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The Missing Profits of Nations

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By exploiting new macroeconomic data known as foreign affiliates statistics, we show that affiliates of foreign multinational firms are an order of magnitude more profitable than local firms in a number of low-tax countries. Leveraging this differential profitability, we estimate that 36% of multinational profits are shifted to tax havens globally. US multinationals shift twice as much profit as other multinationals relative to the size of their foreign earnings. We analyse how the location of corporate profits would change if shifted profits were reallocated to their source countries. Domestic profits would increase by about 20% in high-tax European Union countries, 10% in the US, and 5% in developing countries, while they would fall by 55% in tax havens. We provide a new international database of GDP, trade balances, and factor shares corrected for profit shifting. In contrast to the picture painted by official statistics, our results suggest that the corporate capital share has increased not only in North America but also in high-tax European countries. Capital is making a comeback globally, but its rise is obscured by the tax avoidance strategies of multinational companies.

Key words: Multinationals, Profit shifting, Factor shares

JEL Codes: H26, E25, F23

1. INTRODUCTION

One of the most striking development in global tax policy since the 1980s has been the decline in corporate income tax rates. Between 1985 and 2018, the global average statutory corporate tax rate fell by about half, from 49% to 24%. One reason for this decline is international tax competition. By cutting their tax rates, countries can attract profits and capital from abroad (see Keen and Konrad, 2013, for a survey). Yet, despite the prominence of profit shifting in the academic literature and the public debate, we do not currently have comprehensive estimates of the amount of profit shifted from one country to another.

Our article attempts to fill this gap by drawing on new data. Since the beginning of the 2010s, the statistical institutes of most developed countries—including the major tax havens—have started releasing macroeconomic data known as foreign affiliates statistics. Following international guidelines, these data record the wages and profits of foreign firms, defined as

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firms more than 50%-owned by foreign shareholders (i.e. typically subsidiaries of foreign multinationals). These statistics greatly improve our ability to observe where multinational companies operate and book profits, in particular the amounts they book in tax havens.

Using these data, we propose a simple method to infer profit shifting by multinationals to low-tax countries. By combining foreign affiliates statistics with national accounts data (which cover all firms—foreign plus local—incorporated in a given country), we estimate the profitability of foreign vs. local firms within each tax haven. This exercise reveals that foreign firms are much more profitable than local firms in tax havens. Leveraging this differential profitability, we provide bounds for the amount of profits shifted by multinationals in each haven. Using new bilateral balance of payments data, we then re-allocate these shifted profits to the countries where the profits have been made, or where the multinationals' parents are headquartered.

The specificity of our approach—its global and bilateral nature—sheds light on key aspects of globalization. First, it allows us to estimate comprehensive profit losses for individual countries. For instance, we can estimate the amount of profits shifted out of, say, Germany, a computation that requires global data since all multinationals (not only those headquartered in Germany) can shift profits out of Germany. This improves our ability to quantify the losses of tax revenue caused by profit shifting. Our global perspective also allows us to compare profit losses for developed and developing economies—and to contrast these losses with the gains of tax havens—providing insights into the redistributive effects of globalization. Third, we can compare the profit-shifting intensity of multinationals headquartered in different countries (whether, for instance, US multinationals make a more extensive use of tax havens than European multinationals), a relevant piece of information to study the determinants of corporate tax avoidance. Last, our methodology generates bilateral estimates of profit shifting i.e. amounts of profits shifted out of, say, France to Luxembourg, or Germany to the Netherlands. This allows us to address questions such as: are profits shifted out of European Union countries primarily shifted to other EU countries (shifting that might be hard to regulate given EU treaties guaranteeing the free movement of capital within the European Union) or to non-EU tax havens? And do profits initially shifted to other EU countries ultimately end up in non-EU havens, with EU havens acting as mere conduits?

Our main findings can be summarized as follows. In our preferred estimate, we find that 36% of multinational profits—defined as profits made by multinationals outside of the country where their parent is located—were shifted to tax havens globally in 2015. We establish that US multinationals shift comparatively more profits: in 2015, US firms shifted more than half of their multinational profits, as opposed to about a quarter for other multinationals. The governments of high-tax European Union countries appear to be the prime losers of global profit shifting, with a reduction in domestic profit of about 20%, as opposed to 10% in the US and 5% in developing countries. While most profit shifting out of the European Union is done initially to EU tax havens, our bilateral data reveal that about half of the profits shifted out of the European Union ultimately end up in non-EU tax havens. In sum, quantitatively a key pattern that emerges from our analysis is large profit shifting out of EU high-tax countries, often by US multinationals, first to European tax havens such as Luxembourg or the Netherlands, then eventually to non-EU offshore centres such as Bermuda. The governments of tax havens derive sizable benefits from this phenomenon: by taxing the large amount of profits they attract at low rates, they generate more tax revenue, as a fraction of their national income, than the countries that have higher rates.

These findings have important implications for the measurement of headline economic indicators and in turn for core issues in macroeconomics. The flip side of the profits shifted to tax havens is that output, net exports, and profits recorded in non-haven countries are too low. Adding back the profits shifted out of high-tax countries increases the corporate capital share significantly. Because EU high-tax countries appear to be the most affected by profit shifting, it is in these countries that the adjustment is the largest. In the official statistics of most EU countries,

the corporate capital share seems to have increased little, especially after removing activities related to real estate (Cette, Koehl and Philippon, 2019; Gutiérrez and Piton, 2020). This has led to a view that the rise of the capital share is a North-American specificity, casting doubts on most technological explanations for the decline of the labour share. Our findings, by contrast, suggest that the rise of the capital share is more widespread: after correcting for profit shifting, the capital share of corporate value added rose by about 4 points in high-tax EU countries over the 1985–2015 period. This lends support to theories highlighting the role of international trends like globalization and technological change—as opposed to country-specific shocks—in the dynamic of factor shares, such as declining relative prices of capital (Karabarbounis and Neiman, 2014), capital-biased technical change and automation (e.g. Acemoglu and Restrepo, 2018), the rise of super-star firms (Autor, Dorn, Katz, Patterson and Van Reenen, 2020), or capital accumulation (Piketty and Zucman, 2014). Capital is making a comeback globally, but its rise is obscured by the tax-avoidance strategies of multinational companies.

Our analysis proceeds in three steps. We start by documenting a simple but striking fact: in tax havens, foreign firms are hugely more profitable than local firms. More precisely, in tax havens the ratio of pre-tax profits to wages is around 30–40% for local firms, but it is an order of magnitude larger for foreign firms. For example, foreign firms in Ireland have a profits-to-wage ratio of 800%: for $1 of wage paid to Irish employees, foreign multinationals book $8 in pre-tax profits in Ireland.[1] This huge excess profitability of foreign firms is specific to tax havens. In high-tax countries, foreign firms are slightly *less* profitable than local firms: the profits to wages ratio is typically around 30–40% for local firms as opposed to 20–30% for foreign firms.

In the second step of the analysis, we construct bounds for the amount of profit shifted into each tax haven. The excess profitability of foreign firms relative to local firms in tax havens could in principle be due to a number of factors: foreign firms in these countries may be more capital intensive than local firms; they may operate in different sectors; they may be larger, or more R&D intensive. Exploiting the most detailed foreign affiliates statistics available where sectors, capital intensity, and R&D expenditures can be observed, and building on the literature about multinational firms, we bound the excess profitability of foreign firms in havens that can be attributed to true economic differences with local firms.

Because the excess profitability of foreign haven firms is huge, only a small fraction of it turns out to be attributable to true economic differences with local haven firms. Differences in capital intensity, in particular, cannot explain more than 10% of the excess profitability of foreign haven firms, even under conservative assumptions about the elasticity of substitution between capital and labour. Globally, our preferred estimate for the amount of profits shifted—36% of multinational profits—is sizable, but it appears well founded empirically. We find the same magnitudes using two fully independent methodologies and data sources: our benchmark "excess profitability" methodology, based on the high profits-to-wage ratios of foreign haven firms recorded in foreign affiliates statistics, and an "excess cross-border transactions" methodology, based on the high exports of services and receipts of intra-group interest recorded in the balances of payments of tax havens.

In the third step of the analysis, we re-allocate the shifted profits to the countries where they have been made, or to the countries where the multinationals' ultimate parents are headquartered. In both cases, we exploit new bilateral balance of payments data. To assess where the shifted profits come from, we follow the origin of intra-group interest received by tax havens and the destination of some of their exports, specifically those that have been found in the literature to be conducive of profit shifting, such as exports of the right to use intellectual property and

1. This corresponds to a capital share of corporate value-added of 80–90% in foreign firms operating in Ireland, vs. around 25% in local Irish firms.

management advice. In our second allocation, we follow the ultimate destination of the direct investment income payments made by tax haven subsidiaries. About half of the profits globally shifted to tax havens ultimately accrue to parents located in the US and slightly more than 25% to parents in the European Union. This allocation is highly relevant for policymakers, since it makes it possible to assess the revenue potential of a minimum tax collected by each parent country on the profits booked by its multinationals in tax havens—a minimum tax to which more than 130 countries have agreed to in June 2021 (OECD, 2021).

The rest of this article proceeds as follows. In Section 2, we relate our work to the literature. Section 3 outlines our conceptual framework and methodology, and Section 4 describes the data. We present our estimates of the amount of profits shifted to tax havens in Section 5, before analysing the implications of this phenomenon for the geography of global profits in Section 6. Section 7 discusses our corrected estimates of factor shares and Section 8 concludes. This article is supplemented by an Supplementary Appendix and by a Replication Guide that enables the reader to reproduce all our estimates step by step starting from publicly available data. The Replication Guide and updated estimates are available at http://missingprofits.world.

2. RELATED LITERATURE

2.1. *Microeconometric estimates of profit shifting*

A body of work studies profit shifting using accounting micro-data, collected in the Orbis database of Bureau van Dijk (see Kalemli-Özcan, Sørensen, Villegas-Sanchez, Volosovych and Yeşiltaş, 2015, for a presentation of these data). Profit shifting is estimated by running regressions of the form:

$$\log(\pi_{ic}) = \alpha + \beta(\tau_p - \tau_c) + \delta Firm_i + \gamma Country_c + \epsilon_{ic}, \quad (1)$$

where π_{ic} denotes the pre-tax profits booked by company i in country c, τ_c the tax rate in country c, τ_p the tax rate in the parent's country (or the average tax rate of other subsidiaries), and $Firm_i$ and $Country_c$ firm and country controls.[2] A positive $\hat{\beta}$ is interpreted as evidence of profit shifting, and the global amount of shifted profits is extrapolated from the estimated β. The OECD (2015) uses this methodology for its official estimate of the size of base erosion and profit shifting (Johansson *et al.*, 2017).

In contrast to this line of work, we rely on macro data capturing the profits booked in tax havens, namely foreign affiliates statistics. The advantage of these macro data is that they are more comprehensive than Orbis. To record the profits made by multinationals in their various subsidiaries, Orbis relies on information in public business registries. However, in many countries public registries either do not exist (e.g. Bermuda), or contain no income information (e.g. US and Switzerland). Profits booked by multinationals in these countries are not visible in Orbis. By contrast, statistical authorities have access to more information to compile their foreign affiliates statistics, including private income statements and balance sheets.

To illustrate the limits of Orbis, Figure 1 compares the consolidated global profits of each multinational in Orbis to the sum of its subsidiary-by-subsidiary profits. In 2012, only 17% of the global profits of multinationals could be traced in Orbis. That is, 83% were booked in subsidiaries unknown to Orbis, or for which no profits data were available. For example, Orbis correctly reports that the worldwide consolidated profits of Apple were 55.3 billion euros in 2016. If one adds up

2. Heckemeyer and Overesch (2017) give an overview of 26 studies using this approach; see also de Mooij and Ederveen (2008), Riedel (2018), Wier and Reynolds (2018), and Beer, de Mooij and Liu (2019). A number of studies (e.g. Egger, Eggert and Winner, 2010) use the Bureau van Dijk Amadeus database, which is the European subset of Orbis.

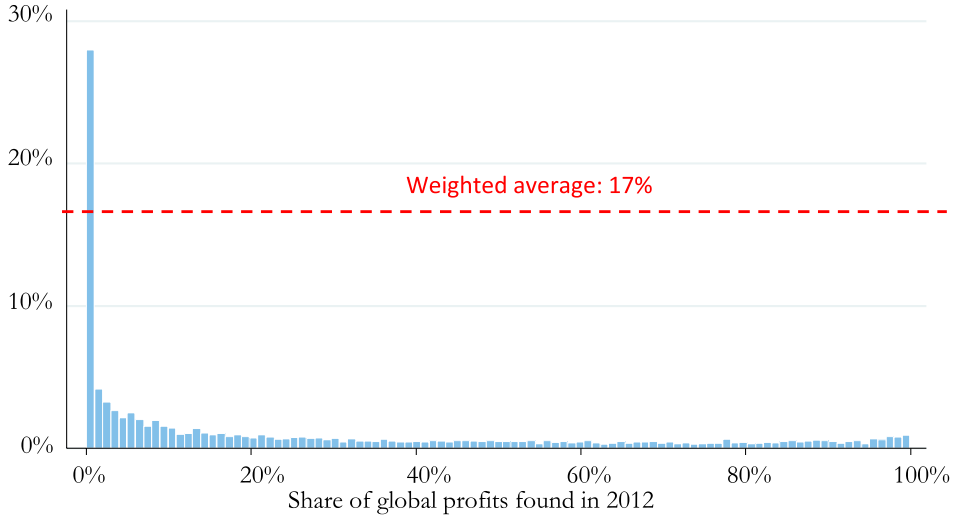

FIGURE 1

Fraction of global profits that can be observed in Orbis

Notes: This graph shows the density of the following ratio for the year 2012. For each multinational firm in Orbis, we compute the sum of the unconsolidated pre-tax profits of all subsidiaries (code U1), and we divide this sum by the consolidated global profits of the firm (code C1). Whenever the ratio is less than 1, this means that only part of the global profits of the firm are visible at the subsidiary level in Orbis. In 28% of the cases, no profits are visible at the subsidiary level. The weighted average of 17% is weighed by profit. *Source*: authors' computations using Orbis data.

all the profits recorded in Orbis by all of Apple's subsidiaries throughout the world, however, then one finds only 2.0 billion euros. None of the profits made by Apple in the US or in tax havens are visible.

