was stated in section 2; we recall it here for the sake of clarity: *foreign* firms are enterprises residing in Italy belonging to a multinational group whose parent company is located abroad; *local* firms are all the remaining firms. With respect to the three sets displayed in panel B of table 3, the set of local firms hence contains both firms which are part of a multinational group with an Italian parent and resident firms that are not part of a group.

[25] As mentioned earlier, our sample is skewed towards medium-large firms. Extending the sample to include smaller firms (which would be to a large extent local firms) would likely amplify the differences between local and foreign firms.

[26] Since Tørsløv et al. (2018) provide estimates for the year 2015 only, we produced our estimates for that same year, in order to make the two results comparable.

omy as the sum of sector-level profit shifting, points to a significantly smaller amount (12% of adjusted profits). The discrepancy between the direct approach and the sector-level approach is relatively large, thus suggesting that macro estimates which ignore sectoral composition, such as the macro approach by Tørsløv et al. (2018), may suffer from a significant bias. The distortion depends on the implicit weighting in the aggregation process of sector-level estimates, i.e. on how profitability differentials $z_l - z_f$ and wages correlate across sectors. Specifically, some industries are more profitable than others and local and foreign firms are not equally distributed across industries. By taking into account industry-level profitability differentials, the industry-level approach seems therefore preferable to an aggregate approach (put forward by Tørsløv et al. (2018) and also applied, even if only in tax-haven countries, by Tørsløv et al. (2022)).

In addition to sector composition, firms can differ in profitability for many reasons, including reasons other than profit shifting (e.g. size, productivity, capital intensity etc.). These considerations justify the need for a firm-level estimation. The synthetic control approach tries to account for differences in selected firm-level characteristics, by matching each foreign firm to a weighted average of comparable local firms in the same industry. Column 3 shows that the estimate of profit shifting records a further decrease when we apply the synthetic control approach. The value of shifted profits becomes EUR 0.6 billion, equal to 5% of total profits. As a share of adjusted profits, the estimate based on synthetic control is only one sixth of the direct estimate, suggesting that a large part of the profitability differential between foreign and local firms is due to differences in firm-level characteristics, such as size, productivity and capital intensity. Indeed, this result is consistent with the general fact that existing micro-studies report lower magnitudes of profit shifting than macro-based studies (Hebous and Johannesen, 2021; Davies et al., 2018).

We further explore the sensitivity of profit shifting estimates. As discussed in section 3.1, our direct estimate is based on the assumption that there are no differences in terms of capital intensity between foreign-owned and local companies or, alternatively, that the production function is Cobb-Douglas (if the elasticity of substitution between capital and labor is equal to unity, different intensities of capital are not reflected in the profit shares and have a null effect on the estimates). We therefore replicate the direct estimate in the more general context of a CES production function, considering balance sheet data on the intensity of tangible capital between foreign-owned local firms[27] and assumptions on the elasticity of substitution between labor and capital. Specifically, we consider a range between 0.7 and 1.3 for the elasticity of substitution σ between labor and capital, in line with the existing literature. Columns 4-6 shows that the range of estimates for profit shifting under the direct approach interval widens considerably (between 1 and 40 per cent). Given that available estimates for Italian firms point to an elasticity of substitution around 0.7 (Saltari et al. (2012); see also Klump et al. (2012) for euro area firms), this would imply that profit shifting is more likely to be toward the lower end of the interval, and therefore significantly smaller than the baseline

[27]Foreign-owned firms tend to display a lower stock of tangible assets, even controlling for industry composition. A caveat applies however to balance sheet measures of capital stock, as they are usually based on historical cost and might not properly reflect the economic depreciation of the underlying assets.

direct approach.

Table 6: Estimates of shifted profits in our sample of Italian firms

	Direct	Industry	Firm	Direct		
				σ=0.7	σ=1	σ=1.3
	(1)	(2)	(3)	(4)	(5)	(6)
Shifted profits (EUR million)	4549	1431	567	81	4549	6955
as % of total profits	30.1	11.9	5.1	0.8	30.1	39.7

The table reports estimates of profit shifting according to three approaches: (1) direct (aggregate), (2) industry (sum across sectors), and (3) firm-level (synthetic control). Columns (4) and (6) report estimates obtained with the first (direct) approach under the hypothesis of a CES production function, assuming σ to be equal to its empirical lower and upper bounds, respectively. When σ is equal to 1 (5), it is equivalent to the Cobb-Douglas case in column (1).

