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Shaping Services Trade: the Heterogeneous Effects of Withholding Taxes

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ABSTRACT: This paper investigates the effects of withholding taxes on cross-border trade in services, using a newly compiled dataset covering the universe of bilateral service imports and withholding tax rates from 2005 to 2021. Employing a theoretical framework that highlights the role of withholding taxes in curbing base-eroding payments, the empirical analysis reveals significant effects, with estimated semi-elasticities of 4 for royalties, 1 for technical fees, and 1 for total service import.

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1. Introduction

International trade in services has emerged as the new driving force for global integration, representing a quarter of global gross exports in 2023. Boosted by advancements in information and telecommunication technologies, the swift expansion of services trade across borders can promote the dissemination of knowledge, especially to developing countries. At the same time, it creates new risks of profit shifting and base erosion, including, for example, through the overpricing of service input costs and strategic location of intellectual property. This in turn may jeopardize revenues that are much needed for development and growth, particularly for many developing countries with high public debt.

Effective use of withholding taxes (WHTs) on outbound base-eroding payments can retain part of revenues in the country where the service is used. Pillar 2 of the OECD/G20 Base Erosion and Profit Shifting (BEPS) Inclusive Framework includes a provision strengthening the use of WHTs through a treaty-based "Subject to Tax Rule" (STTR), which allows developing countries to impose additional taxes on certain payments that are lightly taxed in the recipient country.[1] The United Nation (UN) Tax Committee has approved a similar approach as part of the next edition of the UN Model Convention, with a broader scope covering all types of outbound payment. The effects of cross-border withholding taxes on cross-border services trade, however, have yet to be fully analyzed. This paper is among the first to shed some light on this topic.[2]

Before going into the economic effects of WHTs, it is worth considering how they fit under the international taxation approach. The current international tax framework—which is a myriad of domestic legislations and a wide network of bilateral and multilateral tax treaties, is based on the principle that business profits of multinationals are taxed in the source country, notably through corporate income taxes. Any related passive income, such as interest, dividends, or capital gains, is taxed in the residence country (with the difference that interest is deductible, while dividends are paid out of after-tax income). Final sales of goods and services are taxed in the destination country under value-added or sales taxes. WHTs create deviations from these general principles by tilting the taxing rights more toward source countries. A WHT on passive income shifts some of the revenue from the residence to the source country—which is not the focus of this paper. [3] A WHT on an intermediate input shifts some of the revenue from the exporting to the importing country. Such WHTs on goods are rare, but more common on services, which is the key interest of this paper. By taxing outgoing service flows, they can also deter base-eroding payments, which are otherwise deducted from the taxable profits of multinationals in the source country.

This paper provides new empirical findings—guided by theoretical insights—of how, and how much, WHTs affect cross-border service imports, especially for those related to the use of data and information. The

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[1] The STTR allows jurisdictions to "tax back" where defined categories of income are subject to nominal tax rates below the STTR minimum rate of 9 percent, and domestic taxing rights over that income have been ceded under a treaty. The STTR complements and takes priority over other rules agreed in the 2-Pillar solution, including rules concerning implementation of the Global Minimum Tax.

[2] Previous work (IMF 2023), based on static estimates and focusing just on the STTR, suggests that a very small revenue impact. This is because most treaties signed by developing countries already impose WHTs exceeding the 9 percent ceiling prescribed in the STTR.

[3] A WHT on final consumption is not meaningful as the destination country can collect any tax on final sales it likes (through VAT, excises etc.). Nevertheless, in some cases, such as digital services, taxes are implemented with the stated intention of capturing untaxed profits, even though they apply on gross sales.

difference in the responsiveness of payments for IP and technical services[4] relative to payments for general services then provides some indication of the potential role of WHTs in curbing profit shifting. There is ample evidence that the use of intellectual property (IP) transactions, as captured by their location or flows of royalty payments, facilitates profit shifting by multinationals and exacerbates tax competition between countries.[5] Diverted payments through tax-preferred jurisdictions might significantly impact official statistics such as the balance of payments and economic accounts (Guvenen et al., 2022; Bruner et al., 2023), distorting key macroeconomic aggregates such as gross national income or gross operating surplus, as well as firm-level total factor productivity (Langenmayr and Liu, 2023). A higher WHT on these base-eroding payments can mitigate profit shifting by making it costlier to shift income to low-tax jurisdictions. This in turn will raise more revenue for the source country. Reducing the statutory corporate income tax rate can also help reduce profit shifting, but it is likely to reduce tax revenue for the source country.

To analyze the effect of WHTs on services trade, we created a new dataset on bilateral services imports and related WHT rates, including the general rates in statutory legislation and those detailed in tax treaties. These data explicitly record the value of total services imported by each country, as well as detailed categories of services imports, including those vulnerable to profit shifting, such as royalty payments for the use of IP and technical service fees for which an arm's-length price is difficult to observe. International trade in services statistics have been used before, for example, to assess the scale of profit shifting (Accoto et al., 2024; Hebous and Johannesen, 2021). However, to our knowledge, we are the first to explore the effects of withholding taxation, including its potential interaction with the corporate income tax (CIT), on services trade across a wide range of countries. We then guide the empirics by developing insights from a simple theoretical model of how WHTs affect the incentives for profit shifting by multinationals.

We provide the first systematic evidence on the effect of withholding taxation on the value of service inflows, lending support to the effectiveness of WHTs in mitigating profit shifting through base-eroding payments. While total service imports at the bilateral level are highly responsive to WHTs—a 1 percentage point increase in the applicable WHT is associated with a reduction of one percent in overall service inflows—the sensitivity is four times larger for royalty payments for IP. The effect of WHT is even stronger for IP inflows and technical services from investment hubs to non-hub emerging market developing economies (EMDEs). Consistent with the presence of treaty shopping, the lowest WHT rate among all exporters in each importing country has the largest effect, compared to other WHT rates above the minimum. Across the range of CIT rates in the importing country, the effects of WHTs become weaker at higher levels of CIT in the importing country, although this effect is only significant in advanced economies (AEs). Despite exerting a strong effect on bilateral service imports, there is no evidence that WHTs affect total service imports at the importer level, providing further support that higher WHTs likely lead to a shifting of imports to other more lightly-taxed jurisdictions.

Our paper relates to two broad strands of economic literature. It offers new evidence on the rising role of services trade and its key determinants, highlighting the importance of taxation (Corrado, Hulten, and Sichel, 2009; Jona Lasinio and Manzocchi, 2012; Haskel and Westlake, 2018; Jenniges et al., 2023). At the same time, it contributes to the growing and diverse group of papers that assess the scale of profit shifting by multinational firms. Dharmapala (2014), Riedel (2018), and Beer et al. (2020) review the empirical papers on this topic. By combining

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[4] Technical services, in the context of international taxation, are broadly defined as "any service of a managerial, technical or consultancy nature" and encompass services requiring specialized knowledge, skill, or expertise, including the transfer of such knowledge to the client.

[5] Recent reviews are in Riedel (2018) and Beer et al. (2020).

the estimation of profit shifting with the analysis of service imports, our paper provides a unique addition to these two lines of research. In addition, a small growing literature examines the role of bilateral tax treaties in shaping foreign direct investment and capital income flows (Davies 2004; di Giovanni, 2005; Blonigen et al., 2014; Beer and Loeprick, 2021; Janský et al., 2021). Our paper complements this literature by expanding beyond tax treaties and directly assessing the impact of WHT on international trade.

This paper proceeds as follows. Section 2 provides some background information on cross-border services trade and a simple model to clarify the effects of withholding taxation on profit shifting. Section 3 describes the data set, presents descriptive evidence and the empirical strategy. Section 4 presents the main results. Section 5 presents the effect of WHT on service imports at the importer level. Section 6 concludes.

2. Services Trade and How it is Taxed

2.1 Growing Services Trade

Cross-border trade in services, especially in digital services, has grown faster than trade in goods, accounting for a quarter of global gross exports in 2023. Services now account for over 50 percent of value added in gross exports (Francois and Hoekman, 2010).[6] The significant growth in services trade contrasts sharply with goods trade, which remained stagnant as a share of global GDP from 2005 to 2019 (Figure 1). Moreover, while lockdowns and travel embargoes during the COVID-19 pandemic affected services trade from 2020, the flow of modern services, which largely take place electronically, did not falter during the pandemic (Figure 2). Modern service imports include sub-categories such as telecommunications, computer, and information services, other business services, financial services, and royalties and license fees (Baldwin et al., 2024). [7] Boosted by innovations in information technology and telecommunications, the globalization of services has defied geoeconomic fragmentation and is considered the new driving force of global integration (Georgieva and Okonjo-Iweala, 2023; Li and Zymek 2024).

Figure 1. Growing Services Trade, 2005-2019
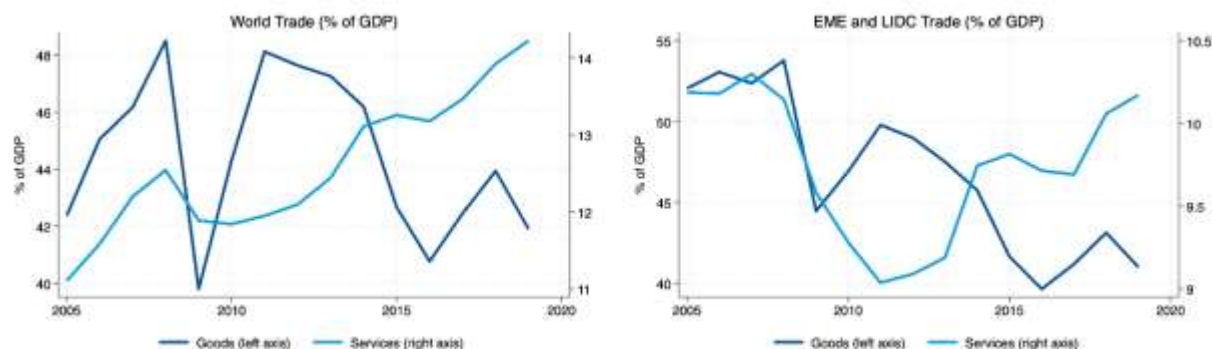
Note: The left panel shows the sum of global exports and imports in goods and services, respectively, as a share of global nominal GDP from 2005-2019. The right panel restricts the sample of source countries to emerging market economies (EMEs) and low-income developing countries (LIDCs). Country income groupings are based on the International Monetary Fund's (IMF) most recent classifications, available at: https://www.imf.org/external/datamapper/Metadata_Apr2023.xlsx.

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[6]   They are also highly complementary to goods trade. For example, services are deeply embedded in the exports of manufacturing goods, representing 30 percent of value added in gross exports.

[7]   Modern services here correspond to the Other Commercial Services (OCS) category in World Trade Organization (WTO) data.

Growing international services trade plays an important role in sharing innovation from countries on the technology frontier with the rest of the world. While the diffusion literature has primarily focused on trade in goods (Keller, 2004), services imports stimulate greater diffusion than goods imports in emerging markets and developing economies (EMDEs), boosting their domestic activities over the medium term (IMF, 2024). The relationship between services imports and economic growth is even stronger: by increasingly using foreign knowledge embodied in services imports, EMDEs can boost their innovation activity and increase productivity by adopting existing technologies. EMDEs can also take advantage of services exports as new opportunities for growth (India at the turn of the 21st century, for example, benefited from such increased cross-border services).