Relatedly, Bilicka (2019) finds that accounting data underestimate the true size of profit shifting outside of the UK relative to more comprehensive tax data. Comparing reported taxable profits to assets for UK affiliates of foreign multinationals and comparable UK firms with no affiliates abroad, Bilicka (2019) finds that foreign multinationals shifted about 50% of their profits out of the UK during the period 2000–14. Our findings (36% of multinational profits shifted to tax havens globally and 43% in our upper bound scenario) are consistent with this order of magnitude.

2.2. *Macroeconomic estimates of profit shifting*

A nascent literature takes a macro perspective to study profit shifting. Most of this literature uses US statistics and focuses on US multinationals (e.g. Clausing, 2009, 2016; Wright and Zucman, 2018; Guvenen, Mataloni Jr., Rassier and Ruhl, 2021).[3] In this article, by contrast, we take a global perspective: we estimate profit shifting by all the world's multinationals and the implications of this phenomenon for each OECD country, the main emerging economies, and tax havens. A global perspective is valuable to estimate profit shifting even in countries where detailed data exist about the global operations of domestic multinationals, because both domestic and foreign multinationals can shift profits out of any given country.

3. See also Grubert (2013) Dowd, Landefeld and Moore (2017) and De Simone, Mills and Stomberg (2017) for studies of profit shifting by US multinationals using IRS data.

In the case of the US, our results are consistent with the important study by Guvenen *et al.* (2021) who estimate that $158.3 billion (0.9% of US GDP) was shifted by US multinationals out of the US in 2015, and an additional $3.5 billion by 127 technology-intensive multinationals headquartered outside of the US. This lines up well with our estimate of $143 billion (0.8% of GDP) in profit shifted out of the US by US plus non-US multinationals.

Two recent studies, Crivelli, de Mooij and Keen (2015) and Bolwijn, Casella and Rigo (2018), use global macro data to study profit shifting. These studies do not rely on foreign affiliates statistics or attempt to infer profit shifting from the differential profitability of foreign vs. local firms in tax havens, the key features of our methodology. Crivelli *et al.* (2015) infer revenue losses due to tax avoidance from the correlation between corporate tax revenue collected and the statutory tax rates of other countries in a panel model.[4] Bolwijn *et al.* (2018) rely on the foreign direct investment statistics of non-haven countries, while our work focuses on what happens within tax havens.[5] An advantage of our approach is that it produces estimates of profit shifting that can be tracked by policymakers annually. Moreover, the bilateral balance of payments we use enable us to provide bilateral estimates of profit shifting, a key input to calibrate quantitative models of multinational production with profit shifting (e.g. Wang, 2018).

3. CONCEPTUAL FRAMEWORK AND METHODOLOGY

This section presents our baseline methodology to infer profit shifting. We define our key statistics of interest, present the assumptions underlying our approach, and validate it in the case of US multinationals for which particularly detailed data are available.

3.1. *Profitability ratios*

3.1.1. Definition of profitability. Throughout this article, our measure of profitability is the profits-to-wage ratio. At the country level, we denote it by π and define it as follows. Using standard notations, we denote by Y the corporate output (or value-added) of a country, obtained by combining effective labour AL and capital K. We consider output at factor cost, i.e., before indirect taxes. We include in the corporate sector all resident corporations, both non-financial and financial. Part of corporate output is paid to workers; the rest, operating surplus, accrues to the owners of capital: $Y=F(K,AL)=rK+wL$. In this framework, r includes both the normal return to corporate capital and any above-normal return (i.e. r is not necessarily equal to the marginal product of capital). The capital share of corporate output (which we will often refer to as "the capital share", for brevity) is $\alpha=rK/Y$ and the ratio of operating surplus to wages is $\alpha/(1-\alpha)$. Corporations pay p percent of their operating surplus rK in net interest. We define (pre-tax) corporate profits as $(1-p)\cdot rK$. The profit-to-wage ratio π measures the amount of profit made by resident firms per dollar of wage paid: $\pi=(1-p)\cdot\alpha/(1-\alpha)$.[6] We subtract net interest paid from corporations' operating surplus because interest payments are typically deductible from the corporate tax base while interest received (e.g. by banks) is typically taxable. At the country level, net interest paid by corporations is generally small (interest paid by non-financial corporations is

4. Using their methodology, Cobham and Janský (2018) estimate country-level tax revenue losses.

5. Our estimate of the global amount of profits shifted offshore ($616 in our preferred scenario in 2015) is comparable in size to the one obtained by Bolwijn *et al.* (2018), $700 billion in 2012. See Supplementary Appendix C for a detailed comparison.

6. Our measure of wage always include non-wage employee compensation (such as retirement benefits, health benefits, payroll taxes, etc.). That is, "wage" in this article always refers to what is called "employee compensation" in the national accounts (SNA code D.1).

offset by interest received by financial corporations), so π is usually close to $\alpha/(1-\alpha)$. We also subtract capital depreciation from profits, because depreciation is deductible from taxable profits. Thus Y, α, r, and π are all net of capital depreciation. This article focuses on the corporate sector: we do not attempt to measure factor shares or profitability in non-corporate businesses, which are not subject to the corporate income tax.

3.1.2. Profitability for foreign vs. local firms. We define the profits-to-wage ratio of foreign firms (π_f) and local firms (π_l) analogously to π. That is, π_f is equal to the pre-tax profits (after net interest payments) made by foreign firms divided by the wages paid by these firms:

$$\pi_f = (1-p_f)\cdot\alpha_f/(1-\alpha_f), \tag{2}$$

where α_f is the net-of-depreciation capital share of the net value-added of foreign firms, and $1-p_f$ net interest received relative to operating surplus. Following international guidelines, foreign firms include all firms where foreign investors own more than 50% of shares with voting rights. This condition is sufficient but not necessary: there are a few other ways firms can be classified as foreign (see Eurostat, 2012).[7] For any country i, we define as "local firms" all firms incorporated in i that are not classified as foreign. In addition to firms with purely domestic operations, local firms include domestic multinationals. For example, foreign firms in Germany include the German affiliates of Microsoft; local firms in Germany include Siemens (a German multinational) and German companies with no activity outside of Germany. By definition, at the country level $\pi = s\cdot\pi_f + (1-s)\cdot\pi_l$, where s is the share of wages paid by foreign firms.

We are mainly interested in how π_f differs from π_l within tax havens. The recorded π_f in tax havens reflects inward profit shifting and other factors (including all economic determinants of true profitability):

$$\pi_f = f(shift, other).$$

There are three forms of profit shifting (see Heckemeyer and Overesch, 2017, for a survey), and each affects the recorded profit-to-wage ratio. First, multinational groups can manipulate intra-group exports and import prices: subsidiaries in high-tax countries can try to export goods and services at low prices to related firms in low-tax countries, and import from them at high prices.[8] Such transfer price manipulations increase the recorded π_f in tax havens. Second, multinationals can shift profits using intra-group interest payments (see e.g. Huizinga, Laeven and Nicodeme, 2008): affiliates in high-tax countries can borrow money (potentially at relatively high interest rates) from affiliates in low-tax countries, which again increase π_f in tax havens. Last, multinationals can move intangibles—such as trademarks, patents, logos, algorithms, or financial portfolios—produced or managed in high-tax countries to affiliates in low-tax countries, which then earn royalties, interest, or payments from final customers.[9]

7. The notion of control is used to classify firms as foreign in Eurostat (2012) guidelines. Control is "the ability to determine the general policy of an enterprise by choosing appropriate directors, if necessary" (Eurostat, 2012, p. 13). The ownership of more than 50% of shares ensures control. In some cases, control can be exerted with a less than 50% ownership, for instance if certain shares have more voting power than others.

8. See, e.g., Bernard, Bradford Jensen and Schott (2006), Vicard (2015), Cristea and Nguyen (2016), and Liu, Schmidt-Eisenlohr and Guo (2020).

9. See Faulkender, Hankins and Peterson (2017) for evidence suggestive of profit shifting by US multinationals through the relocation of intangibles in low-tax countries. See Langenmayr and Reiter (2017) for evidence of profit shifting by German banks through the strategic relocation of financial portfolios in tax havens.

3.1.3. Definition of tax havens. We include 41 countries and territories in our list of tax havens: five OECD countries (Belgium, Ireland, Luxembourg, Netherlands, and Switzerland) and 36 non-OECD countries or territories.[10] Our list of tax havens is taken from Hines and Rice (1994), with the additional inclusion of the Netherlands, Belgium, and Puerto Rico. The Netherlands was not considered as a tax haven by Hines and Rice (1994) because US multinationals reported paying high tax rates there in 1982, but their effective tax rate has fallen since then to 12% in 2015. Belgium is a borderline case: it is a conduit country that receives large flows of cross-border payments found in the literature to be conducive of profit shifting and is sometimes considered a tax haven (e.g. because of the deductibility of notional interest on equity), although its effective tax rate (19%) is the same as the world average in 2015. Belgium accounts for 2% of our baseline estimate of the amount of profit shifted globally. Excluding it from our list of tax haven would not make any significant difference to our results.

Puerto Rico is a US territory which is not subject to the US federal corporate income tax. A number of papers study income shifting by US multinationals to Puerto Rico (e.g. Grubert and Slemrod, 1998; Suárez Serrato, 2019). Puerto Rico is not part of the US for GDP statistics. As a result, if a US multinational shifts profit to this territory, this shifting reduces the officially measured US GDP and capital share of US corporate value added, just as when a US multinational shifts profit to Bermuda. Because we are interested in how profit shifting affects the measurement of GDP and the capital share, including Puerto Rico as a haven separate from the US is pertinent for our purposes.

To illustrate our classification choices, Figure 2 plots the difference between the profits-to-wage ratio of foreign firms (π_f) and local firm (π_l) against the effective corporate income tax rate for the countries and territories we consider in our analysis (tax havens, OECD countries, and a number of developing economies). The countries and territories included in our list of tax havens (in red) have both low effective corporate income tax rates (below 15% except in two cases) and $\pi_f > \pi_l$, often hugely so. By contrast, the countries we classify as non-havens have $\pi_f \leq \pi_l$, with the exception of a small number of borderline cases (in blue). Because in these countries the excess of π_f over π_l is relatively small, including these countries in our list of tax havens would not materially affect our results.

3.2. *Inferring profit shifting: baseline assumptions*

To form our baseline estimate of the amount of profits shifted to tax havens, we set π_f equal to the observed π_l in each tax haven. That is, we compute the aggregate amount of profit that foreign firms in e.g. Ireland would make if they were as profitable as local Irish firms, and similarly in each other tax haven. One merit of this procedure is that it is simple and transparent. Here, we explain the conditions under which it delivers accurate estimates of profit shifting. Section 3.3 provides support for this procedure, and Section 5.2 relaxes our assumptions to construct bounds for the amount of profit shifted into each tax haven.

Assume that there are two types of firms in tax havens, local and foreign.[11] Both types of firms face the same homogeneous labour supply but different capital supplies (for foreign firms capital is supplied by the rest of the world; for local firms it is supplied domestically). In a world

10. Andorra, Anguilla, Antigua and Barbuda, Aruba, The Bahamas, Bahrain, Barbados, Belize, Bermuda, the British Virgin Islands, the Cayman Islands, Cyprus, Gibraltar, Grenada, Guernsey, Hong Kong, the Isle of Man, Jersey, Lebanon, Liechtenstein, Macau, Malta, Marshall Islands, Mauritius, Monaco, the Netherlands Antilles, Panama, Puerto Rico, Samoa, Seychelles, Singapore, St. Kitts and Nevis, St. Lucia, St. Vincent & Grenadines, Turks and Caicos, Vanuatu.

11. To simplify the exposition, in this sub-section, we disregard interest payments (p_f in Equation 2 is assumed to be zero). Results discussed in Section 5.1 show that interest income plays a minor role in profit shifting globally.

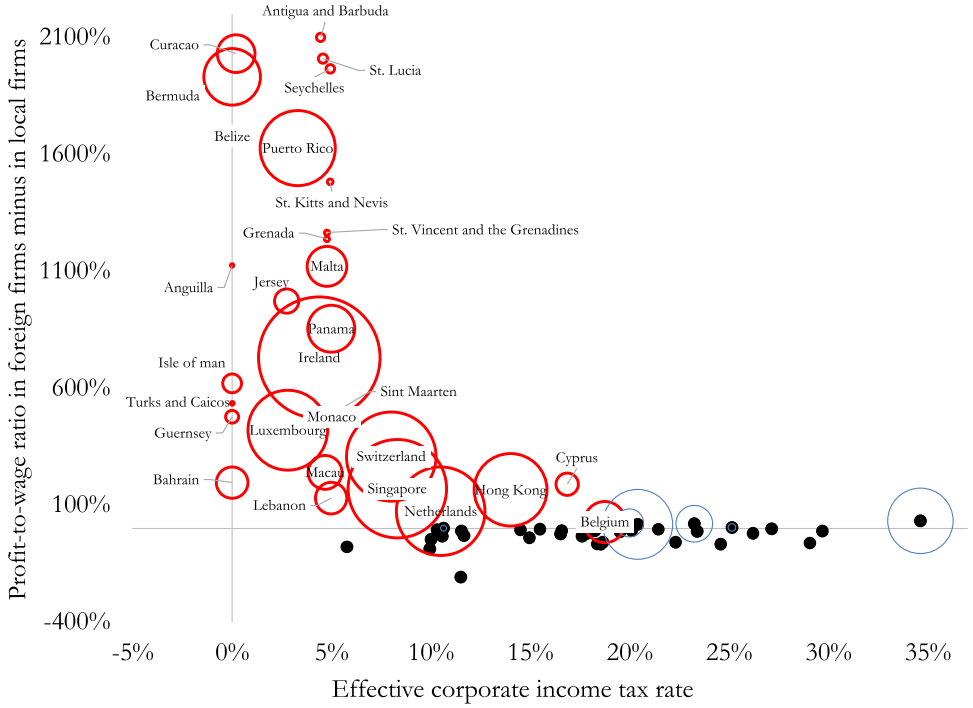

FIGURE 2

Excess profitability vs. effective tax rates

Notes: This graph shows the difference between the profits-to-wage ratio of foreign firms (π_f) and local firm (π_l), plotted against the effective corporate income tax rate. The year is 2015. The sample includes OECD countries, a number of developing non-OECD countries (Brazil, China, Colombia, Costa Rica, India, Russia, and South Africa), and the countries and territories included in our list of tax havens. Bubble sizes are proportional to the excess of π_f over π_l. In red are the countries and territories included in our list of tax havens. In blue are the countries not included in our list of havens that have π_f larger than π_l (with bubble size proportional to the excess of π_f over π_l) . In black are all other non-haven countries (which have π_f lower than π_l). The effective corporate income tax rate is proxied by the effective tax rate of the affiliates of US multinational companies, computed as foreign corporate income tax paid divided by profit-type return in the BEA survey of the foreign activities of US multinationals. *Source*: authors' computations.

without profit shifting, the profit-to-wage ratio of foreign firms π_f is equal to capital intensity in the foreign sector times the rate of return to capital r_f,

$$\pi_f = \left(\frac{K}{wL}\right)_f \cdot \underbrace{MPK_f \cdot (1+\mu_f)}_{=r_f}, \tag{3}$$

where *MPK* denotes the marginal product of capital and μ any return to capital ownership in excess (or below) the marginal product of capital, reflecting market power in the factor market or in the product market.