We then look at results across sectors (table 7), finding wide heterogeneity in terms of profit shifting intensity, as in Barrios and D'Andria (2020) and Hebous and Johannesen (2021).[28] Within the manufacturing sector, larger amounts of shifted profits are observed in pharmaceuticals, machinery, basic metals, electrical equipment, metal products, and leather. Energy & gas, transportation and storage, and information services are among the services sectors with larger flows of profit shifting.[29]

According to the industry-level approach, profit shifting is negative in 8 out of 28 sectors (including large sectors such as telecommunications, business services, chemicals, and transport equipment), thus reflecting the higher profitability of resident foreign-control firms in those sectors. The relatively small number of firms included in sectoral clusters might explain this result: average profitability of foreign or local firms might indeed be affected by idiosyncratic shocks to one or few large firms. Further investigation of industries with negative estimates of profit shifting points to three main patterns. The first is related to an above-average profitability rate of one or very few foreign firms (especially in sectors with an oligopolistic market structure). A second pattern reflects an industry composition effect, where the higher profitability of foreign firms reflects their specialization in within-industry sub-sectors with higher profitability. A third pattern is linked to below-average profitability rates of one or very few local firms; this might be evidence that even local firms might shift profits abroad, thus invalidating one of the main assumptions behind the methodology, as argued in Section 3.1.

Estimates of profit shifting at the industry level derived from the synthetic approach tend to be broadly comparable to those obtained with the industry approach. In the majority of sectors the application of the synthetic approach yields smaller estimates of shifted profits compared to the industry-level approach, although there are some exceptions to this pattern.

[28]Barrios and D'Andria (2020) find that profit shifting intensity varies to a large extent across sectors, and that different tax avoidance scheme may be implemented in different sectors depending on a number of characteristics such as the assets structure of firms, their mode of financing, and their monopoly power.

[29]Differences across sectors tend to be fairly stable over time: the correlation of profit shifting in 2015 and in 2016 or 2017 is almost 80%.

This suggests that the relevance of firm characteristics in terms of explaining a portion of profit shifting estimated at the industry level is not uniform across sectors.

Table 7: Estimates of profit shifting by sector

	Shifted profits (industry)		Shifted profits (synthetic control)	
Sector	$(z_l - z_f)w_f$	% of π_f^*	$(z_l^{synth_f^i} - z^{i_f})w^{i_f}$	% of π_f^{i*}
	(1)	(2)	(3)	(4)
Food	76	0.17	21	0.05
Beverages	173	0.37	77	0.16
Textiles	7	0.78	8	0.88
Wearing apparel	70	2.36	50	1.68
Leather	165	0.43	303	0.78
Paper & print	13	0.15	19	0.22
Coke & ref. petroleum	-76	-0.74	-72	-0.70
Chemicals	-325	-1.62	-844	-4.21
Pharmaceuticals	983	0.47	1155	0.55
Plastics & rubber	141	0.40	83	0.24
Non-metallic mineral prod.	1	0.01	67	0.41
Basic metals	456	2.25	220	1.08
Metal products	174	0.85	149	0.73
Electronics	45	0.11	64	0.16
Electrical equipment	220	0.32	242	0.36
Machinery	491	0.51	448	0.46
Transport equipment	48	11.68	-416	-101.92
Other manuf. products	-14	-1.43	-14	-1.37
Energy & gas	638	3.83	541	3.25
Construction	4	0.03	86	0.63
Wholesale & retail trade	-121	-0.09	211	0.16
Transportation & storage	388	-5.04	-43	0.56
Accommodation & catering	5	0.10	43	0.79
Telecommunications & media	-1192	-0.84	-985	-0.69
Information & computer services	100	1.09	-186	-2.03
Finance & insurance	-23	-0.80	-50	-1.72
Business services	-556	-0.51	-182	-0.17
Residual activities	-458	-6.08	-427	-6.17

Methodology of Tørsløv et al. (2018) and authors' calculations on Italian data. Sectors defined as in tab. 2. All values are in EUR millions and relative to year 2015. Negative sign means inward profit shifting.