Figure 2. Growing Services Trade by Category, 2005-2021
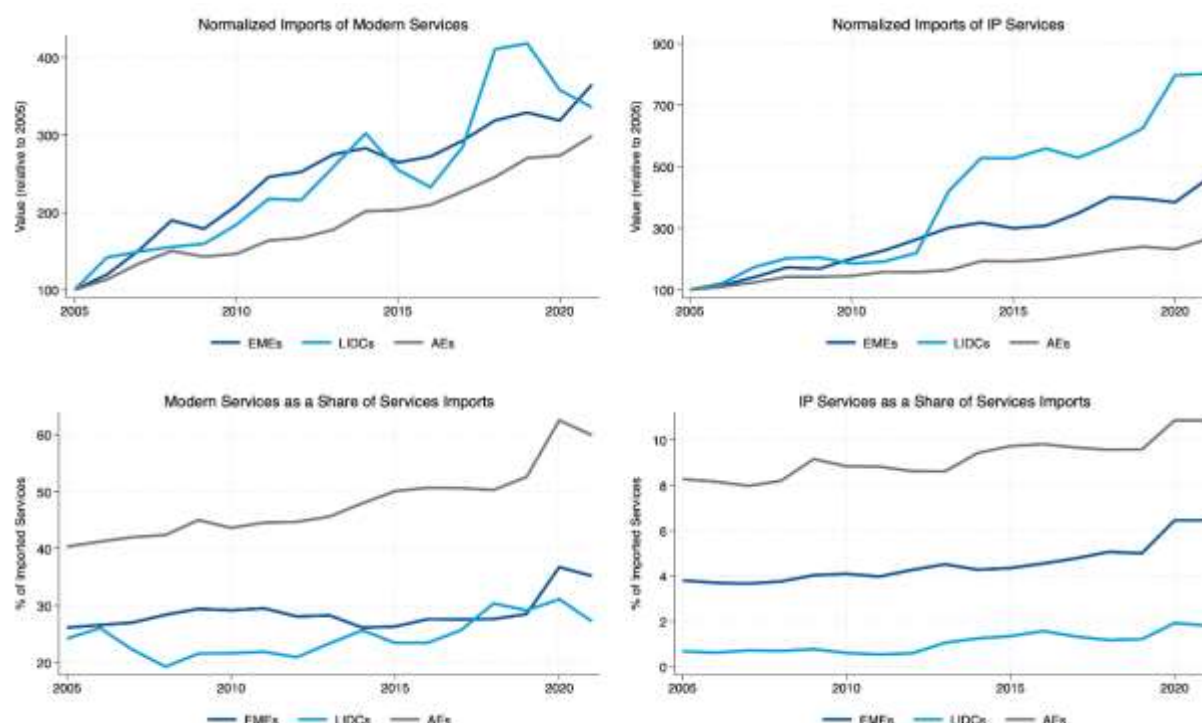
Note: These panels show the absolute (top) and relative (bottom) growth in imports of modern services (left) and IP (right) across source country income groupings. Modern services include telecommunications, computer and information services, other business services, financial services, and royalties for IP.

2.2 Taxation of Services Imports

Risks of Base Erosion and Profit Shifting

The rise of cross-border trade in services also brings new challenges for domestic revenue mobilization, which remains a first-order priority for many developing countries. Take service imports that are intermediate business inputs, for example. On the extensive margin, these imports can facilitate the reallocation of economic activities by multinationals to minimize their global tax bill. This includes registering intellectual property (IP) in low-tax countries and strategically sourcing other services from investment hubs to reduce taxes on associated income. As there are often no comparable transactions for IP between unrelated parties, determining the arm's length price for companies' intangible transactions is usually difficult, leaving room for tax-induced manipulation of transfer prices (Grubert, 2003; Desai et al., 2006).

On the intensive margin, service inflows can also facilitate transfer mispricing through higher charges for imported services due to a lack of arm's length prices for royalties and technical fees (Dischinger and Riedel, 2011; Karkinsky and Riedel, 2012; Griffith et al., 2014). Policy work corroborates that for many countries, the use of management or technical services fees paid to nonresidents is one of the most substantial sources of cross-border revenue leakage (e.g. Perry et al., 2017; 2018). EMDEs face greater base erosion and profit-shifting risks now that hard-to-value intangibles play a significant role in services trade, or the capacity to monitor cost-based profit shifting is limited.

Role of WHTs

As noted, WHTs can collect taxes in a jurisdiction that would otherwise not be able to do so. Where they apply to payments that can be used to shift profits, they also serve as a device to help enforce domestic taxes. WHTs are charged as a fixed percentage of the outbound payments in gross terms, with rates often differ across types of flows.

The statutory WHT rates are specified in domestic law. Bilateral tax treaties then modify the maximum WHT rates a country can charge on respective payments to entities residing in the treaty partner.[8] These maximums are often lower than the statutory rates and sometimes rule out any withholding taxation. In general, withholding liabilities can be credited against corporate income tax liability in the recipient country to prevent double taxation of the same income. However, such crediting may be imperfect for legal or administrative reasons, in which case WHTs can "stick" on cross-border income flows. Moreover, limited administrative capacity in many developing countries suggests that the implementation of crediting arrangements is often imperfect, rendering WHTs a final charge on service imports (Keen, 2008).

Effective use of WHTs can mitigate profit shifting along many channels, including through transfer mispricing, strategic location of management or intellectual property in low-tax countries, and debt shifting through intracompany loans. At the same time, treaty shopping, by exploring considerable variation in the WHT rates across over 3,000 bilateral double tax treaties, may limit such impact of WHTs in service-importing countries. This is because treaty shopping enables multinationals to link different treaties and routing investment and related cross-border payments through intermediate companies in treaty countries that permit no, or very low, taxation on the income of those intermediary companies (Beer and Loeprick, 2021; Janský et al., 2021; Balabushko et al., 2017).[9] To counteract this, modern treaties often have anti-treaty shopping provisions, which are meant to restrict beneficial treaty rates to transactions occurring genuinely between the signatory countries.

Other Taxes on Service Imports

Unlike goods imports, which are frequently subject to tariffs—particularly in developing countries—imports of services do not generally incur duties or excise taxes. Value Added Tax (VAT) usually does apply, but for intermediate services as business inputs, it is creditable and refundable as for any other business input. An increasing number of countries apply WHTs on payments to non-residents for digital services (DSTs). These are conceptually similar to WHTs on cross-border technical services—except that they are usually only deductible from taxable profit, but not creditable against CIT. While such taxes initially focused on business-to-business

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[8] In general, tax treaties represent an important aspect of the international tax rules for many countries. Over 3,000 bilateral income tax treaties are currently in effect, and the number is growing. The overwhelming majority of these treaties are based either on the United Nations Model Double Taxation Convention between Developed and Developing Countries (UN Model Convention) or the Organisation for Economic Co-operation and Development Model Tax Convention on Income and Capital (OECD Model).

[9] Apart from empirical evidence, anecdotal evidence tends to support the claim that treaty shopping has historically been a major problem worldwide. To address the risks associated with a wide treaty network with heterogeneous tax provisions, the United States has for many decades insisted on including limitations on benefits provisions in its tax treaties.

payments for online advertising, they have since expanded to include other digital services and some business-to-consumer transactions. Proponents justify these withholding obligations as attempts to equalize the income tax treatment of non-residents vis-a-vis that of resident service providers in a world with increasing cross-border remote sales—although they apply irrespective of any home country taxation. Tax rates on payments in scope vary widely at relatively high levels of 5 to 15 percent globally.[10]

2.3 A Simple Model of Profit Shifting with WHTs

This subsection develops a simple model that articulates how WHTs affect incentives for profit shifting by multinational corporations (MNCs), modifying the standard profit-shifting model (Hines and Rice, 1994; Grubert and Slemrod, 1998) that incorporates WHTs.

Basic Setup

Consider an MNC with economic activities in country s and affiliates in n countries. Let ρ_i represent economic profits earned in each country by real factors located there.[11] The MNC engages in profit shifting and reduces its tax base in country s by allocating an additional c_i of profits from the importing country to affiliates in country i. We assume that the cost of misreporting rises quadratically in the degree of profit shifting:

$$C_i = \frac{\lambda \, (c_i)^2}{2 \, \rho_i},$$

where $\lambda > 0$ captures the strength of tax enforcement. These costs can be interpreted as various forms of real-world costs of profit shifting, including the costs of paying tax lawyers and accountants, expected fines, and court litigation costs, or the loss of efficiency that results from setting up structures (e.g., new affiliates to manage IP) purely for tax reasons. Profit shifting is achieved by over-invoicing or inflating the cost of services imports above their true cost (captured by c_i). The WHT on the payment in the source country to country i is denoted by τ_{wi} (assumed lower than or at equal to the importer CIT rate without loss of generality). After-tax profits for the MNC are given by:

$$\Pi = (1 - \tau_s) \left[\rho_s - \sum_{i=1}^{n} c_i \right] - \sum_{i=1}^{n} \tau_{wsi} c_i + \sum_{i=1}^{n} (1 - \tau_i)[\rho_i + c_i] + \sum_{i=1}^{n} \min(\tau_i, \tau_{wsi}) c_i - \sum_{i=1}^{n} \frac{\lambda \, (c_i)^2}{2 \, \rho_i}. \tag{1}$$

Here, the first and third terms reflect profits booked in the importing/source and exporting/recipient countries, respectively. The second term corresponds to tax withheld on payments for imported services, while the fourth

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[10] More countries are also opting to apply a general digital service tax on both resident and non-resident companies, which, given their high global turnover and domestic revenue thresholds, means that they effectively target a few large foreign multinationals. Such DSTs target revenue generated through interaction with users in source jurisdictions from a range of digital services (whether for a fee or through the provision of a free service). They are levied on a gross basis at relatively low rates, ranging from 1.5 to 7.5 percent on revenues from the sale of the digital services in scope.

[11] For simplicity the model assumes that service imports occur only for profit shifting. The model can be extended by allowing also service imports for other reasons. Let $\rho_i = g_i - s_i$, where s_i are service imports that reflect nontax considerations and g_i are profits gross of such imports. Such services will still be subject to WHT but will not incur profit-shifting costs. This would reduce profits in equation (1) but would not affect first-order conditions.

term reflects any credit the MNC receives for tax withheld. Finally, the fifth term is the cost of engaging in mispricing.[12]

Optimal Over-reporting of Import Costs.

Taking the first-order condition with respect to c_i, we derive:

$$\frac{c_i}{\rho_i} = \frac{\tau_s - \max(\tau_i, \tau_{wsi})}{\lambda}.$$

(2)

Holding other factors fixed, a higher corporate income tax in source country s and a lower income tax in country i, which houses the non-resident affiliate, increases the incentives for, and intensity of, profit shifting through inflated service imports or strategic location of IP. Shifted profits are also declining in the strength of tax enforcement.

Proposition 1 (Optimal reported profitability). *Relative to the economic profits* ρ_i,

(i)   When the WHT can be fully credited ($\boldsymbol{\tau_i > \tau_w}$), the optimal reported costs increase in the tax differential $\tau_s - \tau_i$.

(ii)   Without full crediting ($\boldsymbol{\tau_i < \tau_w}$), for example under a territorial tax system), the optimal reported costs increase in the tax differential $\tau_s - \tau_{wsi}$.

Proof. Follows directly from equation (2).