Three assumptions are sufficient to infer that within tax havens, the excess of π_f over π_l reflects profit shifting: (i) the elasticity of substitution between capital and labour is equal to 1 in both local and foreign firms, (ii) the degree of competition is the same in foreign and local firms (same μ), and (iii) profit shifting does not affect the reported profitability of local firms.

Assumption 1: Elasticity of substitution $\sigma = 1$**.** As is well known, with an elasticity of substitution between capital and labour equal to 1 (Cobb–Douglas production), capital intensity does not affect the capital share, because any increase in the capital stock is perfectly offset by a corresponding fall

in the marginal product of capital. This means that although local and foreign haven firms may have different capital intensities (e.g. foreign firms may be more capital intensive, as multinationals may chose to locate capital in low-tax countries), if $\sigma = 1$ these differences do not create a gap between π_l and π_f. For example, if both local and foreign firms have the same Cobb–Douglas production function $Y = K^{\alpha}(AL)^{1-\alpha}$, competition is perfect, and the Cobb–Douglas coefficient $\alpha = 25\%$, then both types of firms have $\pi = 33\%$ no matter what their capital stock is, and any deviation of the recorded profits-to-wage ratio from this value reflects profit shifting.

In the more general case where firms have a constant elasticity of substitution production function, the effect of the capital stock on the profits-to-wage ratio is ambiguous. The profits-to-wage ratio varies with the capital stock depending on the value of the capital-labour elasticity of substitution σ. If $\sigma > 1$, then firms with a high capital intensity have high profit-to-wage ratios. Conversely, if $\sigma < 1$, then firms with high capital intensity have low π, as the marginal product of capital becomes very low. In Section 5.2, we consider a range of assumptions about the value of the elasticity of substitution σ to infer what fraction of the high π_f of tax havens can be attributed to high capital intensities.

Assumption 2: Same degree of competition for foreign & local firms within countries. Our baseline estimates assume that the degree of competition (on both the factor and the product market) is the same for foreign firms and local firms within tax havens. Two remarks are in order. First, we do not need to assume perfect competition. For example, we allow for the possibility that corporations located in tax havens may have structurally high profitability due e.g. to rents generated by financial secrecy or lax regulation.[12] However to the extent that deviations from perfect competition exist, they must be the same for foreign and local firms. Second, we do not assume that the degree of competition is the same across countries. Our methodology allows for the possibility that there may be more competition in high-income havens (such as Switzerland) than in lower-income havens (such as Puerto Rico).

Assumption 3: No inward shifting in local sector. Last, we assume that the reported profitability of local firms in tax havens π_l is not inflated by inward profit shifting. Local haven firms include companies that are not part of a multinational group, but also multinationals that are headquartered in tax havens. The latter might shift profits inward. Our baseline procedure assumes that such shifting, if it exists, has negligible effect on π_l. Ideally, we would like to be able to compare the foreign firms of tax havens to local firms without foreign affiliates. Existing foreign affiliates statistics, however, do not currently make it possible to decompose local firms into firms with affiliates abroad vs. firms with only domestic operations.

In practice, there are a number of reasons why these assumptions may not hold. The elasticity of substitution may differ from 1. Foreign firms in tax havens may operate in different sectors with different degrees of competition than local haven firms; they may be larger, have more market power, extract larger rents, and be more R&D intensive.

3.3. *Validation test of baseline methodology*

We provide support for our baseline methodology by applying it to the case of US multinationals. The Bureau of Economic Analysis has compiled outward foreign affiliates statistics, based on annual surveys of the foreign operations of US multinationals, since 1982. Benchmark surveys are conducted every 5 years. Detailed tabulations by country are available annually since 1982

12. Relatedly, we allow for a real effect of profit shifting on the economic activity in tax havens (e.g. higher demand for legal or accounting services), to the extent that this demand benefits both local and foreign firms.

and by country × industry since 1994. Earlier surveys were conducted in 1966, 1970, and 1977. We collected all these data to study the evolution of the profits-to-wage ratio of US affiliates. We estimate specifications of the following model:

$$\pi_{cti} = \alpha_t + \beta_{1t} t \cdot ln(K_{cti}) + \beta_{2t} t \cdot ln(RD_{cti}) + \gamma_t t \cdot X_{ct} + \delta_t t \cdot Haven + \epsilon_{cti}, \quad (4)$$

where π_{cti} denotes the profits-to-wage ratio, K_{cti} the net plant, property and equipment, and RD_{cti} the research and development expenditures of affiliates in country or territory c, in year t, and industry i; X_{ct} denotes time-varying country controls (GDP in US$ using purchasing power parity exchange rates, and population); *Haven* is a dummy for being in our list of tax havens; and α_t are year fixed effects. The coefficient of interest, δ_t, captures the excess profitability of subsidiaries in tax havens relative to subsidiaries in non-havens in year t. Controlling for economic development in host countries (GDP and population) ensures that results are not confounded by the fact that the markups of US multinationals may be lower in high-income countries (Keller and Yeaple, 2020). Capital stocks, research and development, and country controls are all interacted with year dummies to flexibly capture any potential change in the shape of the production function or in how country characteristics affect profitability. All regressions are weighted by compensation of employees.

To visualize the results, we first plot the evolution of the raw profits-to-wage ratio of haven and non-haven affiliates, without controls. We then show the profits-to-wage ratio of haven affiliates obtained by adding the estimated δ_t to the raw profits-to-wage ratio of non-haven affiliates, for three different specifications of equation (4). In the first specification, equation (4) is estimated at the country level and without controlling for R&D expenditures (which are only observed in benchmark survey years, 1999, 2004, 2009, and 2014). This allows us to go as far back as 1982. We then move to the country × industry level. Our second specification still excludes R&D expenditures but include industry × year fixed effects. The last specification includes industry × year fixed effects and R&D expenditures. Figure 3 shows the results. A number of remarkable results emerge.

Starting with the raw series, we can see that the haven affiliates of US multinationals are an order of magnitude more profitable than their non-haven affiliates. In 2015, the profits-to-wage ratio of haven affiliates is 346%, as opposed to 46% for non-haven affiliates. In the 1960s and 1970s, the profitability of both types of affiliates was the same. Since then, the profitability of haven affiliates has surged while that of non-haven affiliates has flatlined. Consistent with the patterns displayed in Figure 2 above for all (US and non-US) affiliates, US affiliates in Ireland, Luxembourg, Bermuda, and the Caribbean tax havens are particularly profitable, with profits-to-wage ratios above 500%.

Second, the excess profitability of haven affiliates remains when adding controls in all specifications. This implies that this excess profitability cannot be explained by differences in capital intensity, R&D expenditures, productivity in home countries, or industry composition effects. In particular, adding industry × year fixed effects has relatively little effects on the excess profitability of haven affiliates. This is consistent with Supplementary Appendix Figure B, which shows that US affiliates in tax havens have a profit-to-wage ratio one order of magnitude larger than US non-haven affiliates *within sector*. Profit shifting is not limited to just a few sectors of the economy, such as information and communication technology: it appears to be an across-the-board phenomenon.[13] Similarly, controlling for R&D expenditures has little effect on profitability.

13. There are several potential explanations for this finding. Firms across all industries may shift profits by using intra-group trade and borrowing. It could also be that multinationals in all sectors can create firm-specific intangibles (such as logos), book these in low-tax places, and charge royalties to high-tax subsidiaries for the right to use these intangibles.

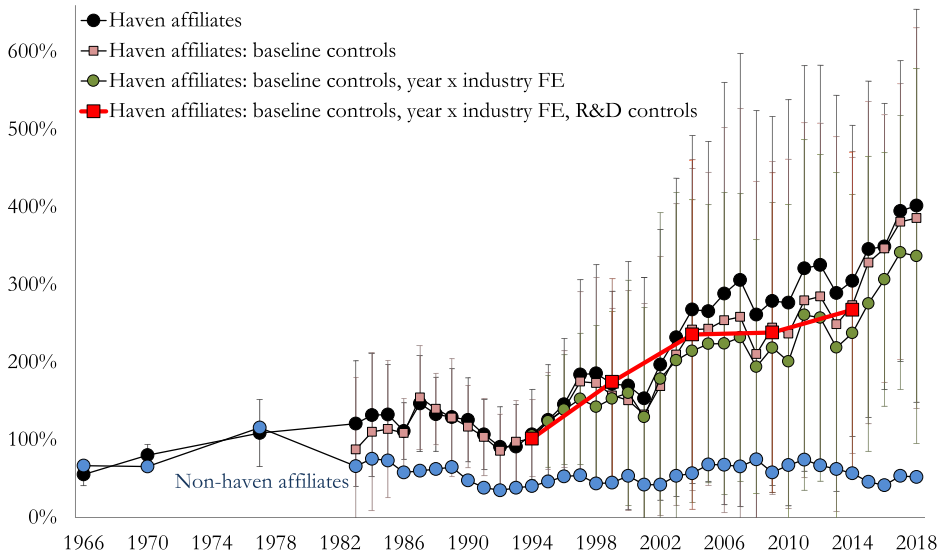

FIGURE 3

Profits-to-wage ratio of the foreign affiliates of US multinationals

Notes: This graph shows the profits-to-wage ratio of the affiliates of US multinationals in non-haven countries (blue line), in tax havens (black line), and in tax havens after controls, following equation (4). See text for description of each specification. R&D expenditures are linearly interpolated between benchmark surveys. Source: Authors' computations using tabulations of the BEA survey of the foreign operations of US multinationals. Profits are measured as profit-type return (Tables II.F.1); see Supplementary Appendix Section A for complete details on variable construction. Regression coefficients for the profitability premium of haven affiliates δ_t are reported in Supplementary Appendix Figure A, with robust standard errors clustered at the country level. The 95% confidence intervals reported here are constructed using these standard errors.

This is consistent with the counts of employees engaged in R&D reported in the BEA benchmark surveys. Only 8% of the R&D workers of affiliates of U.S multinationals were employed in tax havens in 2014, as opposed to 92% in non-haven countries. The high profitability of haven affiliates cannot be explained by local R&D, which by and large is conducted in high-tax countries. Altogether these results lend support to our baseline methodology.

In our year of study (2015) or the closest BEA benchmark survey year (2014), haven profitability is statistically different from non-haven profitability in all specifications, using robust standard errors clustered at the country level. We note that this is not the case before 2014, however, as standard errors can be quite large. We stress two caveats when interpreting these standard errors. First, recall that the regressions are run on the publicly available tabulations of the BEA survey by country $\times$ industry, not on the underlying firm-level micro data. The BEA survey covers the universe of US multinationals in benchmark years and all US multinationals above a size cut-off in non-benchmark years; there is thus virtually no sampling noise in these data. Second, due to country aggregation in the BEA tabulations, the *Haven* dummy is equal to 1 for only seven countries/regions (see Supplementary Appendix A for a full discussion). With clustering at the country level, statistical testing is done on only seven observations. These limitations could be addressed by estimating $\hat{\delta}_t$ using the survey micro-data, a task we leave to future research.

3.4. *How we allocate the shifted profits*

3.4.1. Allocation to source countries. We allocate the shifted profits to the countries where they have been made by tracking the cross-border payments conducive of profit shifting received by tax havens, proceeding in three steps. We first define high-risk service exports x as the

exports of the specific types of service found in the literature to be most conducive of profit shifting: exports of the rights to use intellectual property (patents and trademarks), headquarter services (administration, management and advertising), information and communication technology services, and financial and insurance services (Hebous and Johannesen, 2021). We disregard goods exports, which according to the literature seem to be less important than other profit shifting channels (see Supplementary Appendix C). Using bilateral balances of payments, we observe the amounts x_{ij} of high-risk services exported from haven i to country j. Second, we compute excess high-risk exports $\bar{x}_{ij}$ from i to j as the difference between the recorded and the predicted value of such exports, where predicted exports are projected based on the gross national income of haven i.[14] Third, we similarly compute the excess intra-group interest $\bar{g}_{ij}$ received by haven i from country j. Excess cross-border transactions t_{ij} are computed as $\bar{x}_{ij}+\bar{g}_{ij}$ and the shifted profits received by haven i are allocated to source countries j proportionally to t_{ij}.

For a given haven i, summing the excess cross-border transactions t_{ij} across destination countries j gives an estimate of profits shifted into i which is independent of our baseline estimate (based on the excess profitability $\pi_f - \pi_l$ in haven i). As we shall see in Section 5.1, these two estimates, despite being based on different data, line up well at the haven level.

Our procedure to allocate shifted profits to source countries is consistent with how profit shifting is perceived by policy-makers. Many countries have anti-avoidance policies whereby specific cross-border transactions (typically certain service exports and interest flows) are presumed to be motivated by tax avoidance and taxed accordingly.[15] Our approach does not involve the use of an apportionment formula. We keep the current international tax system of subsidiary-by-subsidiary accounting and arm's length pricing as is, and consider how the geography of global profits would change if incentives to shift profits disappeared, for instance if all countries applied the same effective corporate income tax rate. We do not, however, view our measurements as the counterfactual outcome of a perfect international tax harmonization, which would generate endogenous responses by firms which we would need to model.[16]

Our procedure to allocate shifted profits to source countries is also consistent with Clausing (2009), who estimates the fraction of US multinationals' offshore profits which is shifted out of the US by apportioning these profits proportionally to the amount of affiliate intra-firm transactions that occur with the US.[17]

3.4.2. Allocation to parent countries. We also allocate shifted profits to the countries where the ultimate parents of haven subsidiaries are incorporated. In effect, this allocation tracks the location of the parents who receive dividends paid by haven subsidiaries or to whom the retained earnings of these subsidiaries accrue. To do so, we use the bilateral direct investment

14. Predicted high-risk service exports from i to j are computed as $x_{ij} \cdot (x_{EU}/GNI_{EU})/(x_i/GNI_i)$ where x_{EU}/GNI_{EU} is the average export of high-risk services as a fraction of gross national income in non-haven EU countries, and GNI_i is haven's i gross national income.