Finally, with respect to the limitation mentioned in section 3.1, which reflects the above-mentioned assumption that only foreign-owned firms shift profits abroad, we also considered an alternative approach where this assumption is relaxed. We defined firms as "tax-sophisticated" and "tax-naïve" according to whether they import any amount of IPP services from a tax-haven, independently from whether they are foreign- or local-owned. However, we did not find evidence of statistically significant differences in profitability between the so defined "tax-sophisticated" and "tax-naïve" firms. In the same regressions instead the dummy variable denoting foreign control continued to have a negative and statistically significant

coefficient.

3.4 Comparing estimates of profit shifting

We conclude this section by comparing our estimates of profit shifting in Italy with alternative estimates available in the literature. Table 8 reports the share of shifted profits on adjusted profits according to our three main approaches as well as according to three benchmarks in the literature.

The first benchmark is the estimate from Sallusti (2019), whose analysis employs a quantitative approach applied to a large firm-level dataset (about 63,000 firms). Similar to our approach, his methodology is based on profitability differentials, but the comparison applies to MNEs (i.e. companies belonging to a multinational group) and non-MNEs, a classification which is not entirely consistent with the local-vs-foreign ownership criterion used in our paper. His estimate of profit shifting therefore covers not only foreign-control firms, but also affiliates of *domestic* multinational groups, while our approach only includes the former group.[30]

Our second benchmark estimate is taken from Tørsløv et al. (2018). Their estimate is based on profitability differentials between foreign and local firms, using aggregate data taken from macroeconomic and structural business statistics. National Accounts statistics (NA) provide information on corporate value-added and on its subdivision between compensation of employees and gross operating surplus for the entire economy (i.e. for all resident firms, both local and foreign, as a whole aggregate). To break down these aggregates between local and foreign firms, they resort to Foreign Affiliates Statistics (FATS), which report value added and compensation of employees (w_f) for foreign-control resident firms.[31] However, foreign firms' profits (π_f) are not easily obtained, because these firms' value added needs to be cleared of compensation of employees, interest paid, and depreciation in order to get pre-tax corporate profits. The authors therefore draw on FDI income statistics to derive an estimate of net cross-border interest payments made by foreign firms. Depreciation of foreign firms can then be obtained as a residual, after subtracting income, costs, and taxes from gross operating

[30]The starting point of his analysis is the identification of a control group for every MNE in the sample: the ten "most similar" non-MNEs for each Italian MNE are selected using propensity score matching techniques, under a set of similarity constraints. The matched pairs "MNE–control-group" are then clustered in terms of profitability, in order to identify the MNEs with an "abnormally" low profitability. As a second step, the clustering is adjusted and validated using *receiver-operating-characteristic* (ROC) techniques, in order to determine to what extent the "abnormality" status signaled at the previous step can be reliably confirmed. Once MNEs have been robustly classified into two clusters of profit shifting and non-profit shifting firms, the amount of shifted profits can be estimated by comparing the profits across the two groups, and adjusting the profitability of profit shifting MNEs for the amount needed to bring it in line with that of non-profit shifting MNEs.

[31]Foreign affiliates statistics – FATS describe the activities of firms residing in a country, which are *controlled* or *owned* by other (multinational) enterprises residing outside that country. A firm is labelled as *foreign* if non-resident investors own more than 50% of ordinary shares or voting power. FATS are compiled according to the ultimate controlling investor criterion (UCI): if the foreign controlling investor in local firm A is a foreign enterprise B that is in turn owned by another local firm C, then local firm A is *not* labelled as foreign and it is not included in FATS statistics.

surplus.[32]