With full crediting, relative to the economic profits ρ_i, the optimal reported costs increase in the tax differential $\tau_s - \tau_i$. While τ_{wsi} does increase the tax revenue of the source country at the expense of others, it does not alter the incentives for or intensity of profit shifting. Alternatively, when there is less than full crediting, the optimal reported costs now increase in the tax differential $\tau_s - \tau_{wsi}$, which is less than $\tau_s - \tau_i$. Here, the WHT not only retains tax revenue for the source country, but it also reduces the amount of profit shifting: $\frac{c_i}{\rho_i}(\tau_i < \tau_{wsi}) < \frac{c_i}{\rho_i}(\tau_w = 0)$.

A clear-cut test of the two regimes eludes us in practice, for at least two important considerations. First, the effective CIT rate of any MNC is likely to be below its statutory rate due to existing treaty obligations and tax planning, combined with extensive use of tax incentives in developing countries to attract foreign direct investment (FDI). Moreover, the theoretical prediction applies to the CIT rates in the actual recipient countries. When service inflows pass through a third country, the data shows the CIT rate of the immediate recipient country, which is different from the CIT rate of the final recipient country. This creates mismeasurement of tax rates for all bilateral positions affected by tax planning, including the frequently used FDI data (Keen et al., 2023). Thus, it is left as an empirical question to determine whether and how the WHT influences service imports across countries.

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[12] Strictly, equations (1) and (2) are based on the assumption that $\tau_s \geq \tau_i$. This assumption can be relaxed without affecting the results. For any profit shifted inwards (i.e., $c_i < 0$), the reverse withholding tax τ_{wis} applies. Equation (1) then becomes: $\Pi = (1 - \tau_s)[\rho_s - \sum_{i=1}^{n} c_i] - \sum_{i=1}^{n} \tau_{wsi} c_i (c_i \geq 0) + \sum_{i=1}^{n} \tau_{wis} c_i (c_i < 0) + \sum_{i=1}^{n} (1 - \tau_i)[\rho_i + c_i] + \sum_{i=1}^{n} \min(\tau_i, \tau_{wsi}) c_i (c_i \geq 0) - \sum_{i=1}^{n} \frac{\lambda (c_i)^2}{2 \rho_i} - \sum_{i=1}^{n} \min(\tau_s, \tau_{wis}) c_i (c_i < 0) - \sum_{i=1}^{n} \frac{\lambda (c_i)^2}{2 \rho_i}$. The first order condition of equation is unchanged when $\tau_s \geq \tau_i$, and otherwise becomes: $\frac{c_i}{\rho_i} = -\frac{\tau_i - \max(\tau_i, \tau_{wis})}{\lambda}$.

3. Data and Empirical Strategy

3.1 Cross-Border Services Trade

Our primary outcome of interest is the flow of services between countries, explored in the Balanced Trade in Services (BaTIS) Database compiled by the Organisation for Economic Co-Operation and Development (OECD) and the World Trade Organization (WTO). BaTIS contains annual bilateral data on the imports and exports of services for 202 reporting economies and their partners from 2005 to 2021.[13]

In addition to total services, information is available for 12 major categories of services delineated in the International Monetary Fund's most recent Balance of Payments and International Investment Position Manual (BPM6).[14] This disaggregation allows us to focus on modern service categories that often lack arm's length pricing and are more susceptible to tax planning. These include charges for the use of intellectual property (IP),[15] as well as telecommunications, computer, and information services (ICT), financial services, and other business services.

Similar to other data series on bilateral trade and financial relations, many country-pairs report missing service flows. Around 56 economies report disaggregated bilateral service trade flows, although the coverage has improved over time: around 90 trading partners in 2005, rising to 201 trading partners by 2021. The share of total world services trade that is bilaterally specified ranges from less than one-third in 2005 to two-thirds in 2021.[16]

3.2 WHT Rates

Data source

Information about WHT rates on service payments is drawn from several sources. We start with the Tax Treaties Explorer dataset, compiled by the International Centre for Tax and Development (ICTD), for rates governed by tax treaties between specific countries. This dataset contains details on 2,667 tax treaties signed by 118 economies. These include all African countries, all low and lower-middle-income countries, and all members of the Intergovernmental Group of 24. The dataset specifies the maximum withholding rates that can be levied on payments for royalties and technical fees (for services of a managerial, technical, or consultancy nature) between the signatories. We use the treaty's effective date, as opposed to the time of signing, as the starting point for the WHT rate.

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[13] Importantly, BaTIS excludes sales of local services through affiliates of multinationals, as its coverage is limited to services supplied through direct cross-border trade, the movement of customers to the country of the provider, and the temporary movement of natural persons to provide services in another nation. These correspond to Modes 1, 2, and 4 of the four-pronged definition of services trade under the General Agreement on Trade in Services (GATS). Our analysis focuses on Mode 1, as it corresponds to service inputs for production and value-added. WHTs are most commonly applied to this category of supply..

[14] The categories are: (1) manufacturing services on physical inputs owned by others, (2) maintenance and repair services, (3) transport, (4) travel, (5) construction, (6) insurance and pension services, (7) financial services, (8) charges for the use of intellectual property, (9) telecommunications, computer, and information services, (10) other business services, (11) personal, cultural, and recreational services, and (12) government goods and services.

[15] These rights can arise from research and development, as well as from marketing. This seria also includes charges for licenses to reproduce or distribute intellectual property embodied in produced originals or prototypes (such as copyrights on books and manuscripts, computer software, cinematographic works, and sound recordings) and related rights (such as those on live performances and television, cable, or satellite broadcast).

[16] The BaTIS dataset also reports interpolated bilateral flows, which are only used for descriptive analyses.

We complement the ICTD data with historical archives of treaty rates for high and upper-middle-income countries from the International Bureau of Fiscal Documentation (IBFD) and the OECD, with information available from 2009. For treaty rates between 2005 and 2008, we rely on the Worldwide Corporate Tax Guides by Ernst and Young (EY).[17] Finally, we obtain from the IBFD data the general withholding rates on payments of royalties or technical fees, which are applicable in the absence of a tax treaty. The combined withholding rate dataset includes 202 source countries and 203 recipient countries, with 39,303 unique country pairs. Appendix I provides additional details on the WHT dataset, including how it incorporates multiple WHT rates and the EU Interest and Royalties Directives.

Variation in the WHT Rates

Variation in the WHT rates for a country pair comes from two sources. First, countries renegotiate or enter new bilateral tax treaties that change the ceiling for applicable withholding rates. Second, countries revise the general withholding rates on payments to nonresidents in their domestic legislation. This revision would change the applicable rates for all trading partners without a treaty, and if the rate becomes lower than the existing treaty rate, will also change the applicable rates for the treaties partners affected. Following Janský et al. (2021), Figures III.1-3 in Appendix III show by income group, a list of countries ranked by the number of changes in the applicable withholding rates on royalties and technical fees during the sample period.[18] Variation in applicable rates is largely driven by respective changes to the general WHT rates for royalties and technical fees. For example, Moldova changed its general WHT rate on royalties from 10 to 15 percent in 2009, and to 12 percent in 2012. These changes applied to all its non-treaty trading partners, while only 12 of its treaty rates on royalties were revised over the same period.

3.3 Other Variables

To implement equation (3) in Section 3, we augment the dataset on services trade and WHT rates with information on other tax rates and macroeconomic conditions. Statutory tax rates, including for headline CIT rates, standard VAT rates, and personal income taxes (PIT), are drawn from the IMF World Revenue Longitudinal Database (WoRLD). To assess the effect of CITs on royalty payments, we also collect the relevant CIT rates under IP regimes for relevant countries from OECD.

Bilateral gravity variables are from CEPII:[19] we control for standard factors, including the physical distance between two countries, contiguity, common language, and colonial ties, which may shape cross-border trade. When not including relevant fixed effects, we add additional control variables that are likely to be important determinants of cross-border trade in services. Following Li and Meleshchuk (2024), these include country-level GDP, exchange rates, and measures of inflation from the World Bank's *World Development Indicators*. We also add measures of capital account and trade openness.[20]

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[17] Where possible, we use information on tax treaties published by official national sources online to validate data from the EY guides.

[18] In each figure, the left panel displays all changes to applicable WHT rates, including changes due to revisions of general rates and of treaties. In comparison, the right panel shows the frequency of changes due to treaty revision.

[19] Centre d'Etudes Prospectives et d'Informations Internationales, see Head and Mayer (2014).

[20] Capital account openness is measured using the Chinn-Ito index, which is standardized between zero and one, with higher values indicating greater openness. Trade openness is defined as exports plus imports as a share of GDP.

3.4 New Stylized Facts for WHTs and Service Imports

Treaty typically reduces WHT rates…
Treaty WHT rates are typically lower than the statutory WHT rates, as shown in Appendix III Figures 4-6. As of 2021, treaties with AEs typically reduce the WHT rate by 15 percentage points for both royalties and technical fees. For EMEs, the reductions are 6 percentage points for royalties and 12 percentage points for technical fees. LIDCs see similar reductions of 5 percentage points for royalties and 13 percentage points for technical fees. Notable exceptions are countries with zero statutory WHT rates, which are not affected by treaties. For example, 22 countries have zero statutory WHT rates for royalties, among which 14 are investment hubs. Only one of these countries is an LIDC (Mauritania). The rest are almost evenly split between AEs (including Luxembourg and Switzerland) and EMEs (such as the Bahamas, Hungary, and the United Arab Emirates). Among the 36 countries with zero statutory WHT rates for technical fees, 16 are investment hubs.[21] Again, only one of these countries is LIDC (Afghanistan), and the rest are mostly AEs including Australia, Finland, Germany, Ireland, the Netherlands, and Sweden.

…and can go as low as zero
It is also common for bilateral tax treaties to impose a zero WHT rate on relevant payments. In 2021, 15 and 78 percent of the treaties in our sample specified zero withholding on royalty payments and technical fees, respectively. Zero WHT rates are more common in treaties involving AEs. For the average AE source country, 29 percent of treaties include zero WHT rate on royalties, and 88 percent impose a ceiling of zero for WHT on technical fees. For the average EME, 7 and 72 percent of treaties remove withholding on royalties and technical fees, respectively. For LIDCs, these figures are 6 and 73 percent, respectively. The countries with the highest proportion of treaties featuring zero withholding on royalties are the United States (44 percent), Georgia (42 percent), Bahrain (37 percent), the United Kingdom (31 percent), and Norway (31 percent). In terms of zero withholding on technical fees, the frontrunners are Algeria (100 percent), Tajikistan (100 percent), Nigeria (100 percent), Armenia (98 percent), and Iceland (97 percent).

Higher income countries import more services from treaty partners
Countries across income groups exhibit significant differences in where they source service imports (Figure 3). Advanced economies predominantly import services from treaty partners, with an even higher treaty partner share for modern services. This is partly driven by the fact that high-income countries have concluded substantially more tax treaties than their developing counterparts, with low-income countries having the narrowest treaty networks. As of 2021, the median number of treaty partners was 67 for AEs, 27 for EMEs, and 11 for LIDCs. Emerging market economies follow a similar trend to AEs, though their share of imports from treaty partners is slightly lower. LIDCs import much less services from their treaty partners. However, this share has increased significantly over the past decade, including a near doubling for imports of modern services. In our sample, about 42 percent of tax treaties for LIDCs are with AEs, 46 percent with EMEs, and only 12 percent with another LIDC.[22]

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[21] We compile the list of investment hubs using two sources. The first is the list of "international financial centers" in Hines (2010). We then adapt the methodology used in Beer and Loeprick (2021) to identify economies where the sum of average inward and outward FDI stocks over our sample period exceeds two times the average domestic GDP. Most economies meeting these criteria are already on the Hines (2010) list, but we add Belgium, Cabo Verde, and the Netherlands. We combine both sources because FDI data are missing for almost half the countries in our sample. In total, 41 jurisdictions are classified as investment hubs in our sample. As of 2021, the median number of investment hub treaty partners was 11 for AEs, 5 EMEs, and 1 for LIDCs.