15. For example, residence countries of multinational companies typically have controlled foreign company rules that tax certain forms of income (such as royalties and interest) reported in havens by their multinationals. In 2017, the US introduced a "base-erosion anti-abuse tax" that presumes that certain services transactions by multinational firms with related parties are motivated by tax avoidance.

16. Another approach to allocate the shifted profits would involve trying to figure where production has "truly" taken place. However in many cases, it is impossible to determine where production takes place (e.g. the creation of intangibles occurs through the cooperation and interaction of subsidiaries in various countries). See Devereux and Vella (2017) for a discussion.

17. We generalize this approach in three ways: (i) we apportion the profits shifted by all (not only US) multinationals; (ii) we use balance of payments data which capture all cross-border transactions (not only transactions within divisions of multinationals); (iii) we focus on the transactions identified in the literature as being particularly conducive of shifting.

statistics on an ultimate ownership basis compiled by Damgaard and Elkjaer (2017). This allocation allows us to study whether, for instance, US multinationals make a more extensive use of tax havens than E.U. multinationals.

4. DATA SOURCES AND GLOBAL SUMMARY STATISTICS

This section describes our three main data sources: national accounts data, foreign affiliates statistics, and balance of payments data. All the data sources, references and step-by-step computations are described in a detailed manner in the Replication Guide Section A (national accounts and foreign affiliate statistics) and B (balance of payments data); here, we focus on the main conceptual and practical issues.

4.1. *National accounts data*

We compute π in all tax havens, all OECD countries, and the main developing countries using harmonized national accounts data that follow the 2008 System of National Accounts (United Nations, 2009). The basic data source is the OECD's detailed national accounts by sector (Table 14A). This source covers all OECD countries (which includes prominent corporate tax havens: Ireland, Luxembourg, Netherlands, Belgium, and Switzerland) and a number of developing non-OECD countries (Brazil, China, Colombia, Costa Rica, India, Russia, and South Africa). We extend the OECD database to non-OECD tax havens (such as Singapore, Hong Kong, and Puerto Rico) by manually collecting the official national accounts published by tax havens' statistical institutes and central banks.

The OECD national accounts include the inputs needed to compute the profits-to-wage ratio π: corporate operating surplus rK, net interest payments p, and wages paid wL, for both financial and non-financial corporations, in our benchmark year (2015).[18] A few countries only provide gross-of-depreciation operating surplus series, in which case we impute depreciation based on the average depreciation rates (as a percent of corporate value-added) observed in OECD and non-OECD countries separately.[19] Australia, Canada, Iceland, Japan, Egypt, Indonesia do not isolate the corporate sector from other sectors of the economy (government and households); for these countries, we impute the share of domestic wages paid by corporations, also based on the average share observed in OECD and non-OECD countries.[20]

4.2. *Foreign affiliates statistics*

We compute the profitability of foreign firms (π_f) using foreign affiliates statistics (FATS) disseminated by Eurostat, the OECD, and national statistical agencies. These statistics are based on exhaustive or quasi-exhaustive census-type surveys of multinational enterprises. There are both inward and outward FATS. The inward FATS of, say, France record the value-added Y, operating surplus rK, compensation of employees wL (among other indicators) of foreign firms operating in France and are tabulated by country of the foreign parent company.[21] The outward FATS of France

18. For South Africa and Brazil, we use data for 2014, the latest available year.

19. See Replication Guide Section A.2.2. Capital depreciation amounts to around 15% of corporate gross value-added with relatively little variation across countries.

20. See Replication Guide Section A.2.1. By definition all profits originate from the corporate sector so generally speaking no imputation is required for profits. Profits in Ireland, Netherlands, and Luxembourg are upgraded to be consistent with partner countries' data, as discussed in Section 4.2 below.

21. Other indicators include e.g. turnover, number of employees, investments flows, R&D expenditure, and in some countries (such as the US) tangible capital stocks. When capital stocks are not available, we estimate them by cumulating past investment flows; see Replication Guide section E.

record these same statistics but for the affiliates of French multinationals operating abroad, and are tabulated by country of affiliate.[22] Firms report confidentially to domestic statistical authorities, which then publish tabulated statistics.

Once we have π (based on national accounts data) and π_f (based on inward FATS), we compute the profitability of local firms π_l as a residual using the fact that $\pi = s \cdot \pi_f + (1-s) \cdot \pi_l$, where s is the share of wages paid by foreign firms. This computation delivers accurate results because following international guidelines (Eurostat, 2012), variables in foreign affiliates statistics are defined and constructed just like in the national accounts, the only difference being that inward FATS only capture foreign-controlled corporations, while the national accounts capture all resident corporations. We have checked that the residual π_l is reliable: the labour share in the local sector is consistent with available estimates of the corporate labour share (e.g. Karabarbounis and Neiman, 2014; Cette *et al.*, 2019; Gutiérrez and Piton, 2020). A number of additional points are worth noting about foreign affiliates statistics.

4.2.1. Double-counting issues. Although in most European countries the publication of foreign affiliates statistics started only around 2010, as we have seen in Section 3.3 in the US outward FATS (called "Activities of US Multinational Enterprises") have been published annually since 1982 by the Bureau of Economic Analysis (BEA).

A concern with some of these BEA data is that they double-count foreign income (Blouin and Robinson, 2019). More precisely, "net income" as reported in the BEA Income Statement tables (D1–D13) double-counts the income of US affiliates going through chains of holding companies. However, we do not use "net income" in this article. We use the BEA Value Added tables (F1–F9), which are the tables that report our statistics of interest as defined in Section 3.1: the value-added Y, employee compensation wL, operating surplus rK, net interest paid $p \cdot rK$, and pre-tax profits $(1-p) \cdot rK$ of the majority-owned affiliates of US multinationals abroad (always net of depreciation). Pre-tax profit in the BEA Value Added Tables (called "profit-type return" by the BEA) does not double-count profits, because in contrast to "net income" it does not count as profit equity income received. The foreign affiliates statistics compiled internationally and used in this article are the analogue of the BEA Value Added Tables. Pre-tax profit in these statistics excludes equity income received and does not double count profits.

4.2.2. Imputations for missing countries. The main OECD economies including key havens (such as Ireland, Luxembourg, the Netherlands, and Switzerland) publish foreign affiliates statistics. For these countries, we compute π_f using their inward FATS. For the countries that do not publish FATS yet (which is the case for smaller, non-OECD havens e.g. Bermuda, the Cayman Islands, and Hong Kong), we impute the profits and wages of foreign firms in two steps.

First, we estimate the pre-tax profits of foreign firms using the amount of inward direct investment income reported in balance of payments statistics. Almost all countries and territories publish direct investment statistics (disseminated by the IMF), which follow common international guidelines codified in OECD (2008). Direct investment income is closely related to the pre-tax profits of foreign firms studied in this article. Direct investment income is the net-of-depreciation, net-of-corporate income tax profits of firms that are more than 10% owned by foreign investors,

22. This is in contrast to direct investment income statistics that are tabulated by country of the immediate counterpart. For instance, if a French parent owns a German affiliate through a holding company in Luxembourg, direct investment income received by the French parent is recorded as coming from Luxembourg in the French balance of payment (OECD 2008, Paragraph 218). FATS, by contrast, are tabulated by country of affiliates' primary activity. In the above example, profits are recorded as made in Germany (not Luxembourg).

pro-rated by the ownership stake of the foreign investor. Pre-tax profits in FATS is the net-of-depreciation, gross-of-corporate-income-tax profit of firms that are more than 50% owned by foreign investors, with no pro-rating. Wright and Zucman (2018) present a detailed comparison in the US case showing that both line up closely.[23] When the amounts of inward direct investment income reported by tax havens are lower than the mirror amounts of outward income reported by OECD and EU countries, we correct the haven data so that they match the partner countries'.[24]

Second, we estimate the wages paid by foreign firms by applying the wage/profit ratio seen in the outward FATS of counterpart countries. We rely on the outward FATS of the US which provide data on the foreign operations of US multinationals in small tax havens in isolation, such as Barbados, Bermuda, and Panama. We have checked that our procedure approximates the true amount of foreign profits and wages by implementing it for the sample of tax havens that publish inward FATS.

4.2.3. Bilateral discrepancies. If foreign affiliates statistics were perfect, the inward FATS of host countries (where affiliates are located) would be fully consistent with the mirror outwards FATS of partner countries (where parents are headquartered). We conducted a systematic comparison of the available data to assess the consistency of existing FATS.[25] While inward and outward data are generally consistent, there is one notable discrepancy. In the inward FATS of European tax havens—most importantly Ireland, the Netherlands, and Luxembourg—one finds less profit made by US affiliates than in the mirror outwards FATS of the US. A comparable gap is observed in bilateral balance of payments data, where less direct investment income is paid to the US by affiliates located in Ireland, Netherlands, and Luxembourg than received by the US from these havens.

There are two possible reasons for this discrepancy. First, European tax havens may underestimate the profits that affiliates of US firms book in their territory. These countries may miss some of the profits booked in special purpose entities due to a lack of comprehensive enough corporate registries, non-response to surveys, or other data issues (Angulo and Hierro, 2017; Damgaard and Elkjaer, 2017). Alternatively, the US may overestimate the profits booked by its multinationals in European tax havens. For example, US statisticians may wrongly assign to Ireland profits that in fact have been booked elsewhere (CSO, 2016). 0 To investigate the relative reliability of the data reported by the US, we compare outward US investments in non-havens (as reported by the US) to inward investments from the US in non-havens (as reported by these countries). As shown by Supplementary Appendix Figure G, profits recorded by the US abroad match the data reported by partner non-haven countries. This suggests that the investment data reported by the US are generally reliable. In our central scenario, we therefore upgrade the inward data of tax havens so that they match the counterpart outward data reported by the US. Our procedure ensures that global inward investment income matches global outward investment income.[26] Section 5.2 shows how taking the haven data at face value affects our estimates.

23. For instance in 2014 (the latest benchmark year for US outward FATS), after-tax profit in the US outward FATS is $421.1 while direct investment equity income is $447.8 billion (Wright and Zucman, 2018, Appendix Table A.1, cols. 1 and 4).

24. For instance, the Cayman Islands excludes the offshore sector from its balance of payments statistics, leading to inward direct investment income that is below the outward direct investment income earned in the Cayman Islands by OECD and EU countries. We replace the inward data reported by the Cayman Islands by the mirror outward data reported by OECD and EU countries; see Replication Guide Section A.3 for a step-by-step description of these computations.

25. See Replication Guide Sections A.4.1 and B.3.3.

26. If one takes the inward investment data reported by tax havens at face value, then the profits of US affiliates abroad recorded by US statisticians in all foreign countries combined (as measured in the US balance of payments) exceed

TABLE 1
Global output, corporate output, and corporate taxes paid

	Billions of current US$	% of net corporate profits
Global gross output (GDP)	75,039	
Depreciation	11,940	
Net output	63,099	
Net corporate output	34,084	296
Net corporate profits	11,515	100
Net profits of foreign-controlled corp.	1,703	15
Of which: shifted to tax havens	616	5
Net profits of local corporations	9,812	85
Corporate income taxes paid	2,154	19

Notes: This table reports the global totals in our database in 2015. Profits of foreign corporations include all the profits made by companies more than 50% owned by a foreign country; profits of local corporations equal all corporate profits minus the profits of foreign corporations. *Source*: Replication Guide Tables C.5 and A.3.

4.2.4. Summary statistics. Table 1 presents our database of corporate profits by showing its global totals. In 2015, global gross value-added (i.e. global GDP) reached $75 trillion and global net value-added (i.e. after capital depreciation) about $63 trillion. About 54% of global net value-added was produced by corporations; the rest was produced by governments, households, and non-corporate businesses. Within corporations, the capital share of net value-added was about 1/3 and the labour share about 2/3. Out of the $11.5 trillion in net-of-depreciation corporate profits, close to 15% ($1.7 trillion) were made in foreign firms. This $1.7 trillion number—what we call "multinational profits"—includes all the profits made by, say, Apple in France, Germany, Ireland, Jersey, etc., but not by Apple in the US where its headquarter is located. We estimate that out of these $1.7 trillion in multinational profits, 36% (about $600 billion) were shifted to tax havens.

4.3. *Bilateral balances of payments*

To allocate shifted profits to source countries, we rely on the bilateral balances of payments disseminated by the IMF and Eurostat. Following the adoption of the 6th edition of the IMF (2009) Balance of Payments Manual, most countries have started publishing bilateral balances of payment including bilateral service trade flows by type of service, and bilateral foreign direct investment income (including bilateral intra-group interest payments and receipts). Among tax havens, the data are particularly good for Switzerland and the European Union tax havens (Ireland, Luxembourg, Belgium, Netherlands, Malta, and Cyprus) which must report harmonized statistics to Eurostat.

When two estimates of the same haven- to non-haven flow are available (e.g. exports of services from Luxembourg to Germany as recorded by Luxembourg, and imports of services by Germany from Luxembourg as recorded by Germany), we use the statistics reported by tax havens, because the bilateral data reported by tax havens tend to be more comprehensive than those recorded by counterpart countries. The service exports recorded by the six E.U. tax havens (Ireland, Luxembourg, Netherlands, Belgium, Malta, and Cyprus) to the 22 non-haven E.U. countries exceed the recorded imports by more than 30%. One likely explanation for this gap is

the profits of US affiliates recorded by all foreign countries combined (as measured in their balances of payments). In turn, this imbalance is the main driver of the $200 billion imbalance in global direct investment income recorded in the world balance of payments by the IMF in 2015. As we show in the Replication Guide Section B by leveraging the bilateral direct investment income data of all the world's countries, the bulk of this global direct investment income gap comes from missing profits of US affiliates in inward statistics.

that importers' data miss (at least some of) the services that are exported by tax-haven corporations directly to foreign customers, such as digital music subscriptions or ride-sharing services. There is evidence that the typical business structure of digital services multinationals involves shifting intellectual property to tax haven subsidiaries and then directly selling services to final customers without involving any non-haven subsidiary (see e.g. Pomeroy, 2016). The associated service flows seem at this stage better captured in the tax havens' trade statistics than in the customer countries' statistics.[27]

5. ESTIMATES OF PROFITS SHIFTED TO TAX HAVENS

We now present our results on the amount of profit shifted to tax havens. We start by discussing our baseline results before bounding these estimates.