There are two weaknesses in this methodology (on top of those already discussed in Section 3.1), reflecting in both cases the limitations of the available data. The first is related to the combination of FATS and FDI data, since the two definitions of *foreign* firms do not entirely coincide: while FATS data are based on the criterion of the ultimate controlling country, FDI data are based instead on the immediate counterpart country.[33] The second weakness is related to the residual approach for the estimation of depreciation, which might lead to implausible values in some countries. In particular, an overestimation of foreign firms' depreciation would reduce their reported profitability and therefore reflect into an overestimation of profit shifting. Indeed, this methodology attributes to foreign firms in Italy one of the highest depreciation-to-gross-operating-surplus ratio with respect to any other advanced country in the sample (73% ratio, against an average of 48% among other advanced economies).

Our third benchmark estimate is taken from Tørsløv et al. (2022). Differently from the working paper version, the authors measure the profitability differential between foreign and local firms in tax havens only, in order to estimate the amount of shifted profits that flows in each tax haven from the rest of the world. This amount then is allocated to each non-haven country on the basis of excess "high-risk" services imports from each tax haven to a given country, where "high-risk" imports include IPP and HQ services, i.e. those types of services that are most conducive to profit shifting according to the literature (see Section 2).

Table 8 shows that the estimates by Sallusti (2019) and by Tørsløv et al. (2022) point to a share of shifted profits on adjusted profits between 10 and 13 percent, quite close to our industry-level estimate. The estimate by Tørsløv et al. (2018), according to whom foreign firms' shifted profits would amount to 66 percent of adjusted profits, is instead well above the range of our estimates.[34]

Overall, the wide heterogeneity of profit shifting estimates calls for great caution in their interpretation; this applies in particular to aggregate estimates, which neglect sector com-

[32]Retained earnings, net dividends paid and net interest paid by foreign-control firms are sourced from direct investment income statistics. Data on corporate tax income paid by foreign-control firms are, with a few exceptions (e.g. United States), not available, therefore the authors estimate them by applying to foreign firms the effective tax rate faced by all resident firms (local and foreign) in the economy. Therefore, in formula: gross operating surplus (sourced from FATS) – net interest paid (sourced from FDI) – net dividends paid (sourced from FDI) – retained earnings (sourced from FDI) – corporate income taxes (estimated) = depreciation of foreign firms.

[33]For instance, an Italian firm controlled by a Dutch company, which in turn is owned by an Italian investor, is considered an Italian *local*-control firm in FATS data and a *foreign*-owned firm residing in Italy in FDI data.

[34]This estimate might be biased by the above-mentioned issue regarding the measurement of depreciation for foreign firms. For instance, adjusting the value of π_f (and hence also π_l) for Italy so that the depreciation-to-gross-operating-surplus ratio is in line with the OECD average (i.e. 48%, instead of 73%), the share of shifted profits would fall from 66 to 29%. This simple calculation is an example to show how estimates of capital stock depreciation might dramatically affect the estimate of profit shifting. While depreciation could indeed be higher in foreign firms for structural reasons (for example, their production function could be more intensive in intangible capital, whose depreciation is faster than for physical capital), the large depreciation rate assumed by Tørsløv et al. (2018) might simply be an artefact of the residual approach used for its calculation, reflecting statistical inconsistencies across the various domains or other issues. This caveat should be kept in mind when evaluating results from their methodology.

position effects as well as other firm-level characteristics that might affect profitability differentials, and which seem to suffer from an upper bias, compared to industry or firm-level approaches.

Table 8: Shifted profits as a share of adjusted profits: comparison across various methods

Estimate	shifted profits (%)	Methodology	Aggregation level	Profit shifters
Direct (aggregate)	30	Profitability differential	Aggregate	Only foreign MNEs
Industry (sum across sectors)	12	Profitability differential	Industry	Only foreign MNEs
Firm (synthetic control)	5	Profitability differential	Firm	Only foreign MNEs
Sallusti (2019)	13	Profitability differential	Firm	Foreign and local MNEs
Tørsløv et al. (2018)	66	Profitability differential	Aggregate	Only foreign MNEs
Tørsløv et al. (2022)	10	Profit. diff. + risky services reapportionment (*)	Aggregate	All resident firms

The table reports estimates of profits shifted by Italian firms as a share of total profits. All estimates refer to year 2015, apart from Sallusti (2019), which refers to 2016. (*) The profitability differential methodology is applied to tax-havens only. The estimated amount is then allocated to non-havens, based on their share of risky services imports from tax-havens (see also footnote 21).