[22] Countries with the largest number of bilateral tax treaties include UK (124 treaties), France (119), China (103), Switzerland (102), and Italy (100). Non-AEs with more expansive treaty networks are typically resource rich, including Uzbekistan, Kyrgyz Republic, Tajikistan in central Asia as well as Cote d'Ivoire and Senegal in Africa.

Figure 3. Services Imports from Treaty Partners
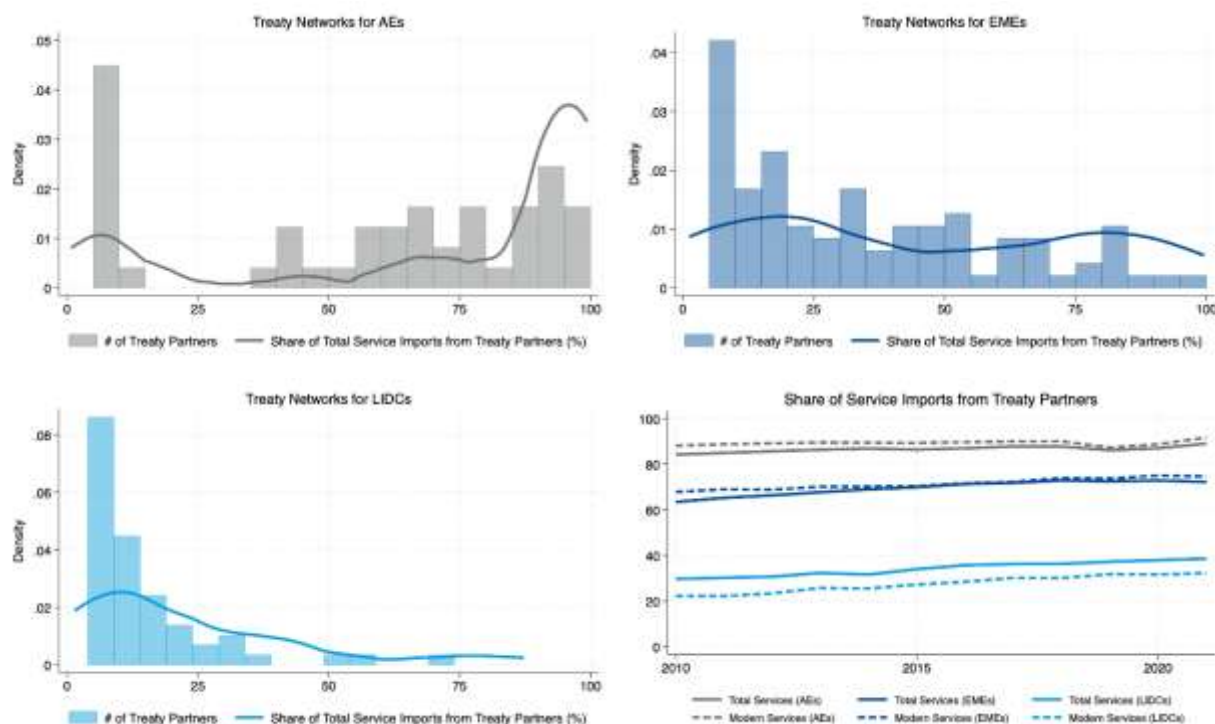
Note: The panels plot the distributions of the number of treaty partners and the share of service imports sourced from treaty partners across income groups in 2021. The highest bins for the histograms include countries with more than 100 partners. The panel on the bottom right shows the share of total imports coming from treaty partners across income groups and service categories.

Countries of all income groups import more services from investment hubs

The share of service imports from investment hubs has steadily increased during most of the sample period, notwithstanding a sizable drop for AEs during COVID. Countries import more modern services from these low-tax jurisdictions, consistent with the hypothesis that these services may be used as a profit-shifting tool. On average, the share of modern services and IP imports sourced from investment hubs is more than double the share for government services, which are unlikely to be influenced by tax planning. Treaty rates with investment hubs are generally lower. On average, WHT rates on royalties are about 2.5 percentage points, or 26 percent, lower in treaties with investment hubs. For technical fees, the difference is 0.3 percentage points, or 9 percent, lower in treaties with investment hubs.

Figure 4. Services Imports from Investment Hubs
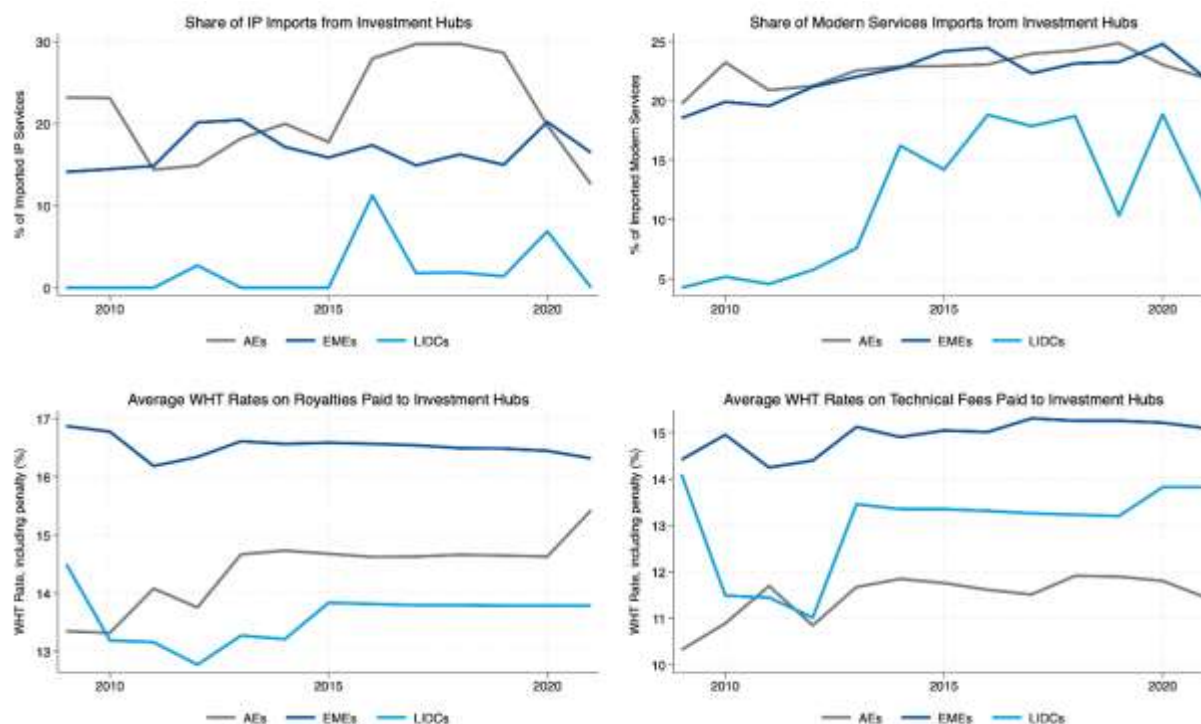
Note: The top panels present the share of officially reported modern services and IP imported from investment hubs for different source country income groups. Panels on the bottom display the average applicable withholding rates on payments for imports from investment hubs across source country income groups.

3.5 Empirical Strategy

To estimate the relationship between withholding taxation and services imports, we follow the previous literature in international trade and estimate the following augmented gravity model using a Poisson pseudo-maximum likelihood (PPML) estimator. As Santos Silva and Tenreyro (2006) and Eaton et al. (2013) note, PPML estimation is preferred to an ordinary least squares (OLS) specification, in which one takes the logarithm of the dependent variable, for two reasons: (i) the prevalence of zero trade flows between country pairs, which presents an issue for logarithmic transformations, and (ii) the robustness of PPML to heteroskedasticity.[23] Our main estimation equation is:

$$Y_{sit} = \exp(\beta_0 + \beta_1 \tau_{sit} + \mu_{st} + \gamma_{it} + \mathbf{\Gamma}' X_{sit}) + \varepsilon_{iet}. \tag{3}$$

Here, we relate the monetary value of service imports into country *s* from exporter *i* in year *t* to the relevant WHT rate τ_{si}. β_1 captures the elasticity of payments for royalties or technical services to the associated WHT rate.

We control for a variety of time-varying factors specific to the source country and trading partner by including importer-year fixed effects μ_{st} and exporter-year fixed effects γ_{it}. Importantly, the inclusion of these fixed effects

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[23] In particular, the appeal of this estimator is that in the presence of many zeroes, it requires no distributional assumptions and relies on the correct specification of the conditional mean. On the properties and applications of PPML more widely, see Santos Silva and Tenreyro (2006).

controls for multilateral resistance (for example, accession to WTO or regional economic membership), or the ease of market access for each trading partner, which is an important feature of structural gravity models. Commonly used bilateral gravity variables for each country pair $\mathbf{X_{si}}$, including physical distance, contiguity, common language, and common colonizer, are also included. Inclusion of importer-year FE also accounts for the effects of digital service taxes, since these do not vary across exporting countries. Standard errors are clustered at the country-pair level across specifications, corresponding to the level at which WHT rates vary. Identifying variation comes from differences in the WHT rate for the relevant service payments across exporting countries as well as any changes in these differences over time, including for example upon signing a bilateral tax treaty with a particular country.

In alternative specifications, we also estimate the elasticity of service imports to the CIT rate in the source country, replacing the importer-year fixed effects with importer fixed effects. Moreover, since importer fixed effects only account for time-invariant characteristics, we add controls for potentially confounding macroeconomic indicators, including nominal GDP, the Chinn and Ito (2008) index of capital account openness, a measure of trade openness, the nominal exchange rate, and inflation. In this set of specifications, identification of the tax effects relies on changes in the level of CIT and WHT rates over time in each source country, in addition to differences in the WHT rates across recipient countries and any changes in these differences over time.

4. The Effects of WHTs on Bilateral Service Imports

This section presents baseline results, considers heterogeneity, and explores the robustness of estimates for how WHTs impact imports of services.

4.1 Baseline Results

Table 1 reports baseline results from the estimation of equation (3). The top panel includes importer fixed effects and exporter-year fixed effects, allowing us to identify and compare the effect of the CIT in the importing country. The first column examines the effect of WHTs on total service imports. The coefficient on the CIT is positive and significant, consistent with a higher CIT being linked to over-invoicing of service imports. The coefficients on the WHT rates for royalties and technical fees are negative and highly significant, respectively. These results are consistent with the hypothesis that higher WHTs mitigate over-invoicing, countering the effect of a higher CIT.

Imports of services are highly elastic to WHTs, with a semi-elasticity of around 1.4 percent for royalties and 0.7 percent for technical service fees. The interpretation here is that a one percentage point increase in the relevant WHT rate is associated with a reduction of 1.4 percent in outbound royalty payments—an effect twice as large as that of CIT—while the reduction in outbound technical fees is 0.7 percent. Although few existing studies provide us with an opportunity to compare results, our estimated elasticities are comparable with those in Janský et al. (2021), who estimate semi-elasticities for dividend payments of 1.9-2.4 percent to the applicable WHT.