5.1. *Baseline estimates*

5.1.1. Profitability in local vs. foreign firms. Figure 4 displays our key statistics of interest: the profits-to-wage ratios for foreign firms (π_f) and local firms (π_l). A key finding emerges: foreign firms in tax havens are an order of magnitude more profitable than local firms in tax havens. The reported profitability of foreign firms in tax havens is truly exceptional, with π_f ratios of 800% in Ireland and as high as 1,625% in Puerto Rico in 2015. Overall, foreign firms in havens have a profits-to-wage ratio eight times larger than local firms in havens.[28]

Two other results are worth noting. First, while foreign firms are an order of magnitude more profitable than local firms in tax havens, the opposite is true in high-tax countries: in these countries foreign firms are slightly *less* profitable than local firms. For instance, in the United Kingdom the profits-to-wage ratio is 26% for foreign firms (π_f) vs. 48% for local firms (π_l).[29] There are several possible reasons for the this finding. Foreign firms may be younger than local firms, or they could operate in less profitable industries.[30] The fact that $\pi_f < \pi_l$ in high-tax countries while $\pi_f >> \pi_l$ in tax havens suggests that profit shifting is also part of the reason why foreign firms appear unprofitable in high-tax places. However, inferring profit shifting out of high-tax countries from the profitability gap observed in these countries is difficult, because both local and foreign

27. When a firm incorporated in Luxembourg directly exports digital services to French customers without going through a French subsidiary, French statistical authorities cannot rely on corporate income statements to capture such flows, and have to use other—typically less comprehensive—data sources, such as household consumption surveys. Beginning 2014, value-added taxes have started to be imposed in France (and other E.U. countries) on direct foreign-business-to-consumer sales. In principle, VAT returns could be used as inputs to better estimate French imports of services. Looking forward, systematically using VAT returns could help fix the imports–exports service mismatch between havens and non-havens countries.

28. In our data, foreign firms in havens have a profits-to-wage ratio of 277% globally, and local firms in havens a ratio of 34%, a difference by a factor of 8. This excess profitability is consistent with the excess profitability by a factor of 7.5 found in Section 3.3 between the haven and non-haven affiliates of US multinationals (profits-to-wage ratio of 346% and 46%, respectively). Affiliates of US multinationals appear slightly more profitable than those from other multinationals across the board (i.e. in both havens and non-havens).

29. The lower profitability of foreign firms in the UK compared to local firms, by a factor of about 2, is consistent with Bilicka (2019) who finds that foreign multinational subsidiaries in the UK under-report their taxable profits by about 50% relative to domestic standalone.

30. See e.g. Lupo, Gilbert and Liliestedt (1978) and Mataloni (2000) for an analysis of the relatively low profitability of foreign firms operating in the US. Note that the fact that foreign firms appear slightly less profitable than local firms in high-tax countries is consistent with the widely noted fact that multinationals tend to have high revenue productivity (i.e. high revenue per employee). We checked that in our data, foreign firms have higher revenue productivity than local firms in both low-tax and high-tax countries.

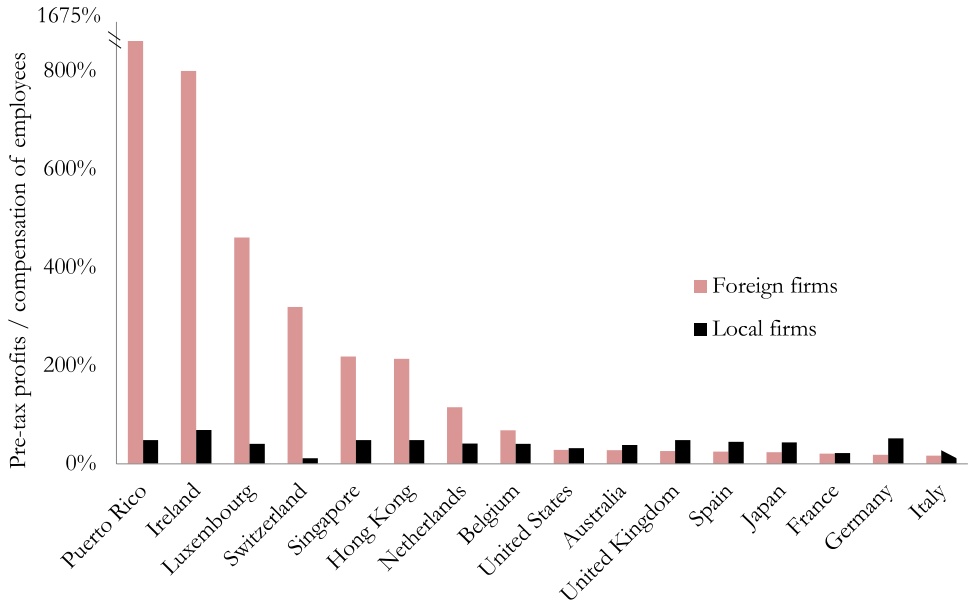

FIGURE 4

Profitability in foreign vs. local firms

Notes: This figure shows the ratio of pre-tax profits to compensation of employees for local firms (π_l) and foreign firms (π_f) in 2015, in the eight largest tax havens and the eight largest non-haven high-income countries in our sample. *Source*: Replication Guide Table A.7.

firms can shift profits (e.g. both US affiliates operating in Germany and German multinationals can shift profit out of Germany). In this article, we do not rely on the $\pi_l - \pi_f$ gap observed in non-haven countries to infer outward profit shifting; we only use the $\pi_f - \pi_l$ gap observed in tax havens (to infer inward shifting, which we then allocate to source countries using balance of payments data).

Second, local firms in tax havens are generally as profitable as local firms in non-haven countries. Local haven firms do not seem to be abnormally profitable, which could in principle be the case if the reported profitability of local haven firms was inflated by inward profit shifting. This suggests that the recorded π_l of tax havens are a good reference point to assess what fraction of the large π_f of tax havens can be attributed to profit shifting (Assumption 3 in Section 3.2).

5.1.2. Profits shifted into each haven. The first column of Table 2 reports our baseline estimate of the amount of profits shifted obtained by setting $\pi_f = \pi_l$ in tax havens. Ireland appears as the number one shifting destination, with about $100 billion in shifted profits in 2015. Singapore, the Netherlands, Caribbean tax havens, and Switzerland come next.

The second column of Table 2 reports our alternative estimate of profits shifting, based on the amount of excess cross-border transactions recorded in the balance of payments of tax havens (Section 3.4). Despite being based on totally different and fully independent data, our baseline "excess profitability" and this "excess transaction" methodologies deliver consistent results. The estimates match not only globally but also at the haven level. The fact that the "excess transaction" methodology yields slightly larger numbers ($646 billion for globally shifted profits) than our baseline approach ($616 billion) can be explained by the fact that the "excess transaction" methodology captures profit shifting by multinationals headquartered in tax havens.

TABLE 2
Bounding the amount of profits shifted to tax havens

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
	Baseline estimates (excess profitability	Alternative estimate (excess transactions)	45 pp increase in benchmark profitability	Adjustment for capital intensity with $\sigma = 0.7$	Adjustment for capital intensity with $\sigma = 1.3$	Accounting for inward shifting headquarters	Removing corrections to haven data	Baseline estimates: lower bound	Baseline estimates: upper bound
Belgium	13	34	0	16	11	20	12	0	23
Ireland	106	89	100	115	102	109	95	84	118
Luxembourg	47	88	42	46	47	47	30	26	46
Malta	12	4	12	13	12	12	8	7	13
Netherlands	57	74	22	70	51	66	48	6	79
Caribbean	97	91	95	104	92	97	70	64	105
Bermuda	24	22	23	25	23	26	14	13	27
Singapore	70	74	52	88	61	75	48	20	93
Puerto Rico	42	44	41	42	41	42	42	40	42
Hong Kong	39	28	28	41	38	72	35	23	74
Switzerland	58	50	50	57	59	75	58	50	74
Other havens	51	47	42	45	49	52	47	36	46
Total	616	646	506	663	586	693	507	369	740

Notes: This table reports estimates for the amount of profit shifted into tax havens in 2015, in billions of US$. The first column reports our baseline estimates, obtained by equating the profitability of foreign and local firms within each tax haven. Column 2 reports an alternative estimate based on the excess cross-border transactions conducive of profit shifting observed in the balances of payments of tax havens. Columns 3–7 shows how the baseline estimates from Column 1 are affected when changing one assumption at a time. Finally, Columns 8 and 9 report lower and upper bounds for our baseline estimates, obtained by changing all our assumptions at the same (either in the most conservative or least conservative manner).

A number of additional results are worth mentioning. First, we study the contribution of interest income to the excess profitability of foreign firms in tax haven, following equation 3 above. We find that the high π_f of tax havens are driven by their high recorded capital shares, not by net interest. The main exception is Luxembourg, where net intra-group interest receipts are the key driver of the high recorded profitability.[31] Overall, 15% of our estimated amount of profits shifted comes from interest, consistent with the literature that suggests that debt-shifting is second-order relative to transfer pricing and the strategic location of intangibles (Heckemeyer and Overesch, 2017).[32] We obtain similar results focusing on the affiliates of US multinationals, using the outward FATS of the US. Haven affiliates receive only 1.1 time more interest (relative to operating surplus) than non-haven affiliates in 2015 (see Supplementary Appendix Figure C). Second, we compare the amount of shifted profits to total profits recorded by local and foreign firms combined in tax havens. We find that if profit shifting ended, profits booked in tax havens would fall by 55%, and by as much as 90% in havens such as Malta and Bermuda.

5.2. *Bounding the amounts of shifted profits*

Because our baseline estimates of profits shifted are obtained using a simple methodology, it is easy to assess how changing one, several, or all of our assumptions at the same time affects the

31. Throughout this article, we exclude offshore mutual funds (i.e. mutual funds with foreign investors and foreign investments) from our π, π_f, and π_l ratios, because offshore mutual funds otherwise distort the profitability of tax havens. By convention mutual funds have an apparently high profitability as defined in our paper (i.e. after net interest payments), but for purely accounting reasons. All income paid by mutual funds to their shareholders is recorded as dividends in the national accounts, even for mutual funds that only invest in bonds; as a result bond funds are large receivers of net interest. In OECD countries, offshore mutual funds are only significant in Luxembourg, Ireland, and to a lesser extent the Netherlands. See Replication Guide Section A.3.

32. Intra-group interest received by tax havens amount to $101 billion in 2015 (15.7%) vs. $545 billion for the exports of services most conducive of profit shifting (84.3%).

results. There are four margins of uncertainty: profitability differences between local and foreign firms unrelated to profit shifting; the elasticity of substitution between capital and labour; inward shifting into the local firms of tax havens; and bilateral discrepancies in international investment statistics. For each of these margins, we quantify the uncertainty involved by building on the most recent literature and then create bounds factoring in all sources of uncertainty.

5.2.1. True profitability differences between foreign and local haven firms. A potential concern with our estimation procedure is that π_l may not be a good counterfactual for the profitability of foreign haven firms absent profit shifting. A body of work documents heterogeneity in markups and capital shares across firms (e.g. Yeaple, 2003; Antràs and Yeaple, 2014; Autor *et al.*, 2020; Kehrig and Vincent, 2021). As we saw in Section 3.3, even after controlling for capital stocks, R&D expenditures, industry fixed effects, and host-country characteristics, haven affiliates remain an order of magnitude more profitable than non-haven affiliates. However, unobserved firm characteristics may still cause π_f to differ from π_l absent profit shifting.

To bound the fraction of the $\pi_f - \pi_l$ gap that can be due to true profitability differences between local and foreign firms, we build on Paul and Isaka (2019) who analyse the determinants of factor shares at the firm level globally. Foreign ownership is associated with a 2 percentage point increase in the capital share, which, when applied to the global average capital share of 34% computed in Table 1 above, implies an increase in profitability of 4 percentage points.[33] A similar computation implies that moving from the bottom to the top of the firm size distribution further increases the profits-to-wage ratio by 24 percentage points, and a 50% rise in total factor productivity by 17 percentage points.[34] These effects obtained in a regression framework that controls simultaneously for firm size, foreign ownership, and productivity at the firm level are additive. Therefore in column 3 of Table 2, we consider the implications of increasing our benchmark profitability by $4+24+17=45$ percentage points. Since the average profitability of local firms in tax havens π_l is around 43% (unweighted π_l of the eight havens depicted in Figure 4), this is equivalent to roughly doubling π_l in tax havens—or, equivalently, to assuming that the net-of-depreciation capital share of foreign firms (absent profit shifting) would be around 47%. The effect is negligible in havens like Puerto Rico where the profitability of foreign firms is truly enormous. It is more significant in Belgium and the Netherlands where the profitability of foreign firms is only marginally higher than that of local firms.

5.2.2. Elasticity of substitution σ different from 1. In our baseline estimates, the capital/labour elasticity of substitution σ is assumed to be 1, meaning that differences in capital intensities between local and foreign firms cannot explain any of the $\pi_f - \pi_l$ gap within tax havens. However, a micro literature finds $\sigma < 1$ (e.g. Lawrence, 2015; Oberfield and Raval, 2021), while a macro literature finds $\sigma > 1$ (e.g. Karabarbounis and Neiman, 2014; Piketty and Zucman, 2014).

33. Specifically, the global capital share in Table 1 above is net corporate profits ($11,515 billion) divided by net corporate output ($34,083 billion) i.e. 33.8%. Paul and Isaka (2019, Table 3) report regressions of labour income shares on a set of firm characteristics. We use their results at the firm level (columns 4–6). The average point estimate for being foreign-owned is a decline in the labour share of 0.02. Starting from a capital share of 34%, the profits-to-wage ratio increases from $0.34/(1-0.34)$ to $0.36/(1-0.36)$ i.e. by 4 percentage points.