4 The relation between shifted profits and imports of IPP services

We now compare our estimates of profits shifted abroad by foreign firms with the value of services traded by the *same* group of firms. We focus on imports of IPP and HQ services, either from the rest of the world or from tax havens only.[35] Our underlying assumption is that shifted profits are channelled abroad via the cross-border payments made by resident firms as compensation for the consumption of imported IPP services (i.e. paying fees for the use of intellectual property, buying R&D services, purchasing software or other computer services). Profit shifting occurs insofar the counterparts for such payments are located in tax havens. Profit shifting may be more intense if such transactions are over-invoiced, and IPP and HQ services transactions are indeed more easily susceptible to over-invoicing than other types of services or even goods (whose market prices for each product can be easily observed by the tax agency).[36]

Table 9: Estimates of profit shifting and imports of selected services

Shifted profits		IPP imports		IPP+HQ imports	
Synth. control	Industry	Total	Tax havens	Total	Tax havens
(1)	(2)	(3)	(4)	(5)	(6)
567	1431	2312	1293	3873	1830

Estimates of shifted profits with synthetic control (1) and sum-across sectors (2) approach.
Imports of IPP (3) and HQ services (5), *of which*: imports from tax havens: (4) and (6).
All values refer to 2015 and are in EUR million.

Table 9 compares our two more conservative estimates of shifted profits by foreign firms (based on industry, and synthetic control approach) with their imports of IPP and HQ services. Overall, imports of IPP and HQ services can in principle accommodate profit shifting flows: IPP and HQ imports made by foreign-controlled firms in our sample jointly amount to 3.9 € billion, of which 1.8 € billion from tax havens. If we assume that estimated shifted profits are moved abroad exclusively via imports of IPP and HQ services from tax havens, this would imply that between 30 and 80% of such imports are overstated (depending on whether profit shifting is estimated through the synthetic control or the industry-level approach), i.e. such

[35] Instead of resorting to a list of tax-havens, an alternative approach could be based on cross-country differences in the corporate tax rate. However, the corporate tax rate does not necessarily take into account all possible determinants of the actual fiscal burden borne by resident firms; indeed, special arrangements, subsidies, cooperation treaties, and favourable treatment of intangible assets can significantly lower the fiscal burden of firms even in countries with a high corporate tax rate. For this reason, we preferred to adhere to the tax havens list compiled by Tørsløv et al. (2018).

[36] As mentioned in section 1, profit shifting may happen through other channels, including financial transactions or transfer of assets or relocation of headquarters (via corporate inversions). There are might also be broader restructurings of corporate activities where functions are reorganized in such a way to concentrate more profitable activities in low-tax countries. Finally, export under-invoicing might be an additional channel.

flows would reflect transactions at an artificially high price in order to move profits to another country. This percentage would rise even more if we restrict the analysis to IPP imports only.

Table 10: Shifted profits and imports of IPP and HQ services from tax havens by sector

Sector	Shifted profits (industry)	Shifted profits (synth. control)	Imports from tax havens IPP	Imports from tax havens IPP+HQ
	(1)	(2)	(3)	(4)
Food	76	21	11	40
Beverages	173	77	12	35
Textiles	7	8	0	2
Wearing apparel	70	50	0	2
Leather	165	303	0	178
Paper & print	13	19	1	4
Coke & ref. petroleum	-76	-72	2	24
Chemicals	-325	-844	15	77
Pharmaceuticals	983	1155	17	21
Plastics & rubber	141	83	40	41
Non-metallic mineral prod.	1	67	3	4
Basic metals	456	220	9	12
Metal products	174	149	5	13
Electronics	45	64	5	50
Electrical equipment	220	242	94	96
Machinery	491	448	28	58
Transport equipment	48	-416	53	57
Other manuf. products	-14	-14	0	0
Energy & gas	638	541	4	4
Construction	4	86	0	0
Wholesale & retail trade	-121	211	26	84
Transportation & storage	388	-43	20	52
Accommodation & catering	5	43	3	3
Telecommunications & media	-1192	-985	0	0
Information & computer services	100	-186	907	918
Finance & insurance	-23	-50	0	0
Business services	-556	-182	38	49
Residual activities	-458	-427	0	5