Table 1. Baseline Results

Dependent Variable: Payments for	All Services	IP	Business, Non-insurance Financial	Business, Financial, Insurance	Government, Travel
	(1)	(2)	(3)	(4)	(5)
Panel A					
CIT, Importer	0.004**	0.005*	0.0001	0.002	0.002
	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)
WHT on Royalties	-0.013**	-0.044***			-0.012
	(0.006)	(0.011)			(0.008)
WHT on Technical Fees	-0.007**		-0.010***	-0.010***	-0.001
	(0.003)		(0.003)	(0.003)	(0.003)
Importer FE	Y	Y	Y	Y	Y
Macro Controls	Y	Y	Y	Y	Y
Panel B					
WHT on Royalties	-0.014**	-0.045***			-0.012
	(0.007)	(0.011)			(0.008)
WHT on Technical Fees	-0.007*		-0.010***	-0.010***	-0.002
	(0.003)		(0.003)	(0.003)	(0.003)
Importer-Year FE	Y	Y	Y	Y	Y
In both panels:					
Observations	122,873	57,610	61,414	58,114	52,406
Zero Rated Flows	20,839	21,286	20,509	20,509	15292
Exporter-Year FE	Y	Y	Y	Y	Y
Gravity Variables	Y	Y	Y	Y	Y
Unique Importer-Exporter Pairs	6,590	3,443	4,571	4,321	3,779
Unique Importers	169	138	167	160	163

Note: This table shows the effect of WHT on service imports from the main empirical specification. Panel A includes importer fixed effects to identify the effect of importer CIT. Panel B follows equation (3). Gravity variables for each importer-exporter pair include physical distance and indicators for contiguity, common official language, and common colonizer. Macroeconomic controls include source country nominal GDP, trade openness, capital account openness, exchange rate for national currency to USD, and consumer price index. Standard errors clustered at the importer-exporter pair level.

The remaining columns of the top panel in Table 1 look more closely at the tax effects across different types of service payments. Column 2 finds a much stronger effect of WHTs on royalties, with an estimated semi-elasticity of 4, which is consistent with existing literature that documents IP services as one of the main profit-shifting tools. Columns 3 and 4 examine various categories of technical fees that have been found to facilitate profit shifting. The results confirm the negative impact of WHTs on charges for financial and insurance services and for other business services. As a placebo test, Column 5 uses payments for government and travel services as the dependent variable and as expected, finds that these flows are not influenced by changes in the CIT or WHTs.

The bottom panel in Table 1 uses the same dependent variables as in the top panel, adding importer-year fixed effects that subsume the effect of importer CIT. The identifying variation now relies on differences in the WHT rates across recipient countries for each source country and any changes in these differences over time. In each specification, the coefficients of WHT rates remain remarkably similar to those in the top panel. The estimated effect can be interpreted as a lower bound for the true effect of WHT in light of potential endogeneity: to the extent that countries lower their WHT rates to attract more service imports, it would bias against findings of any negative effect for the WHT.

4.2 Heterogeneous effects of WHT

Across Country Groups

Table 2 explores how the effects of WHTs on royalties (Panel A) and technical service fees (Panel B) vary across country groups, by interacting the respective WHT with an indicator for the respective country characteristic. For royalties, the effect of WHT is similar between AEs and EMDEs (Column 1), including between AEs and EMDEs that are not investment hubs (Column 2). While the effect of WHT is also similar between treaty and non-treaty partners for non-hub AEs, its effect almost doubles on IP inflows from treaty partners to non-hub EMDEs (Column 3 and 4). Focusing on the role of investment hubs, the effect of WHT is even stronger for IP inflows from investment hubs to non-hub EMDES (Columns 5 and 6), and for technical services from investment hubs to non-hob EMDEs (Panel B). For the latter, the results are somewhat different between treaty and non-treaty exporters, with a stronger effect of WHTs on IP inflows from treaty exporters to non-hub AEs.

Table 2. Varying Effects of WHT across Country Groups

Dummy indicator for:	EMDE Importer		Treaty Partner		Hub Exporter	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Royalty payments						
WHT on Royalties	-0.053***	-0.046***	-0.029*	-0.024***	-0.040***	-0.014
	(0.014)	(0.016)	(0.016)	(0.009)	(0.013)	(0.009)
WHT on Royalties x Dummy for	0.002	0.004	-0.004	-0.018*	0.025	-0.042***
	(0.017)	(0.019)	(0.020)	(0.010)	(0.020)	(0.014)
Observations	52,401	38,722	20,662	20,618	21,728	20,618
Zero Rated Flows	20,141	14,344	6,409	6,867	6,769	6,867
Unique Importer-Exporter Pairs	3,405	2,340	1,350	1,836	1,452	1,836
Unique Importers	154	94	30	93	31	93
Panel B: Payments for Business and Financial Services						
WHT on Technical Fees	-0.009***	-0.006	-0.002	-0.006	-0.010**	-0.001
	(0.003)	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)
WHT on Technical Fees x Dummy for	0.001	0.000	-0.014**	-0.001	-0.003	-0.025***
	(0.005)	(0.006)	(0.006)	(0.007)	(0.006)	(0.009)
Observations	52,742	39,028	22,144	20,621	21,728	20,621
Zero Rated Flows	11,609	7,908	2,338	4,701	1,664	4,701
Unique Importer-Exporter Pairs	3,413	2,344	1,441	1,837	1,452	1,837
Unique Importers	154	93	30	93	31	93
In both panels:						
Sample	All Importers	Non-Hub Importers	Non-Hub AE Importers	Non-Hub EMDE Importers	Non-Hub AE Importers	Non-Hub EMDE Importers
Importer-Year FE	Y	Y	Y	Y	Y	Y
Exporter-Year FE	Y	Y	Y	Y	Y	Y
Gravity Variables	Y	Y	Y	Y	Y	Y

Note: This table shows the estimates from the empirical specification in Equation (3), adding interaction terms between the withholding rates and subsets of countries to identify variation in the semi-elasticity of service imports to withholding rates across country groups. The sample is restricted to non-hub importers in Column (2), non-hub AE importers in Columns (3) and (5), and non-hub EMDE importers in Columns (4) and (6). Gravity variables for each source country-trading partner pair include physical distance and indicators for contiguity, common official language, and common colonizer. Standard errors clustered at the importer-exporter pair level.

Stronger effect of minimum WHT rate

Table 3 continues to explore the differential effect of WHTs, differentiating between the minimum WHT rate for each importer and those exceeding it. The results across various samples show a consistent pattern that point to systematic treaty shopping: WHTs above the minimum rate have a weaker effect, and IP and technical service imports are particularly sensitive to the lowest WHT rate at the importer level.

Table 3. Stronger effects of minimum WHT rate

	(1)	(2)	(3)	(4)
Panel A: Royalty payments				
WHT on Royalties	-0.100***	-0.098***	-0.058*	-0.072***
	(0.023)	(0.022)	(0.032)	(0.024)
Dummy for WHT Above Min	-0.654***	-0.492**	-0.532*	-0.176
	(0.218)	(0.208)	(0.274)	(0.223)
WHT on Royalties x WHT Above Min	0.088***	0.085***	0.060*	0.052**
	(0.023)	(0.023)	(0.036)	(0.025)
Observations	67,731	59,372	27,213	27,107
Zero Rated Flows	26,697	22,429	8,360	9,019
Unique Country Pairs	3,774	3,459	1,544	2,086
Unique Importer Countries	160	131	32	98
Panel B: Payments for business and financial services				
WHT on Technical Fees	-0.046***	-0.060***	-0.000	-0.087***
	(0.015)	(0.017)	(0.006)	(0.027)
Dummy for WHT Above Min	-0.114	-0.220	-0.380**	0.300
	(0.145)	(0.141)	(0.160)	(0.295)
WHT on Technical Fees x WHT Above Min	0.040***	0.055***		0.066***
	(0.014)	(0.015)		(0.022)
Observations	74,963	64,799	23,678	31,982
Zero Rated Flows	27,181	23,036	2,709	11,220
Unique Importer-Exporter Pairs	5,074	4,596	1,591	2,755
Unique Importer Countries	191	155	31	124
In both panels:				
Sample	All Importers	Non-Hub Importers	Non-Hub AE Importers	Non-Hub EMDE Importers
Importer-Year FE	Y	Y		Y
Exporter-Year FE	Y	Y		Y
Gravity Variables	Y	Y		Y

Note: This table plots the estimates from the empirical specification in Equation (3), adding a discrete indicator that takes the value of 1 if the WHT rate exceeds the minimum rate for each importer and its interaction with the withholding rates. Columns (2) restrict the sample to non-hub importers, while Columns (3) and (4) focus on the sample of AE and EMDE importers, respectively. Gravity variables for each source country-trading partner pair include physical distance and indicators for contiguity, common official language, and common colonizer. Standard errors clustered at the importer-exporter level.

Interaction with the CIT

Table 4 examines how the effect of WHTs on royalties (Panel A) and technical service fees (Panel B) varies with the level of CIT across different country groups. The results suggest an interesting pattern of non-linear effects, especially for royalty payments. The effects of WHTs become weaker at higher levels of CIT in the importing country, although this effect is only significant in AEs. One possible explanation is that a very high CIT makes profit shifting more attractive even if the WHT captures part of the CIT savings, while the statutory

CIT rate in AEs better captures the marginal tax saving there as it is less attenuated by sector and project specific tax incentives that are prevalent in EMDEs. Figure 5 shows the full effects of WHTs on royalty payments. Throughout the range of the CIT rates in AE importers, the WHT has a negative and statistically significant effect on outbound royalty payments (Panel A); the only exceptions are those with extremely high CIT rates (of 30 percentage points or more compared to the average of 20). This is also generally the case for payments to treaty partners when importer CIT rates are below 50 percent, and to investment hub exporters when importer CIT rates are less than 40 percent.

Table 4. Varying Effects of WHT across CIT Rates

Subsample:	AE Importer	EMDE Importer	Treaty Partner	Non-Treaty Partner	Investment Hub Exporter	Non-Hub Exporter
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Royalty Payments						
WHT on Royalties	-0.084***	-0.021	-0.102***	-0.004	-0.075**	-0.059***
	(0.023)	(0.015)	(0.026)	(0.017)	(0.033)	(0.018)
WHT on Royalties	0.002**	0.0002	0.002**	-0.0003	0.002*	0.0001
x Importer CIT	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	33,462	27,430	35,783	37,754	11,524	55,108
Zero Rated Flows	10,937	9,046	8,165	28,894	4,105	22,136
Unique Importer-Exporter Pairs	1,809	2,123	1,711	5,352	973	3,160
Unique Importers	41	112	85	149	85	121
Panel B: Payments for Business and Financial Services						
WHT on Technical Fees	-0.003	0.007	-0.009	-0.021*	-0.019	-0.004
	(0.011)	(0.013)	(0.013)	(0.012)	(0.013)	(0.013)
WHT on Technical Fees	-0.0002	-0.001	-0.00004	-0.0001	0.0002	-0.00001
x Importer CIT	(0.0003)	(0.001)	(0.0004)	(0.0002)	(0.0004)	(0.0004)
Observations	30,123	32,491	29,952	32,972	12,687	60,968
Zero Rated Flows	3,846	11,255	1,046	21,055	4,895	22,020
Unique Importer-Exporter Pairs	1,892	2,809	1,557	3,668	1,266	4,225
Unique Importers	40	145	99	167	103	175
In both panels:						
Importer-Year FE	Y	Y	N	N	Y	Y
Importer FE	N	N	Y	Y	N	N
Exporter-Year FE	Y	Y	Y	Y	Y	Y
Gravity Variables	Y	Y	Y	Y	Y	Y

Note: This table plots the estimates from the empirical specification in equation (3) for different subsets of our sample, as indicated in the Column labels, adding interaction terms between the withholding rates and source country CIT rates to identify variation in the semi-elasticity of service imports to withholding rates across different CIT rates. Columns (3) and (4) include importer fixed effects and macroeconomic controls. Gravity variables for each importer-exporter pair include physical distance and indicators for contiguity,

common official language, and common colonizer. Macroeconomic controls include source country nominal GDP, trade openness, capital account openness, exchange rate for national currency to USD, and consumer price index. Standard errors clustered at the country-pair level.