34. Firm size in Paul and Isaka (2019) is categorized into four levels: micro, small, medium, and large. The point estimate of moving up one category is an increase in the labour share of 0.03. Therefore, the total effect of moving from micro to large is 0.09. Starting from a capital share of 34%, the profits-to-wage ratio increases from $0.34/(1-0.34)$ to $0.43/(1-0.43)$ i.e. by 24 percentage points. Similarly, the average point estimate of increasing TFP by 50% is 0.07 (half of the point estimate of 0.14 corresponding to a TFP increase of 100%). Starting from a capital share of 34%, the profits-to-wage ratio increases from $0.34/(1-0.34)$ to $0.41/(1-0.41)$ i.e. by 17 percentage points.

To assess the quantitative implications of the assumed σ, in Table 2 we consider capital-labour elasticities of substitution equal to 0.7 (the aggregate elasticity for the US manufacturing sector found by Oberfield and Raval, 2021) and 1.3 (the average macro elasticity of Karabarbounis and Neiman, 2014, Table 1). With $\sigma = 1.3$, our baseline estimate of the amount of globally shifted profit is reduced by 5%. With $\sigma = 0.7$, it is increased by 7%. While one may consider an even broader range of elasticities (as opposed to prioritizing recent studies), quantitatively the implications would be similar: for plausible values of σ, differences in capital intensities explain little of the $\pi_f - \pi_l$ gap in tax havens.

Why does σ turn out to have a relatively small impact? To better understand this result, the top panel of Figure 5 reports tangible capital stocks in foreign vs. local firms within the main havens and a sample of large high-tax countries. Foreign firms appear to have a relatively high capital stock in Ireland and Puerto Rico, and a relatively low one in Luxembourg, Switzerland, and Hong Kong. The differences, however, are small relative to the large differences in profitability between foreign and local firms shown in Figure 4. The bottom panel of Figure 5 shows how applying the capital/labour ratio of foreign firms to local firms would modify the observed profits-to-wage ratio of local firms π_l, for different values of σ. For instance in Ireland, if local firms were as capital intensive as foreign firms, then with $\sigma = 1.3$, π_l would equal 100% instead of the observed value of 68%. This would still be almost an order of magnitude less than the observed π_f of 800%. The same conclusion holds for other havens.

5.2.3. Inward shifting in local sectors of tax havens. Our preferred estimates assume that π_l in tax havens is not distorted by inward profit shifting. In Column 6 of Table 2, we relax that assumption. To do so, we identify all listed multinationals headquartered in tax havens using Compustat Global data. Out of roughly 30,000 listed firms globally, 8% were headquartered in tax havens in 2015; altogether they made $212 billion in pre-tax income. Assuming that these firms shifted 36% of their global profits inward, our baseline estimate would understate global profit shifting by $76 billion (12%). The effect is significant for Hong Kong—where about half of the haven multinationals are located—and to a lesser extent in Singapore and the Netherlands.

Other ways to account for this issue have more modest impacts. First, if we assume that local firms in tax havens are in reality as profitable as local firms are on average in the OECD ($\pi_l = 41\%$), our estimate of global profit shifting rises by 3% only. Second, as we have seen our "excess transactions" methodology conceptually captures inward shifting by firms with headquartered in havens, while our baseline "excess profitability" methodology does not. The difference between the two suggests we may miss 5% of global profit shifting by ignoring shifting by multinationals with haven headquarters.

5.2.4. Effect of bilateral discrepancies. In our preferred estimate, the inward investment data of tax havens are upgraded so that they match the outward data of counterpart countries. Specifically, the true amount of profit made by US multinationals in European tax havens is assumed to be given by the US outward investment data, not the EU haven inward data. When tax havens report low inward investment income in their balance of payments, these data are replaced by the mirror outward investment data of OECD and European Union countries.

Column 7 of Table 2 shows how our estimates change when we instead take the haven data at face value. This reduces our preferred estimate of global profit shifting by 18%, with larger effects in the havens where data quality is more limited (Caribbean tax havens and Bermuda). Our view is that the haven data *must* be corrected, however. In a number of cases, it is clear that these data are incomplete (e.g. the Cayman Islands excludes its large offshore sector from its balance of payments statistics); and when taking the haven data at face value, there is globally

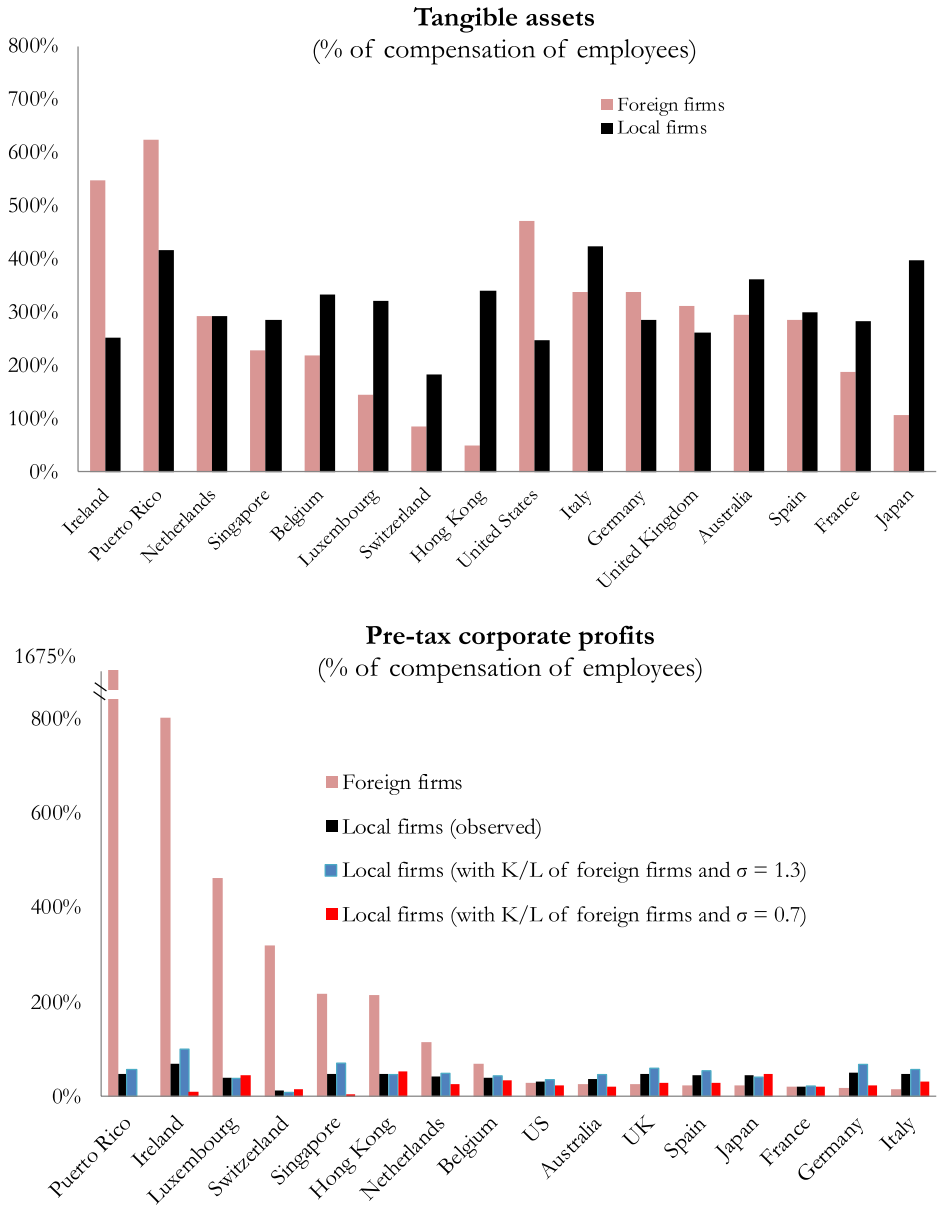

FIGURE 5

Capital intensities in tax havens

Notes: The top panel shows the ratio of the tangible capital stock of local and foreign firms to wages paid in 2015, in the eight largest tax havens and the eight largest non-haven high-income countries in our sample. The bottom panel shows, in the same sample, the profit-to-wage ratio in foreign firms and in local firms obtained by applying the capital intensity of foreign firms, for different assumptions about the elasticity of substitution between capital and labour σ. *Source*: Replication Guide Table E.1.

less direct investment income made by affiliates (as recorded in inward statistics) than earned by parents (as recorded in outward statistics), which cannot be true.

5.2.5. Lower and upper bounds. The last two columns of Table 2 report lower and upper bounds for the amount of profit shifted into each haven. The lower bounds start from our baseline

estimates, consider a benchmark profitability of foreign haven firms (absent profit shifting) 45 percentage points higher than the observed profitability of local firms, assume a capital-labour elasticity of substitution of 1.3 and remove our corrections to the haven data. The upper bounds assume a capital-labour elasticity of substitution of 0.7 and allow for inward shifting in the local firms of tax havens. Our preferred estimate of the amount of globally shifted profit is 36% of multinational profit, with a lower bound of 22% and an upper bound of 43%. We stress that due to the complex structures used by multinationals and to the data limitations discussed in Section 4.2, allocating the shifted profits to specific jurisdictions involves a margin of error.

6. THE INTERNATIONAL REDISTRIBUTION OF CORPORATE PROFITS

6.1. *Allocating the shifted profits*

6.1.1. Profit losses in source countries. Table 3 reports our estimates of the profit loss for each OECD non-haven country and a number of non-OECD economies. We consider three ways to express losses: in absolute terms, relative to GDP, and relative to domestic corporate profits.

Starting with absolute numbers, in our preferred estimates $143 billion in profit was shifted out of the US in 2015 (23% of the global total), $216 billion was shifted out of the European Union (36% of the global total), $76 billion out of other OECD countries (12% of the total) and the rest (29%) from non-OECD countries. More than 70% of profit losses originate from high-income countries.

As noted in Section 2.2 above, our estimate for the amount of profit shifted out of the US ($143 billion) lines up well with Guvenen *et al.* (2021), who find that $158.3 billion was shifted by US multinationals out of the US in 2015, plus $3.5 billion by 127 non-US technology-intensive multinationals. The slightly lower number (by 0.1% of US GDP) implied by our methodology can be explained by the fact that Guvenen *et al.* (2021) allocate the worldwide profits of US multinationals proportionally to wages and capital stocks, while we allocate haven profits proportionally to the cross-border payments conducive of profit shifting. To illustrate the difference, consider the case of a US company with an affiliate in Bermuda that owns an affiliate in France selling digital services to French customers. The French affiliate pays royalties to the Bermuda holding for the right to use the firm's intellectual property, stripping earnings out of France. If employees and capital are in the US, profits are assigned to the US in the Guvenen *et al.* (2021) approach, while some are allocated to France in ours.[35] There is no unambiguously correct way to allocate profits of multinationals with complex production structures, and we view both benchmarks as relevant and complementary.

When expressing profit losses as a fraction of GDP (column 5), a key finding emerges. The European Union appears as the region most affected by profit shifting, with profit losses reaching 1.5% of GDP, as opposed to 0.8% in the US, 0.7% in other high-income countries, and 0.7% in developing countries. As we shall see in Section 7, this has important implications for the analysis of the dynamic of the labour share.

In column 6, we express shifted profits as a percentage of reported domestic corporate profits (column 1), which are the sum of the profits recorded by local firms (column 2) and foreign firms (column 3). Absent profit shifting, according to our baseline estimates, corporate profits would

35. In effect, in our work part of the supernormal profits of multinationals (profits above and beyond factor payments) are allocated to the destination countries where sales are made. This is consistent with the view that underpins the agreement reached by more than 130 countries in June 2021 to allocate some of the supernormal profits of multinationals to destination countries, the so-called "Pillar One" in OECD (2021).

TABLE 3
Profit and corporate income tax revenue losses

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
	Reported domestic profits	Of which: local firms	Of which: foreign firms	Shifted profits (baseline)	Shifted profits (% reported GDP)	Shifted profits (% reported profits)	Corporate tax loss (% tax collected)
OECD countries							
Australia	179	151	28	13	1.1	7	7
Austria	48	37	11	4	0.9	7	11
Canada	143	96	47	19	1.2	13	10
Chile	68	58	10	5	2.3	8	12
Czech Republic	34	16	17	2	0.9	5	5
Denmark	52	47	5	3	1.0	6	8
Estonia	4	3	1	0	1.1	6	10
Finland	25	21	4	3	1.2	11	11
France	188	156	32	32	1.3	17	21
Germany	553	510	43	55	1.6	10	28
Greece	23	21	1	1	0.5	5	7
Hungary	21	11	10	2	2.0	12	21
Iceland	2	2	0	0	2.6	20	22
Israel	54	48	6	1	0.2	1	2
Italy	212	199	13	23	1.2	11	19
Japan	634	602	32	9	0.2	1	2
Korea	248	246	3	5	0.3	2	3
Latvia	4	3	1	0	0.7	5	7
Mexico	325	302	23	13	1.1	4	11
New Zealand	44	37	6	2	0.9	3	5
Norway	76	69	7	5	1.3	7	8
Poland	88	68	19	4	0.8	4	8
Portugal	27	22	5	3	1.3	10	9
Slovakia	12	6	5	1	0.7	5	5
Slovenia	3	2	1	0	0.5	7	6
Spain	159	138	21	14	1.2	9	14
Sweden	63	39	24	9	1.7	13	13
Turkey	213	209	4	5	0.6	2	8
UK	425	353	72	62	2.1	14	18
US	1,889	1,737	153	143	0.8	8	14
Non-OECD countries							
Brazil	274	245	30	14	0.6	5	9
China	2,069	1,906	162	61	0.5	3	4
Colombia	59	52	7	1	0.5	2	2
Costa Rica	13	12	1	1	1.9	8	21
India	376	368	8	9	0.4	3	9
Russia	290	253	37	12	0.9	4	6
South Africa	76	68	9	4	1.2	5	6
Other non-havens	1,423	1,309	114	79	0.8	6	7
Non-haven total	11,515	9,812	1,703	616	0.8	5	9

Notes: This table shows pre-tax corporate profits in OECD countries and a number of non-OECD countries other than tax havens, as published in national account statistics. Column 4 reports our baseline estimate of the amount of profit shifted out of each of these countries, which is then expressed as a fraction of reported GDP (Column 5) and reported profits (Column 6). Column 7 shows the implied corporate income tax revenue loss, obtained by applying the statutory corporate income tax rate to the amount of shifted profits reported in Column 4. Amounts are in current billion US$. All data are for 2015. *Source*: Replication Guide Tables A.6., A.7, C.4d, and C.4.

be 17% higher than they currently are in France, 14% higher in the UK, and 8% higher in the US. Profits in the main developing countries would be around 5% higher, and profits in Japan only 1% higher. One caveat is that the delimitation of the corporate sector varies across countries. In principle, the corporate sector should only include corporations, but a number of countries also include some non-corporate businesses and self-employed workers in it (Gutiérrez and Piton, 2020). As originally pointed out by Pionnier and Guidetti (2015), the problem is particularly severe in Germany and Italy. Reported domestic profits recorded in the national accounts of

these countries are overstated—and thus the ratio of shifted profits to reported profits reported in Column 6 is downward biased.[36]

To address this issue, it is useful to compare the losses of tax revenues caused by profit shifting to the amounts of corporate tax revenues collected. Taxes collected are not affected by the delimitation of the corporate sector, since only actual corporations pay the corporate income tax—not the self-employed or non-corporate businesses.