Methodology of Tørsløv et al. (2018) and authors' calculations on Italian data. Sectors as in tab. 2
All values are in EUR million and relative to year 2015. Negative sign in columns (1) or (2) means inward profit shifting.

The comparison presented in table 9 keeps the door open to the hypothesis that imports of IPP and HQ services may actually be used as a profit shifting channel, insofar the overall size of the channel is compatible with the overall size of the flow to be shifted. However, an industry-level analysis casts more doubts on the relation between the two phenomena. Estimates of profit shifting exceed imports of IPP and HQ services in quite a few sectors, such as pharmaceuticals, energy & gas, basic metals, transportation and storage, and machinery.[37]

[37]This applies also to the synthetic control estimate of profit shifting, with the exception of transportation and storage.

Conversely, there are a few sectors with significant imports of IPP and HQ services but low or even negative estimates of shifted profits: telecommunications, business services, chemicals, information services, and wholesale and retail trade.

The former discrepancy (shifted profits larger than imports of IPP and HQ services) could be interpreted as suggestive evidence that imports of IPP and HQ services are not the only channels through which profit shifting occurs: other ways to transfer profits abroad include transfer pricing practices on goods and other services, or strategic pricing of intra-group liquidity transactions (see note 4). The latter discrepancy (shifted profits smaller than imports of IPP and HQ services) might reflect instead either an underestimate of profit shifting or an authentic use of the IPP and HQ services provided by tax havens as real input of firms' production process.

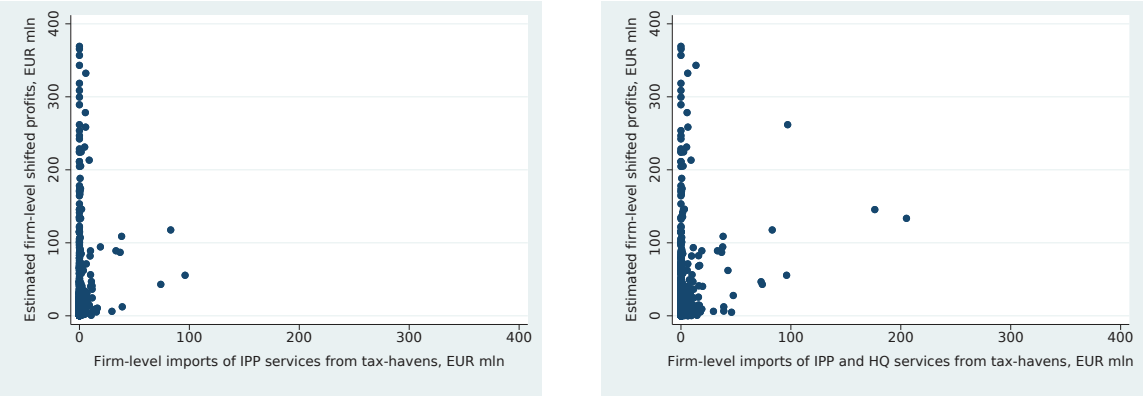
A further concern with the assumed relation between profit shifting and service imports may stem from the fact that the importing firms are not necessarily the *same* firms that shift profits abroad. We have therefore looked at the correlation between shifted profits and imports of IPP and/or HQ services from tax havens *at the firm level*, to verify to what extent the two variables reported in table 9 reflect activities from the same firm.

The scatter diagram (Figure 1) shows that among the foreign firms in the sample there is a very low correlation between firm-level estimates of shifted profits and firm-level imports of IPP services (left panel), or IPP and HQ services (right panel) from tax havens. In both cases the distribution is vertically skewed at the extreme left of the scatterplot, suggesting that a large majority of foreign firms import null or very low amounts of IPP services from tax havens, even though the same firms appear to shift profits abroad with heterogeneous intensity.