Figure 5. Non-Linear Effects of WHTs on Royalties

| (a) AE importers | (b) Treaty exporters | (c) Hub exporters |
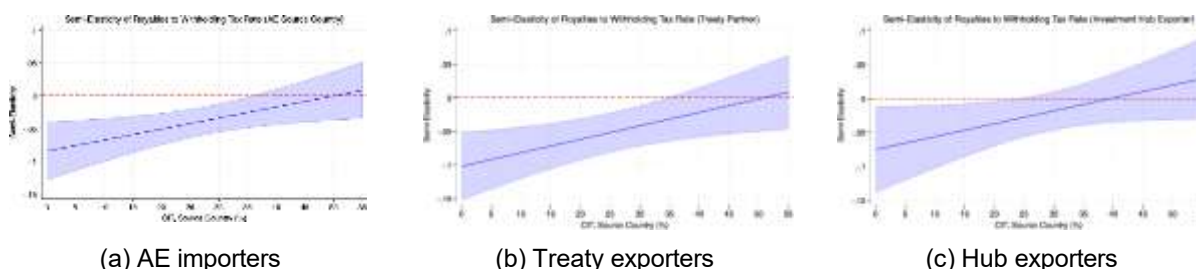
Note: This figure plots variation in the semi-elasticity of service imports to withholding rates across the range of importer CIT rates. Panel (a) presents results for non-AE importers (Column 1 in Table 3), panel (b) for imports from treaty partners (Column 3), and panel (c) for imports from investment hubs (Column 5).

Extensive and Intensive Margins of Service Imports

Given the abundance of zeroes in the services trade data, **Table 5Error! Reference source not found.** assesses the effects of WHT on the extensive and intensive margins of service imports separately. Intuitively, there are fixed costs associated with setting up business with a foreign partner, and the fixed cost introduces an element of lumpiness into the location decision. **Table 5** reports results from estimating a Heckman-type self-selection model, including fixed effects at both stages, the inverse Mills ratio at the second (intensive) stage, and controls as described above. For identification purposes, we impose the exclusion restriction that established bilateral investment relation (positive FDI in the last three years) enters the first (extensive) stage but not the second stage; we also consider the exclusion of the overall tax burden in the importing country, as proxied by the lagged ratio of tax revenue to GDP.

In Columns (1)-(3) of **Table 5**, neither the CIT in the importing country nor the WHT has a significant effect on positive royalty flows in the first stage. The effect of WHT remains negative and highly significant in the second stage, together with the inverse Mills ratio. The results are broadly consistent with a pattern of WHTs constraining profit shifting by affecting the pricing of IP. Turning to imports of technical services (Columns (4)-(6)), the results suggest that the relevant WHT rate matters for both stages. The significant effect of WHT at the extensive margin is consistent with the fact that the associated fixed costs in setting up affiliates to provide related technical services are considerably higher than moving around IP.

Table 5. Effects of WHT across Extensive and Intensive Margins

Dependent Variable:	Royalties	Royalties	Royalties	Technical Services	Technical Services	Technical Services
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: First Stage (Dep. Var. > 0)						
CIT, Importer	0.0004	0.001	0.0004	-0.012	-0.013	-0.013
	(0.002)	(0.002)	(0.002)	(0.014)	(0.014)	(0.014)
WHT	-0.006	-0.006	-0.006	-0.014***	-0.013***	-0.013***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
Lagged Tax-GDP Ratio, Importer	-0.023**		-0.021**	0.006		0.008
	(0.009)		(0.010)	(0.016)		(0.016)
Positive FDI, Past 3 Years		0.170***	0.167***		0.200**	0.200**
		(0.048)	(0.048)		(0.098)	(0.098)
Observations	65,195	65,195	65,195	47,763	47,763	47,763
Importer FE	Y	Y	Y	Y	Y	Y
Exporter FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Macro Controls	Y	Y	Y	Y	Y	Y
Unique Country Pairs	6,328	6,328	6,328	4,013	4,013	4,013
Unique Importers	115	115	115	121	121	121
Panel B: Second Stage (Dep. Var. (log))						
WHT	-0.012*	-0.012*	-0.012*	-0.013***	-0.013***	-0.013***
	(0.007)	(0.007)	(0.007)	(0.004)	(0.004)	(0.004)
Inverse Mills Ratio	-0.548*	-0.576**	-0.578**	-0.824***	-0.868***	-0.869***
	(0.284)	(0.285)	(0.285)	(0.223)	(0.223)	(0.223)
Observations	24,229	24,229	24,229	29,253	29,253	29,253
Importer-Year FE	Y	Y	Y	Y	Y	Y
Exporter-Year FE	Y	Y	Y	Y	Y	Y
Unique Country Pairs	1,550	1,550	1,550	1,825	1,825	1,825
Unique Importers	88	88	88	117	117	117
In both panels:						
Gravity Variables	Y	Y	Y	Y	Y	Y

Note: Standard errors clustered at the country-pair level. Gravity variables for each source country-trading partner pair include physical distance and indicators for contiguity, common official language, and common colonizer. Macroeconomic controls include source country nominal GDP, trade openness, capital account openness, exchange rate for national currency to USD, and consumer price index, as well as the exporter's nominal GDP, trade openness, capital account openness, and deflator for exports.

4.3 Robustness

Table 6 reports a series of robustness tests for the semi-elasticities of service imports to WHT rates. Controlling for the scale of multinational investment, including foreign affiliate investment (FAI) in physical assets (Column 1) and FDI inflows (Column 2) leads to similar effects of WHTs as in the baseline regressions, confirming that the observed tax effects are not only driven by reduction in real investments. Restricting the sample to the pre-COVID period of 2005-2019 in Column 3 yields a slightly larger effect of WHT on royalties. Excluding multilateral treaties leaves the results unchanged (Column 4), while disregarding the penalty rates imposed on imports by 24 countries on national blacklists leads to larger effect of WHTs on royalties (Column 5). Similarly, the estimated effect of the WHT for technical fees remains qualitatively unchanged across different specifications.

Table 6. Robustness Checks for Effects of WHTs

Type of Check:	FAI Control	FDI Flow Control	Pre-Covid Sample	No Multilateral Treaties	No Penalty Rates
	(1)	(2)	(3)	(4)	(5)
Panel A: Royalty Payments					
WHT on Royalties	-0.042*	-0.047***	-0.052***	-0.041***	-0.056***
	(0.023)	(0.016)	(0.011)	(0.012)	(0.013)
Observations	10,371	10,352	44,760	41,601	52,295
Zero Rated Flows	3,449	2,813	17,399	17,807	20,141
Unique Importer-Exporter Pairs	1,377	1,421	3,325	3,055	3,405
Unique Importers	32	78	154	154	154
Panel B: Payments for Business and Financial Services					
WHT on Technical Fees	-0.0104***	-0.015***	-0.0098***	-0.010***	-0.011***
	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)
Observations	10,371	10,355	45,071	74,959	52,743
Zero Rated Flows	1,003	689	10,016	27,177	11,663
Unique Importer-Exporter Pairs	1,377	1,421	3,332	5,072	3,429
Unique Importers	32	78	154	191	154
In both panels:					
Importer-Year FE	Y	Y	Y	Y	Y
Exporter-Year FE	Y	Y	Y	Y	Y
Gravity Variables	Y	Y	Y	Y	Y

Note: This table estimates variations of Equation (3) to consider the robustness of our baseline results for WHTs on royalties (Panel A) and technical fees payments (Panel B). Column 1 adds a control for the level of foreign affiliate investment in tangible asses at the bilateral level. Column 2 includes FDI inflows into the importing country from the relevant exporter. Column 3 drops years affected by the COVID-19 pandemic. Column 4 excludes multilateral treaties, also excluding the country pairs affected by the EU Interest and Royalties Directive for Panel A. Column 5 replaces WHT rates with the second-highest tier for countries that charge punitive rates on payments to blacklisted investment hubs (these blacklists vary across countries and time). Gravity variables for each importer-exporter pair include physical distance and indicators for contiguity, common official language, and common colonizer.

5.WHTs and Rerouting of Service Imports

The negative effect of WHT on service imports estimated in Section 4 may have two alternative interpretations: it could reflect a reduction in service imports by multinationals due to a higher cost of doing business; or a shifting of imports to other more lightly-taxed jurisdictions without impacting their total service imports, or real activities such as investment and output. To test these two alternative explanations, we use a similar estimation approach based on Eq. (3). The dependent variables are now at the importing country level, reflecting for each importer the amount of service import from all exporters. WHT now also varies by importer, reflecting either the lowest WHT rate or the average WHT level among all exporters for each importing country and year.

Table 7 summarizes the results. Column (1) shows that the lowest WHT rate for each importer has no significant impact on total IP inflows, while the CIT there continues to exert a positive impact. The finding is similar for the average WHT rate (Column 2), suggesting that changes in either the minimum or average WHT rate do not affect total IP inflows. Combined with the large effect of the minimum WHT rate on bilateral IP inflows, the results are consistent with relocation of IP inflows across different exporters in response to changes in the WHT rate. The effect of WHTs on technical fees and modern services are very similar, as shown in the remaining columns. Overall, the absence of a clear effect of WHT rate on importer-level service imports suggests that the negative effect of WHTs on modern service imports might indeed be due to a relocation effect of service imports.

Table 7. WHTs and Total Service Imports

Dependent variable:	IP		Technical Services		Modern Services	
	(1)	(2)	(3)	(4)	(5)	(6)
Importer CIT	0.007***	0.006**	0.001	0.001	0.006***	0.005***
	(0.002)	(0.002)	(0.005)	(0.005)	(0.002)	(0.002)
WHT on Royalties, Minimum	-0.002	-0.0004			0.001	0.001
	(0.012)	(0.012)			(0.011)	(0.011)
WHT on Technical Fees, Minimum			0.002	0.004	-0.0004	0.002
			(0.009)	(0.009)	(0.006)	(0.007)
WHT on Royalties, Average		-0.024				-0.005
		(0.018)				(0.009)
WHT on Technical Fees, Average				-0.010		
				(0.011)		
Observations	2,174	1,690	1,954	1,869	1,949	1,489
Zero Rated Flows	0	0	0	0	29	29
Importer FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Macro Controls	Y	Y	Y	Y	Y	Y
Unique Importers	151	144	167	166	166	143

6. Conclusion

WHTs on cross-border services have long been an important policy lever, including in multilateral settings such as the EU (through the Directive), and most recently the STTR. They also form an important part of any double-taxation agreement. Still, there has been surprisingly little empirical work assessing their impact on corporate behavior, including on service imports.

This paper has considered such international WHTs and their interaction with corporate income taxes. Predictions of a simple model are very clear: WHT on services matter, but only if they are not fully creditable against CIT in the country from which services are imported. Where WHTs bind, the difference between the domestic CIT and WHT rates affects the optimal amount of profit shifting—which in this case occurs through service imports. However, in cases where WHTs are fully creditable, it is the simple difference between the domestic and foreign CIT rates, which matters and WHTs should have no impact.