6.1.2. Tax revenue losses in source countries. Column 7 of Table 3 reports estimates of the tax revenue losses due to profit shifting, obtained by applying the statutory corporate tax rate to the amount of profits shifted outward. We checked that using forward-looking effective marginal tax rates (from Spengel, Schmidt, Heckemeyer and Nicolay, 2019) delivers similar results for EU countries.[37] Consistent with the above discussion, tax losses relative to taxes paid are generally higher than profit losses relative to recorded profits. This is especially the case in the countries where recorded profits are most inflated by the income of the self-employed, Germany and Italy.

Overall, profit shifting reduces corporate tax revenues by 18% in the European Union, 14% in the US, 5% in other OECD countries, and 5% in developing countries. Within the European Union, higher-tax countries (such as France and Germany) have higher losses relative to revenue collected than lower-tax countries (such as Eastern European countries), consistent with the notion that higher corporate tax rates give more incentives to shift. Two caveats are worth stressing. First, countries attempt to tax profits that are shifted outward through controlled foreign corporations rules. This means that a dollar of lost profit does not necessarily translate into τ cents lost in tax revenue, if τ is the statutory (or effective marginal) corporate tax rate.[38] Second, it is possible that with better enforcement there would be more real responses to taxation, such as more mobility of tangible capital to low-tax places. Our tax revenue loss computations keep everything else constant, as is standard in the literature on tax evasion (e.g. Johns and Slemrod, 2010; Alstadsæter, Johannesen and Zucman, 2019).

In Supplementary Appendix B, we symmetrically compute the tax revenue gains for tax havens. Globally, tax havens tend to collect more corporate tax revenues relative to their national income than high-tax countries. We find that tax havens such as Malta, Puerto Rico, Ireland, and Luxembourg derive more than half of their corporate income tax revenues from taxes collected on shifted profits.

6.1.3. Heterogeneity in shifting by parent country. Finally, we allocate shifted profits to the countries where the ultimate parents of the tax haven subsidiaries are located. We find that

36. Even when national accounts data are accurate, the incentives to operate as corporations as opposed to non-corporate businesses vary across countries, with ambiguous implications for our purposes. In the US, doctors, dentists, and lawyers—which in other countries would often be self-employed—frequently operate as corporations (so-called S-corporations); their income is included under corporate profits in the national accounts. But large businesses in the financial, real estate, and oil sector—which in other countries would be incorporated—operate as non-corporate partnerships; their profits are excluded from corporate profits (and included under mixed income).

37. We used the forward looking effective tax rate estimated by Spengel *et al.* (2019) for large corporations in the non-financial sector, computed at the corporate level, for average asset composition and funding sources. In 2015, these rates are 28.2% for Germany (vs. a statutory rate of 30%), 38.3% in France (vs. a statutory rate of 33.3%), and 21.5% in the UK (vs. a statutory rate of 20%). Spengel, Schmidt, Heckemeyer and Nicolay (2019) do not report estimates for non-EU countries.

38. A related issue is that high-tax countries require that intangibles be sold by the parent firm to a low-tax subsidiary at an arm's length price. We do not have data on the prices charged at the time of the transfer. For our main purpose in that paper—quantifying the international mobility of profits—whether fair prices are enforced at the time of the transfer is not relevant. To quantify the tax revenue implications of profit shifting this issue is relevant, however.

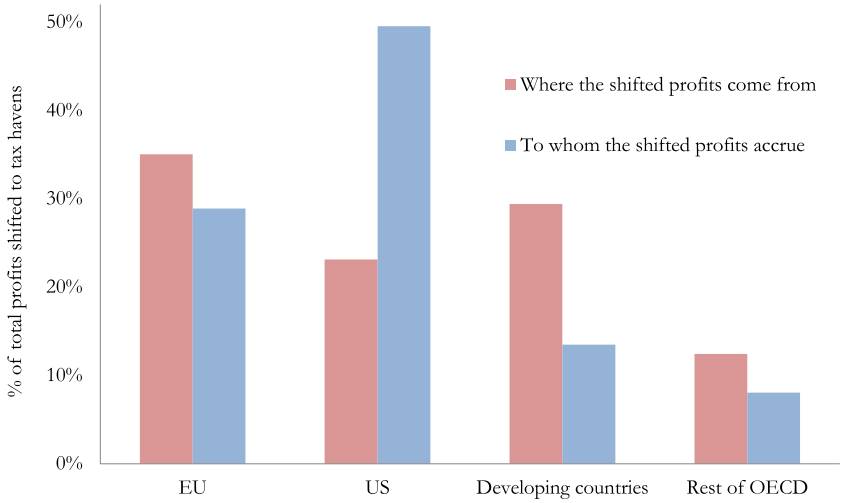

FIGURE 6

Allocating the shifted profits

Notes: This figure shows the regions from which the profits shifted to tax havens originate (pink bar), and the regions where the ultimate parent companies to which the shifted profits ultimately accrue are incorporated (blue bar) in 2015. In both cases, profits are expressed as a fraction of the global amount of profits shifted to tax havens, $616 billion in 2015. *Source*: Replication Guide Tables C.4b, C.4c, and C.4d.

about half of the globally shifted profits accrue to US parents and slightly more than 25% to E.U. parents.

To understand the meaning of these results, it is worth taking a step back. Recall that our allocation of the shifted profits to source countries (Table 3) shows that 23% of the profits shifted globally are shifted out of the US (by US and non-US multinationals). By contrast, when allocating shifted profits to parent countries, 50% of global profit shifting appears to be done by US multinationals (shifting profits out of the US and other countries). Figure 6 illustrates this imbalance. For the US, profit shifting appears to be a tax-avoidance strategy more than a tax revenue loss. For other economies, it appears to be a revenue loss more than a tax-saving strategy. Of course, a complete analysis would take into account heterogeneity within each country: not all economic actors gain or lose from profit shifting equally.

Further, if we compare the profits shifted by US multinationals to the profit made by these firms outside of the US, our estimates imply that US multinationals book 54% of their foreign profits in tax havens. The corresponding figure for other multinationals is 27%. A salient—and novel—pattern thus emerges from our analysis. Although multinationals from all countries shift profit—and most countries lose some tax revenues—US multinationals appear to shift twice as much profit (relative to the size of their earnings) as EU multinationals, while the European Union appear to lose twice as much profit (relative to GDP) as the US. The higher shifting intensity of US multinationals can be explained by the specific provisions contained in the US tax code before 2018 and by US policies adopted in the mid-1990s that facilitated shifting from foreign high-tax countries to tax havens, known as check-the-box regulations; see e.g. Wright and Zucman (2018) and Guvenen *et al.* (2021).[39]

39. Using our balance of payments data, we can also estimate that about 60% of the shifted profits were retained in tax havens in 2015 (and 40% were repatriated). Repatriation does not imply that the shifted profits were taxed, because

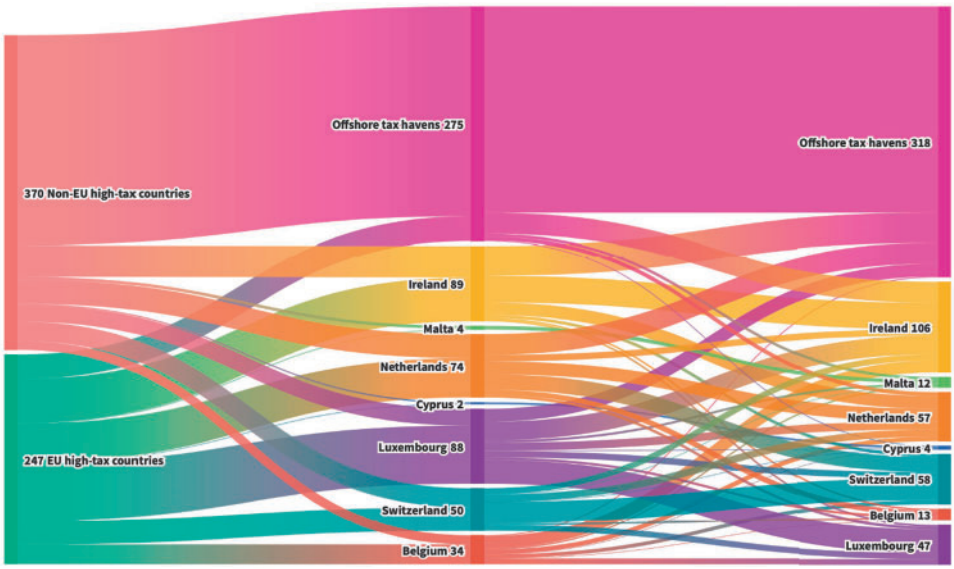

FIGURE 7

Mapping the ultimate destination of shifted profits

Notes: This diagram shows intragroup interest payments and exports conducive of profit shifting from payee/buyer countries (on the left) to immediate recipient havens (in the middle) and ultimate recipient havens (on the right) in 2015. The left panel visualizes profit shifting on an immediate counterpart basis (payments from high-tax countries to the immediate counterpart haven) while the right panel visualizes how havens transact among themselves. Offshore tax havens denote the aggregate of all non-EU havens. An interactive version of this diagram is available at https://public.flourish.studio/story/939975/.

6.2. *The destination of shifted profits*

Our bilateral data allow us to track the destination of shifted profits granularly. On an immediate counterpart basis, 77% of the profits shifted out of the European Union are shifted to E.U. tax havens, primarily Ireland, Luxembourg, and the Netherlands. The profits shifted out of the US are primarily shifted to non-E.U. havens.

But do profits initially shifted to E.U. havens stay there? By using the bilateral service exports and interest payments data of tax havens compiled in this project, we can study the ultimate destination of shifted profits. To do so, we build a reallocation matrix Ω to convert profits shifted from an immediate to an ultimate destination basis.[40] An entry in this matrix, ω_{jk}, equals the fraction of profits received by haven j that are ultimately shifted to haven k. Multiplying Ω by the vector $\mathbf{a}$ of profits shifted to the k havens by any country i, we obtain the vector $\mathbf{b}$ of profits shifted by i on an ultimate destination basis.[41]

To illustrate the relevance of this exercise for the European Union, in our application we consider eight havens j and k: Belgium, Cyprus, Ireland, Luxembourg, Malta, the Netherlands, Switzerland, and a non-EU offshore haven aggregate. Figure 7 offers a visualization of the flows underlying the transformation of shifted profits from an immediate to an ultimate destination basis. The figure shows the transactions t_{ij} (as defined in Section 3.4 above, primarily royalties

in contrast to the US (before 2018), most countries do not tax repatriated income. For profits shifted by US companies, 72% were retained in tax havens in 2015.

40. See Replication Guide Section C.3.2 for step-by-step computations.

41. See Coppola, Maggiori, Neiman and Schreger (2021) for a related attempt at redrawing the map of capital flows involving tax havens.

and intra-group interest payments) from payee/buyer countries (on the left) to recipient havens (on the right). The left panel shows profit shifting on an immediate counterpart basis: high-risk payments from origin high-tax countries (left) to the immediate counterpart haven (middle). The right panel shows how havens transact among themselves. Payment from high-tax countries to a tax haven on an immediate counterpart basis are often further shifted to another tax haven. For example, Luxembourg receives $88 billion on an immediate basis but pays back half of this to non-EU havens such as Bermuda, only keeping $47 billion.

We find that while on an immediate counterpart basis 77% of the profits shifted out of EU high-tax countries go to EU havens, on an ultimate destination basis 46% end up in non-EU havens. This result is relevant from a legal and policy perspective. EU treaties prohibit member states from taxing payments (such as intra-group interest or royalties) to other EU countries. A country like Germany can impose taxes on payments to Bermuda (a classic anti-avoidance strategy), but not on payments to Luxembourg. By shifting profits first to Luxembourg and then to Bermuda, a multinational company can avoid the German anti-avoidance rules. Popular tax planning strategies such as the "double Irish with a Dutch sandwich" (see e.g. Zucman, 2014, for an analysis in the case of Google Alphabet) and the "green Jersey" indeed involve a set of conduit EU tax havens facilitating shifting to non-EU havens. In practice, to circumvent anti-avoidance rules, companies must have a minimal level of real activity in conduit EU havens.

7. IMPLICATIONS FOR FACTOR SHARES

7.1. *A macroeconomic database corrected for profit shifting*

The flip side of the high profits recorded in tax havens is that profits recorded in non-haven countries are too low. In both cases, core macroeconomic statistics are distorted. In the countries where shifted profits are booked, GDP, corporate profits, the capital share of corporate value-added, and trade balances are inflated. In non-haven countries, these indicators are under-estimated. In this section, we present macroeconomic statistics corrected for the effect of profit shifting for all OECD countries, the main tax havens, and the main emerging economies.

To adjust the official statistics, we proceed as follows. We add the profits shifted through transfer prices and the strategic location of intangibles (85% of the total) to the recorded operating surplus rK of their source country. We then correct the full sequence of economic accounts of the source countries accordingly (i.e. we increase the value-added Y of the corporate sector, GDP, exports, and the trade balance by the same amount) and compute corrected corporate capital shares $\alpha = rK/Y$ and labour shares $1-\alpha$.[42] Profits shifted through the use of intra-group interest payments (15% of the total) do not affect recorded operating surplus rK but only the breakdown of operating surplus into corporate profits $(1-p)\cdot rK$ and net interest payments p; we adjust corporate profits and net interest payments accordingly.