At the same time, there is a small subset of firms (some of them being also quite large) for which there seems to be some correlation between the two variables. This might suggest that for a specific subset of firms imports of IPP and HQ services from tax havens appear to be the main channel through which profit shifting occurs, while for the remaining firms profit shifting may occur through different channels. This hypothesis should nonetheless be taken with great caution, as the discussion in Section 3 shows the significant limitations and uncertainty surrounding the estimates of profit shifting, even at the firm level.

A side-observation to previous evidence is that profit shifting is not evenly distributed across firms, but tends to be relatively concentrated, in line with the results from Davies et al. (2018).

Figure 1: Firm-level shifted profits and imports of IPP and HQ services from tax havens



Both graphs exclude foreign firms associated with null or negative amounts of shifted profits. For graphical clarity, we omit one firm with services imports larger than EUR 400 million.

5 Conclusions

The rising relevance of intangible capital in the balance-sheets of multinational corporations has led to a worldwide surge in the trade of services related to intellectual property products. Some studies have claimed that the underlying intangible assets can be strategically located in fiscally favourable jurisdictions, so that IPP services imports (i.e. the remuneration of intangible assets) can easily become a conveyor belt to shift profits to tax havens.

This paper aims at bringing new evidence on this issue. Using detailed firm-level data for Italy, we first document that trade in IPP services shows indeed quite peculiar features. More than 40% of IPP services are imported from tax havens, compared to less than 30% for the other services. Trade in IPP services is highly concentrated among firms, with foreign firms accounting for two-thirds of IPP imports. Imports of IPP services are made not only by firms specialised in ICT sectors, but are relatively widespread across sectors (including manufacturing).

We have then estimated the amount of profits shifted to tax havens by foreign firms, applying the methodology initially proposed by Tørsløv et al. (2018) to our firm-level data. We find that our baseline estimates of profit shifting vary between 5% and 30% of adjusted profits (i.e. the sum of officially reported and shifted profits), depending on whether the methodology is applied at the firm level (through a synthetic control approach), at the industry level or on all the firms as an aggregate, with the baseline estimate more likely to be toward the lower end of the interval. The range of estimates becomes however even larger in a set of robustness analyses, thus pointing to great caution and uncertainty surrounding estimates of profit shifting.

We then compare the aggregate level of estimated profit shifting with imports of IPP and HQ by foreign firms, under the hypothesis that such import flows are used by MNEs to relocate profits to tax havens. If we take into account imports from tax havens only, their size can accommodate our more conservative estimates of shifted profits, although this would imply that the bulk of IPP and HQ services imports are overstated and exclusively made for

strategic transfer-pricing transactions (which seems a quite strong and presumably unrealistic assumption).

Finally, we check at the firm level whether companies associated with relatively higher levels of estimated shifted profits profit are the same firms involved in services imports from tax havens. We find that there is a very low correlation at the firm level between shifted profits and imports of IPP and HQ services from tax havens, except for a small subset of firms. This would suggest that services imports from tax havens might be the main channel of profit shifting for a specific subgroup of firms, while other channels might be relevant for the majority of firms.

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Appendix

Table A1: Trade in services as a percentage of firms' sales, by economic activity