Empirical results are broadly in line with expectations, but some aspects also proved surprising and warrant further research. In general, WHTs appear to have a negative impact on service imports, as expected. Moreover, payment for IP, which is likely the most mobile factor, revealed the greatest sensitivity of imports with respect to WHT rates. Also, while WHTs affect both royalties and technical services at the intensive margin, only technical services are affected at the extensive margin, in line with the presence of set up costs. One of the more puzzling findings is that service imports in advanced countries, while generally sensitive to WHTs, are not significantly affected by WHTs in transactions involving investment hubs.

Annex I. Details on Data

I.   Additional details on the WHT dataset

Dealing with Multiple WHT Rates

The ICTD Tax Treaties Explorer dataset contains three different royalties WHT rates: (i) the general rate applying to most types of royalties, (ii) the specific rate applying to copyright payments, and (iii) the specific rate applying to payments for the use of equipment. In the case of multiple applicable WHT rates, we use the general rate that is the most widely applicable. In cases where countries have tiered non-treaty WHT rates, we use the top rate as it is most comparable to the level of domestic corporate income tax rate. Around 24 countries have punitive general WHT rates (up to 75 percent) for payments to entities in economies they deem low-tax jurisdictions. As a robustness check, we replace the applicable non-treaty WHT rates for these countries with the second-highest tier, which may be more widely applicable in certain cases. Finally, where more than one WHT rate is available for a given year and country, we use the one effective for the largest part of the year.

The EU Interest and Royalties Directives

We explore additional sources of information to update the withholding rate dataset, including the European Union (EU) Interest and Royalties Directives. According to this directive, companies are exempt from paying WHTs on royalty payments when two conditions are met. First, both parties involved in the transaction must be residents of EU member states or Switzerland. Second, the payer must hold a sizable stake in the non-resident company distributing royalties. Following this directive, we apply a zero rate for all pairs where both the source and recipient countries are EU member states or Switzerland, assuming all royalties are qualifying flows. Several EU member states were given a timeline for staggered implementation of this directive, and we adjust applicable rates accordingly.

Descriptive Statistics

	(1) Mean	(2) Std. Dev.	(3) Min	(4) Max
Service Import Variables				
All Services	416.34	2525.45	0	156268
Intellectual Property	61.78	687.47	0	61956
Business and Financial Services	236.07	1313.94	0	84352
Government and Travel Services	174.59	1136.94	0	65901
Tax Variables				
Source Country Corporate Income Tax (%)	23.42	7.82	0	55
General WHT on Royalties (%)	17.89	11.13	0	75
Applicable WHT on Royalties (%)	13.34	10.25	0	75
General WHT on Technical Fees (%)	15.40	13.26	0	75

|				
Applicable WHT on Technical Fees (%)	10.72	12.31	0	75
Gravity Variables				
Distance (km)	6721.36	4079.67	55	19629
Contiguous (%)	1.93	13.76	0	100
Common Colonizer (%)	3.24	17.69	0	100
Common Official Language (%)	6.89	25.32	0	100
Observations	122873	122873	122873	122873

Annex II. Supplementary Figures and Tables
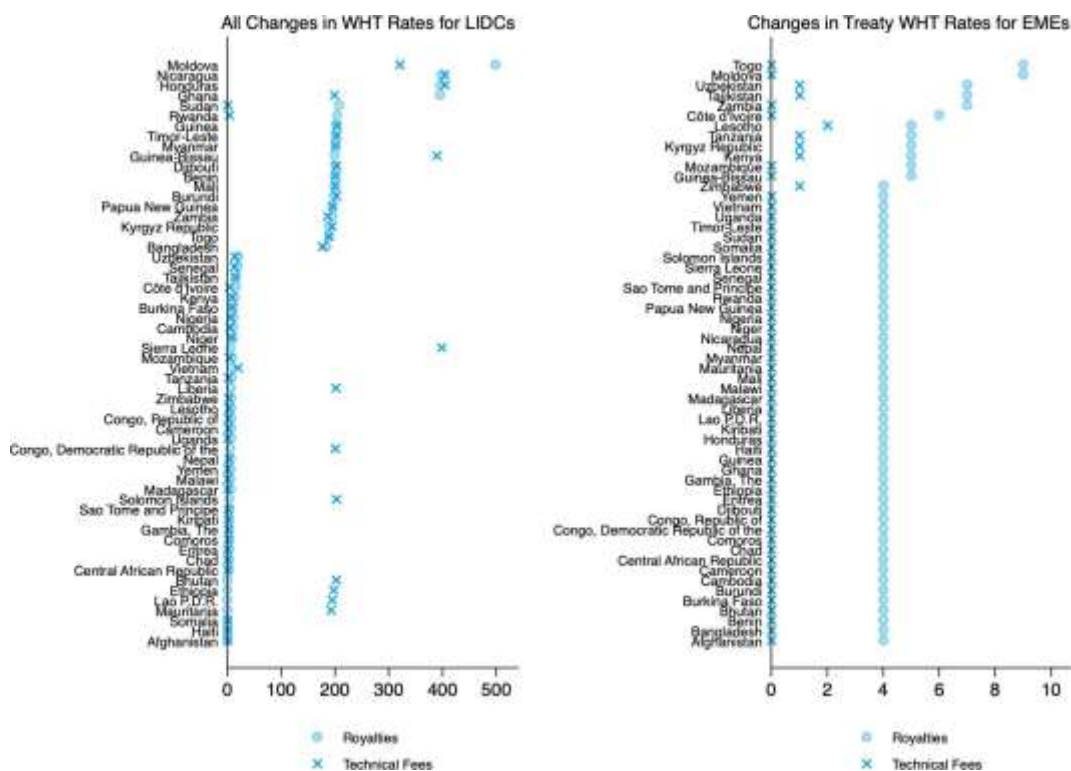
Figures

Figure II.1: Time-Variation in WHT Rates, EMEs
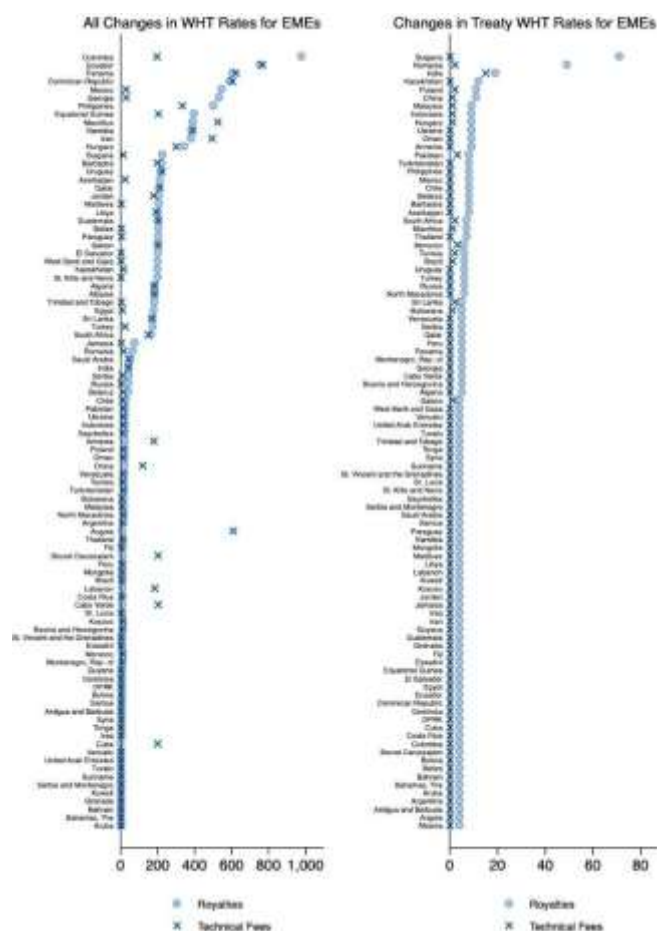
Note: Number of changes in applicable bilateral withholding rates due to any reason (left) and treaties (right) for EMEs, 2005-2021.

### Figure II.2: Time-Variation in WHT Rates, AEs
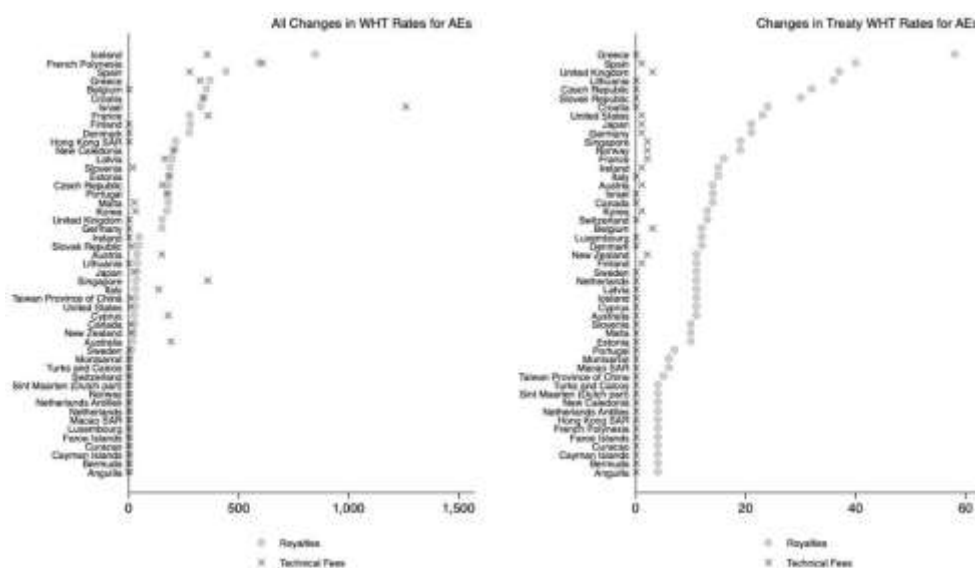
Note: Number of changes in applicable bilateral withholding rates due to any reason (left) and treaties (right) for AEs, 2005-2021.