Table 4 presents our estimates of capital shares and trade balances corrected for profit shifting in 2015. A number of results are worth noting. First, accounting for profit shifting increases the capital share of corporate value-added in non-haven countries significantly.[43] Consistent with our

42. Bruner, Rassier and Ruhl (2018) discuss how the effect of profit shifting cascades through the economic accounts and present US macroeconomic statistics corrected for profit shifting; see also Avdjiev, Everett, Lane and Shin (2018).

43. Note that it does not necessarily increase the capital share of national income, since the profits of the offshore subsidiaries belonging to domestic shareholders enter national income as direct investment income received from the rest of the world. We focus on correcting corporate factor shares (which are the focus of most of the literature on the decline of the labour share e.g. Karabarbounis and Neiman, 2014; Gutiérrez and Piton, 2020).

TABLE 4
Macro statistics corrected for profit shifting

	Corrected capital share (%)	Difference with published data (%)	Corrected trade balance (% GDP)	Difference with published data (%)
OECD countries				
Australia	26	+1.2	−1.3	+0.9
Austria	29	+1.3	4.1	+0.8
Canada	24	+1.5	−1.4	+1.0
Chile	51	+1.6	2.0	+1.9
Czech Republic	39	+1.0	6.5	+0.7
Denmark	31	+1.2	8.2	+0.8
Estonia	35	+1.1	5.0	+0.9
Finland	28	+1.6	0.9	+1.0
France	19	+2.1	0.4	+1.1
Germany	31	+1.8	9.2	+1.2
Greece	43	+1.1	0.3	+0.5
Hungary	39	+2.3	10.4	+1.5
Iceland	33	+3.4	9.5	+2.0
Israel	37	+0.2	3.2	+0.2
Italy	30	+1.9	3.9	+1.0
Japan	27	+0.3	−0.4	+0.2
Korea	38	+0.4	8.0	+0.3
Latvia	31	+0.9	−0.5	+0.6
Mexico	71	+0.7	−1.1	+1.0
New Zealand	44	+0.7	1.5	+0.7
Norway	41	+1.3	6.5	+1.1
Poland	45	+0.9	3.7	+0.6
Portugal	33	+1.8	2.8	+1.1
Slovakia	35	+1.1	3.4	+0.6
Slovenia	18	+0.9	9.1	+0.4
Spain	29	+1.6	3.4	+1.0
Sweden	31	+2.2	6.3	+1.4
Turkey	55	+0.5	−2.3	+0.5
UK	31	+2.5	0.2	+1.8
US	27	+1.1	−2.1	+0.7
Non-OECD countries				
Brazil	26	+1.1	−0.2	+0.5
China	44	+0.6	3.7	+0.5
Colombia	55	+0.5	−5.9	+0.5
Costa Rica	45	+2.0	1.7	+1.8
India	56	+0.6	−2.5	+0.4
Russia	40	+0.9	8.9	+0.7
South Africa	39	+1.5	0.1	+1.1
Main havens				
Belgium	24	−2.5	0.1	−2.2
Ireland	42	−20.0	−5.8	−36.8
Luxembourg	27	−11.8	4.0	−30.0
Netherlands	32	−2.0	6.4	−4.2
Singapore	23	−7.1	3.9	−21.3
Puerto Rico	30	−37.8	−20.4	−43.5

Notes: This table shows corrected capital shares and trade balances in our sample of non-haven countries and in the main tax havens in 2015; see text for the construction of these corrections. *Source*: Replication Guide Tables C.5 and C.5b.

earlier result that EU countries are particularly affected, the capital share is under-estimated by about 2–2.5 percentage points in the main EU countries, vs. 1.1 point in the US. One caveat is that because we correct official data, and official data overstate corporate profits (for the reasons noted in Section 3.4), especially in Germany and Italy, our adjustments to the corporate capital share are too conservative. Indeed, for the case of Germany, France, and Italy discussed below, the upward adjustment is 4.4 percentage points. Second, there is a large mirror adjustment in tax havens: according to our estimates, the capital share is over-estimated by 20 points in Ireland and

close to 12 points in Luxembourg. Last, profit shifting has significant effects on trade balances. Japan, the UK, France, and Greece turn out to have trade surpluses in 2015, in contrast to the published data that record trade deficits. According to our estimates, the true trade deficit of the US was 2.1% of GDP in 2015, instead of 2.8% in the official statistics.[44]

7.2. *Dynamics of the capital Share*

Finally, to illustrate the importance of accounting for profit shifting for the analysis of factor shares, we present corrected time series of the corporate capital share in Germany, France, and Italy, three countries that accounted for about 50% of the GDP of the European Union in 2015 and for which high-quality estimates of corporate profits exist (from Gutiérrez and Piton, 2020).

The top panel of Figure 8 motivates this analysis by showing the evolution of the aggregate profit-to-wage ratio π in Ireland. The figure shows a dramatic increase in profitability starting in the mid-1980s, from 30% up to the early 1980s (the same level as in the US and high-tax European countries) to 250% in 2015. In 2015, the profits-to-wage ratios recorded by Ireland increased particularly strongly. Recorded real GDP grew 26.3%, reflecting transfers of multinational intangible assets (see e.g. OECD, 2016). Because there was little profit shifting before the 1980s, official statistics under-state not only the level but also the *rise* of the capital share in Ireland's partner countries.

To adjust the time series of EU high-tax countries, we start from 1 minus the adjusted gross corporate labour shares of Gutiérrez and Piton (2020). This is the best available measure of the gross-of-depreciation corporate capital share in these countries; it excludes the effect of self-employment and real estate.[45] As shown by the blue line in the bottom panel of Figure 8, by that metric the capital share has not increased since 1985. To account for profit shifting, we proceed as follows. First, consistent with our discussion in Section 6 above, we assume that the fraction of profit shifted outward in 2015 is given by the loss of corporate income tax revenues relative to taxes paid. For example, for France we assume that for any euro of gross corporate profit recorded by Gutiérrez and Piton (2020), 21 cents (corresponding to Column 7 in Table 3) was shifted to tax havens in 2015. Second, we assume that the fraction of EU profits shifted to tax havens before 2015 follows the evolution of the fraction of global profits shifted to tax havens by US multinationals, leveraging the fact that that US outward Foreign Affiliates Statistics are available back to the beginning of the early 1980s (see Supplementary Appendix A). Ideally we would like to use a time series for profits shifted to havens by all (i.e. US plus non-US) multinationals, but long time series are only available for US multinationals. Since more than half of the profits booked in tax havens globally were booked there by US multinationals in 2015, this approach is not unreasonable.

While these assumptions are simplified, meaning that results should be seen as merely illustrative, they reveal a novel insight. In contrast to a view according to which the rise of the capital share is a specifically North-American phenomenon, the corporate capital share is likely to have increased substantially in high-tax European countries too. In our preferred scenario, it rose by 3.0 points in the arithmetic average of Germany, France, and Italy over the 1985–2015 period, and by 3.5 points in the upper bound scenario (bottom panel of Figure 8). This lends support to theories highlighting the role of global trends—as opposed to country-specific shocks—in the

44. See Sandholtz (2018) for an estimation based on US bilateral trade data.

45. We do not subtract taxes on production (e.g. property taxes paid by businesses) net of subsidies, which are thus included in our measure of the capital share.

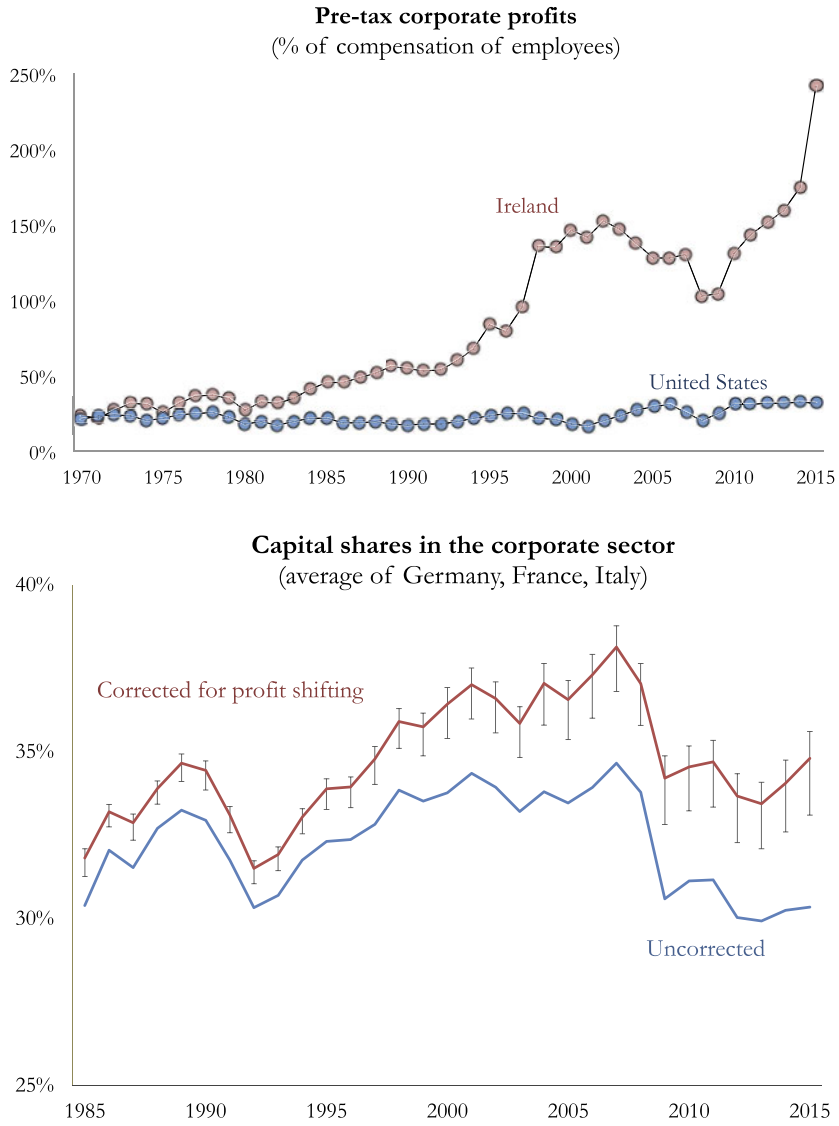

FIGURE 8

The Rise of Profit Shifting: Implications for Factor Shares

Notes: the top panel shows the ratio of profits to wages in Ireland and the US, using national accounts data. The bottom panel shows the arithmetic average of the gross-of-depreciation corporate capital share (gross corporate profits relative to gross corporate value-added) in Germany, France, and Italy. The blue line is taken from Gutiérrez and Piton (2020) and the red line is adjusted for profit shifting; see text. The point estimate corresponds to our preferred estimate of global profit shifting and the confidence interval is constructed using the lower and upper bounds for global profit shifting reported in Table 2, Columns 8 and 9.

dynamic of factor shares. After our corrections, the rise of the capital share in Europe becomes closer to the one seen in the US, albeit still not as large.[46]

46. In the official BEA statistics, the (gross-of-depreciation) corporate capital share rose 5.8 points between 1985 and 2015, although a range of alternative estimates exist depending on the treatment of S-corporations and partnerships (see footnote 36).

8. CONCLUSION

Our article provides a new method to estimate global profit shifting using macroeconomic data. Foreign affiliates statistics recently made available by many countries show that in tax havens, foreign firms are much more profitable than local firms. By exploiting this differential profitability as well as new bilateral balance of payments data, we estimate how much each tax haven gains in profit—and how much each OECD country and the main emerging economies lose. In our preferred estimate, 36% of multinational profits are shifted to tax havens in 2015. Non-haven European Union countries appear to be the largest losers from this phenomenon.

Our findings have implications for policy. They can be used to study corporate tax reforms such as the move to a formulary apportionment system (e.g. Gordon and Wilson, 1986), destination-based corporate taxes (Auerbach, 2010), or minimum country-by-country corporate taxes (OECD, 2021). Although quantifying the effects of such reforms would require a structural model of multinational production with profit shifting that falls outside the scope of this research, bilateral estimates of profit shifting are a necessary input to calibrate such models. Our work can also be used to evaluate the effect of policy efforts aimed at reducing profit shifting. Our estimates are for the year 2015 and we plan to update them annually,[47] making it possible for researchers to assess the effects of the OECD "base erosion and profit shifting" initiative (which started in 2016), the US tax reform enacted in December 2017, or an agreement on a global minimum tax (OECD, 2021).

Our investigation has uncovered statistical gaps that limit our ability to monitor global economic activity. To solve the asymmetries in bilateral foreign affiliates and direct investment statistics, national statistical authorities need to be authorized to exchange micro-data. The foreign affiliates statistics that we exploited in this article need to be compiled by more countries and expanded to include more information, such as interest payments, corporate income taxes paid, and capital stocks (as the US e.g. already does). A number of Caribbean tax havens do not currently publish comprehensive enough national accounts. Last, many countries—including the US and a number of tax havens—could improve their public corporate registries so that all firms are included and profit information is made publicly available at the subsidiary level.

Our analysis has focused on the redistribution of profits across countries. In future research, it would be good to introduce the inequality dimension in the analysis i.e. to quantify how much the various income and wealth groups in each country have gained or lost from profit shifting. By our estimates, about half of the globally shifted profits accrue to the shareholders of US multinationals (many of which, but not all, are Americans). Because equity ownership is concentrated (see e.g. Saez and Zucman, 2016), profit shifting reduces the effective tax rate of the wealthy, which may contribute to increasing inequality. A quantitative analysis of these redistributive effects across income and wealth groups would make it possible to make progress towards a full-fledged macro-distributional analysis of globalization. This raises major conceptual and empirical challenges for future research.

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47. Updated estimates for 2016, 2017, and 2018 are available in Tørsløv, Wier and Zucman (2021).

supplemented by an Supplementary Appendix. In addition, a Replication Guide, data, and code are available online at http://missingprofits.world.

Supplementary Data

Supplementary data are available at *Review of Economic Studies* online. And the replication packages are available at https://dx.doi.org/10.5281/zenodo.6790852.

Data Availability Statement

The data and code underlying this research is available on Zenodo at https://dx.doi.org/10.5281/zenodo.6790852

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