		Export				Import			
Economic activity	NACE code	IPP	HQ	Other	Total	IPP	HQ	Other	Total
Food	[10]	0.6	0.3	0.7	1.6	0.4	0.3	0.6	1.3
Beverages	[11]	0.2	0.2	0.9	1.3	0.5	0.4	1.2	2.2
Textiles	[13]	0.1	0.3	0.2	0.5	0.1	0.2	2.0	2.3
Wearing apparel	[14]	1.8	0.0	0.1	2.0	0.5	0.8	3.9	5.1
Leather	[15]	3.2	3.7	0.7	7.7	1.5	2.1	3.3	6.9
Paper & print	[17 + 18]	0.2	0.1	3.2	3.5	0.3	0.3	0.6	1.2
Coke & ref. petroleum	[19]	0.0	0.0	0.1	0.1	0.1	0.0	0.5	0.7
Chemicals	[20]	0.6	0.6	0.9	2.0	1.0	0.5	0.9	2.4
Pharmaceuticals	[21]	2.1	1.0	1.6	4.7	1.4	1.2	1.3	3.9
Plastics & rubber	[22]	1.9	0.9	0.9	3.7	0.9	1.0	1.7	3.5
Non-metallic mineral prod.	[23]	0.5	1.9	2.8	5.2	0.3	0.3	1.6	2.2
Basic metals	[24]	0.0	0.1	0.3	0.4	0.1	0.1	0.4	0.5
Metal products	[25]	0.1	0.7	9.6	10.3	0.3	0.4	1.6	2.4
Electronics	[26]	11.4	2.4	10.4	24.2	1.1	0.6	6.4	8.1
Electrical equipment	[27]	2.2	0.9	0.5	3.6	1.2	0.5	3.6	5.3
Machinery	[28]	0.7	0.6	2.1	3.4	0.5	0.6	2.4	3.5
Transport equipment	[29 + 30]	1.6	0.5	2.0	4.1	0.7	0.4	1.6	2.7
Other manuf. products	[32]	0.5	0.2	0.4	1.1	1.4	0.5	1.0	2.8
Energy & gas	[D]	0.0	0.1	0.3	0.4	0.0	0.0	0.3	0.4
Construction	[F]	0.2	0.9	1.7	2.7	0.2	0.4	1.6	2.2
Wholesale & retail trade	[G]	0.1	0.2	0.7	0.9	0.2	0.2	0.8	1.1
Transportation services & storage	[H]	0.0	0.1	2.9	3.0	0.2	0.1	7.4	7.6
Accommodation & catering	[I]	0.1	0.1	0.3	0.5	0.5	0.5	0.7	1.6
Telecommunications & media	[J58 …J61]	0.1	0.2	5.8	6.1	1.4	0.5	6.1	8.0
Information & computer serv.	[J62 + J63]	6.4	2.7	0.4	9.5	10.4	2.3	0.8	13.5
Finance & insurance	[K]	0.0	0.0	0.2	0.3	0.1	0.0	0.1	0.2
Business services	[M + N]	1.3	0.8	2.5	4.6	0.9	0.6	1.5	3.0
Residual activities	(*)	0.4	0.0	1.0	1.4	0.1	0.2	1.9	2.2
Total economy		0.6	0.3	1.3	2.2	0.5	0.3	1.5	2.3
Memo item: Manufacturing	[C]	1.0	0.5	1.4	3.0	0.5	0.4	1.5	2.4

All values are in percentage terms on firms' sales, calculated as average on the 2013–2017 interval.
In squared brackets the NACE (Rev.2) code of the economic sector of the trading firms.
(*) Includes activities with the following NACE codes: A, B, E, L, P, Q, R, S, U, 12, 16, and 33.

Table A2: Profitability and foreign ownership

	(1)	(2)	(3)	(4)
	$y =$ profitability index z			
Foreign control	-0.290***	-0.247**	-0.209**	-0.152*
	(0.0815)	(0.0792)	(0.0747)	(0.0738)
Log employees			-0.198***	-0.577***
			(0.0444)	(0.0842)
Log assets				0.532***
				(0.0832)
Year FE	yes	yes	yes	yes
Sector FE	no	yes	yes	yes
N	8530	8530	8516	8480
adj. R^2	0.003	0.079	0.099	0.168

Clustered standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A3: Balancing test

Variable	Local		Foreign		
	Mean	SD	Mean	SD	Std Diff
Log revenues	11.82	1.50	12.18	1.32	-0.26
Log employees	5.37	1.68	5.67	1.46	-0.19
Log assets	11.77	1.70	11.85	1.40	-0.05
Log revenues per employee	6.42	1.47	6.51	1.30	-0.06
Log value added per employee	4.61	1.09	4.57	0.99	0.03
Ratio of value added to revenues	0.24	0.19	0.22	0.16	0.11

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