Figure II.3: Time-Variation in WHT Rates, LIDCs

Note: Number of changes in applicable bilateral withholding rates due to any reason (left) and treaties (right) for LIDCs, 2005-2021.
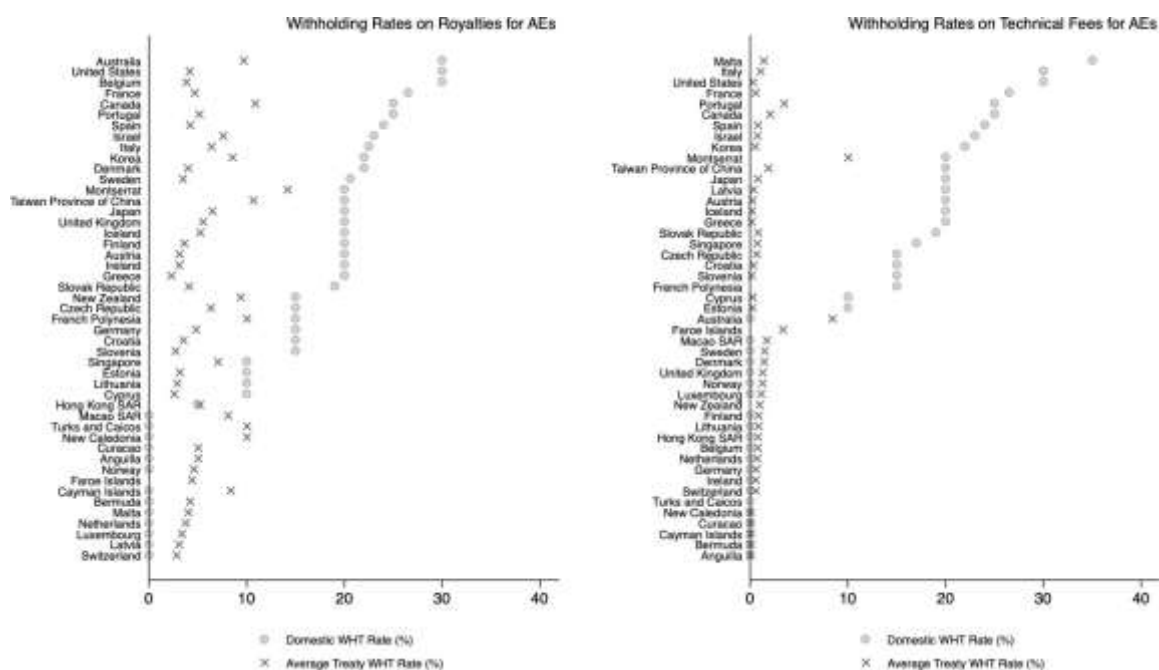
Figure II.4: WHT Rates in EMEs - Domestic versus Treaty Rates, 2021
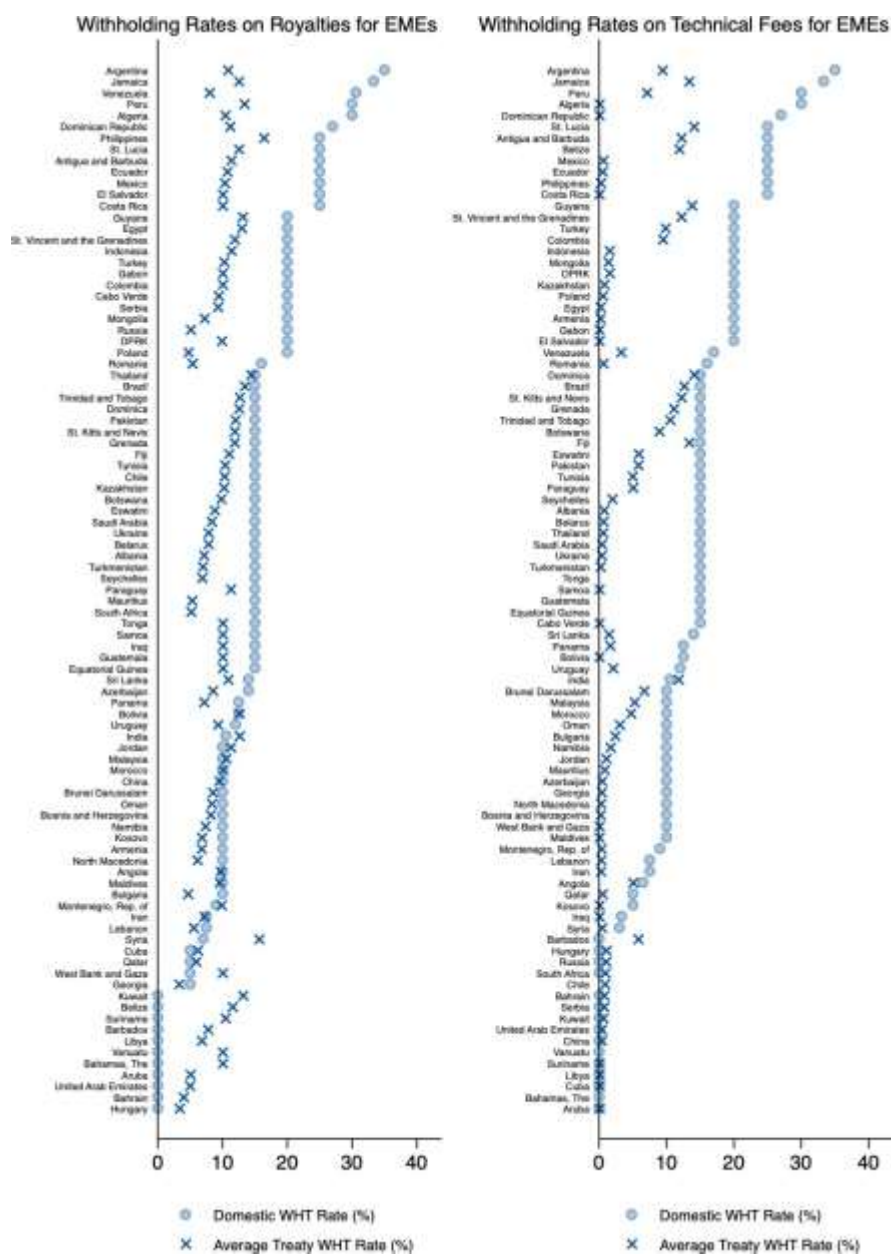
Note: Non-treaty and average treaty withholding rates on royalties (left) and technical fees (right) for EMEs in 2021.
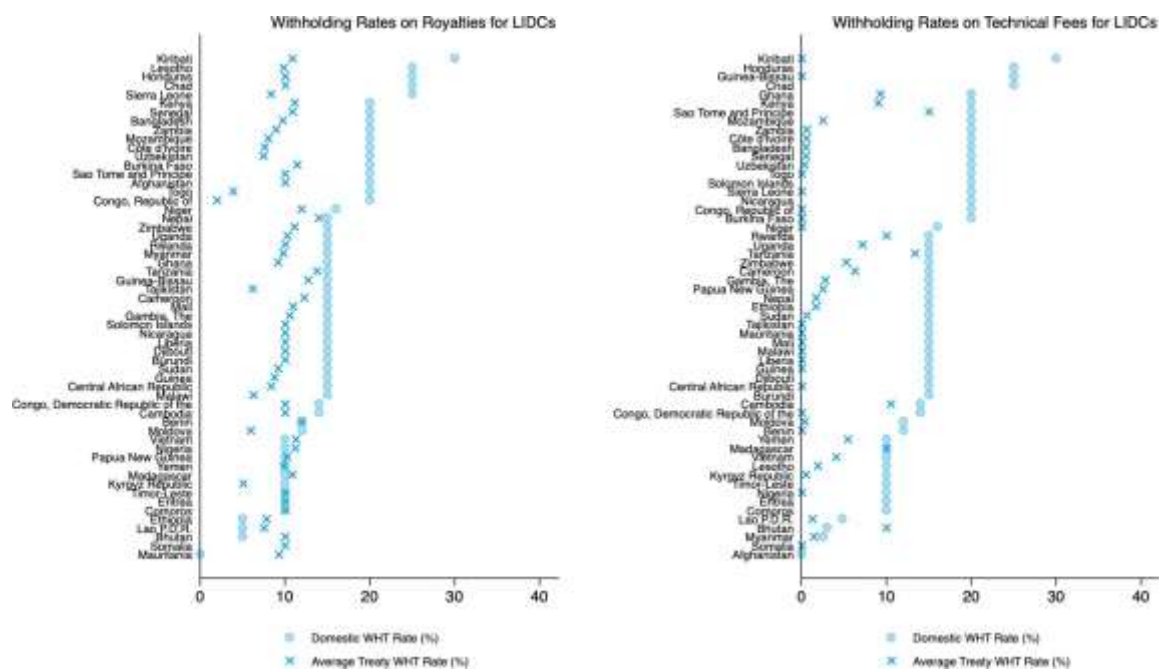
**Figure II.5: WHT Rates in AEs - Domestic versus Treaty Rates, 2021**

Note: Non-treaty and average treaty withholding rates on royalties (left) and technical fees (right) for AEs in 2021.

Figure II.6: WHT Rates in LIDCs - Domestic versus Treaty Rates, 2021


Note: Non-treaty and average treaty withholding rates on royalties (left) and technical fees (right) for LIDCs in 2021.

Figure II.7: Top Countries with Zero-Rated Payments for Royalties in Bilateral Treaties, 2021

Prevalence of Bilateral Treaties with Zero WHT on Royalties
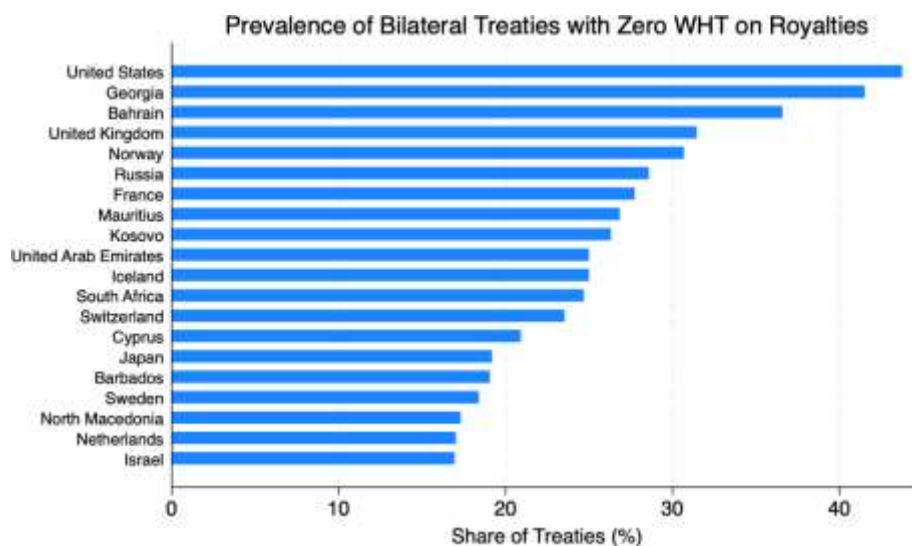
Note: Only countries with at least 10 bilateral tax treaties are considered.

Figure II.8: Top Countries with Zero-Rated Payments for Technical Fees in Treaties, 2021

Prevalence of Bilateral Treaties with Zero WHT on Technical Fees
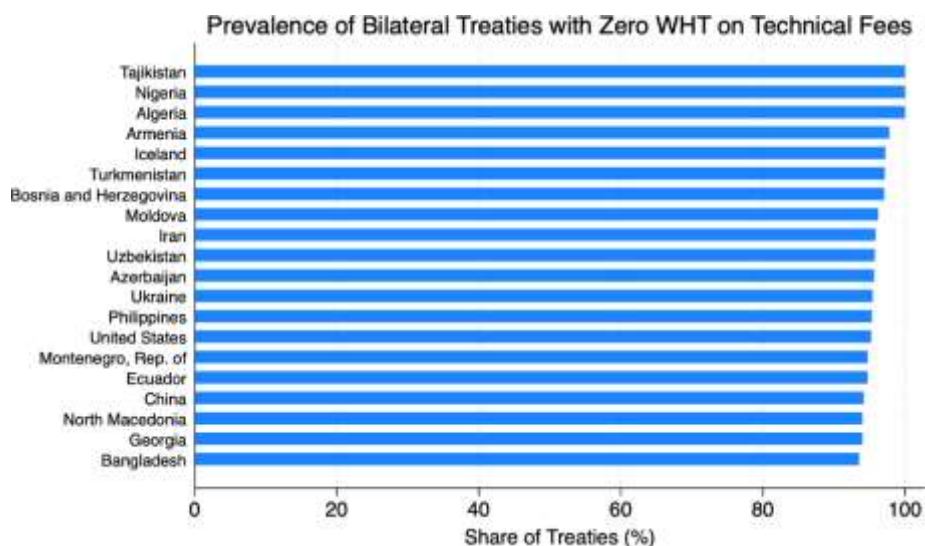
Note: Only countries with at least 10 bilateral tax treaties are considered.

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