Tax Spillovers in Cross-Border Real Investment: Evidence from a New Dataset on Multinationals

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Abstract

This paper investigates the nature and extent of cross-border spillovers on real investment, using a newly assembled dataset on real investment in physical capital by foreign affiliates of multinationals. It articulates the channels through which such effects can arise, finding strong spillovers through statutory rates in a form that is consistent with implicit profit shifting associated with real commercial decisions. Contrary to much policy discussion, there is little evidence of cross-border effects though traditionally-defined marginal effective tax rates. Applying these results, preliminary simulations of the real investment effects of a global minimum tax are reported.

Keywords: Corporate Tax, Multinational Investment, Tax Policy Spillovers
JEL Classification: H21, H25, H32

1 Introduction

Spillovers in corporate taxation—the effects of one country's tax rules and practices on others—have become a prominent policy concern in recent years, reflecting increased recognition of the macro-relevant impact on flows of both real capital and finance, and on both the level and the cross-country allocation of tax revenues (IMF, 2014). Policy makers have become increasingly focused on extent of tax-related spillovers on domestic investment and revenues, and, not least, on whether their own corporate tax system remains competitive in light of tax reforms elsewhere. These concerns promoted the G20-OECD led project on Base Erosion and Profit Shifting that culminated in the unprecedented widespread agreement in October 2021 on fundamental reform of the international tax architecture.[1]

The depth of empirical knowledge of the various underlying concerns–and hence of the appropriate design and impact of alternative responses—however, varies considerably. The distortion to financial flows is largely evident from (or at least strongly suggested by) the heavy concentration of reported Foreign Direct Investment (FDI) and foreign portfolio investment in countries with limited domestic activities.[2] And there is a large literature on profit shifting—artificial transactions intended simply to reduce total tax liability–that points to potentially sizable effects.[3]. The exact magnitude of profit shifting remains contentious, but has been estimated as dissipating 5-10 percent of total corporate income tax revenue in advanced and emerging economies (OECD (2015) and Tørsløv et al. (2018)), a third or more of all U.S corporate tax revenue (Clausing (2020), and up to 1.3 percent of GDP in developing countries (Crivelli et al. (2015)). Much less attention has been paid, however, to effects on real investment, even though these are evidently a primary concern for many policy makers. Much of their evident desire to attract foreign investment, including through offering various tax incentives, appears to stem from the desire to create jobs and encourage knowledge spillovers that is associated primarily—though not only, and perhaps decreasingly— with investment in tangible assets. And there is indeed ample evidence on the positive spillovers of foreign direct investment on, accumulation of know-how (Baldwin et al. (2005) and Keller

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[1]OECD (2020a,b).

[2]See for instance Blanchard and Acalin (2021), Damgaard et al. (2019) and Coppola et al. (2021).

[3]Recent reviews are in Beer et al. (2020a) and Dharmapala (2019)

(2010)), and economic growth for capital-importing countries (for example Bosworth and Collins (1999), Smarzynska Javorcik (2004), and Alfaro et al. (2004)), and on domestic capital formation for capital-exporting countries (Desai et al. (2005)). The aim of this paper is thus to strengthen understanding of this least-understood channel of tax spillovers: the impact on real investment.

Two things are needed to make progress in this area. The first is an appropriate dataset, a major challenges in the past having been the lack of suitable information on real investment by foreign affiliates. The empirical literature has typically relied on FDI data to identify the impact of corporate taxation, including tax spillovers, on cross-border investment, though it has been recognized that "FDI does not correspond directly to any measure of real investment [...] It is more accurately thought of as a measure of financial flows rather than of real investment (Slemrod, 1990)."[4] In addition, FDI statistics report the location of the immediate parent of foreign affiliates, not that of the ultimate parent company whose tax and other considerations drive real investment: they thus include 'conduit' flows that simply pass through some jurisdiction without any impact on investment. This conflation of real and financial decisions [5] and their inclusion to some unknown degree of investment in intangibles, severely limit the usefulness of FDI data in understanding real investment decisions.

We overcome these difficulties by turning to a new measure of investment in physical capital—Foreign Affiliate Investment (FAI)—which is part of foreign affiliate statistics (FAS) that are provided by national statistical authorities. The FAI data is free from the typical measurement issues in FDI statistics: they record tangible investment by foreign affiliates in each host country and the location of their ultimate parent.[6] Along with FAI, the FAS data reports turnover, gross-value added, employment and other economic activities for foreign

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[4]A major part of FDI consists of the financial flows associated with mergers and acquisitions, which account for more than 60% of all FDI in developed countries (OECD, 2020a). This implies an ownership change in the absence of any real investment. Other components of FDI are joint ventures and equity increases. The latter component typically comprises investment in financial capital.

[5]This gives rise to double counting of pass-through FDI, as the same underlying investment can be recorded multiple times whenever it changes destination. The scale of these "indirect" foreign investment with no substance and no real links to the local economy is estimated to account for around 40 percent of global FDI (Aykut et al., 2017) and Damgaard et al. (2019). Blouin and Robinson (2019) discuss a related issue of double counting in foreign profits, which is rooted in equity method of accounting.

[6]FAI data thus put to rest the lament with which the quotation from Slemrod (1990) continues: "Unfortunately, no data exist on real investment made by foreign branches and subsidiaries."

affiliates from 187 parent countries in 32 host countries during the period of 2003 to 2016. We combine these information with country-level tax rates and other macroeconomic variables, as well as bilateral data on geography and culture proximity. The rich information in this new data set thus allows us to disentangle the effect of taxes from unobserved, confounding factors on foreign investment.

The second requirement for a firm understanding of tax spillovers on real investment is a clear articulation of the channels through which such effects may operate—which has been harder to find than one might expect. One possible channel, on which much attention often focuses, is through the marginal effective tax rate (METR), in the tradition of King and Fullerton.[7] The reduced METRs associated with the 2017 Tax Cuts and Jobs Act in the United States, for example, prompted concerns in Canada with the impact on investment there; and, beyond a benchmarking purpose, the construction of cross-country 'league tables' of METRS presumably reflects a concern with METR-driven spillovers of some kind. It is not clear, however, as will be seen later, why the METR in one country—constructed with a closed economy in mind—should impact investment elsewhere. A second possible channel is through profit shifting. Here any impact may be quite subtle, since artificial transactions will affect investment only to the extent that do not simply confer windfall gains in the form of reduced tax payment but affect the cost of capital. A third and relatively neglected potential channel is through what might be thought of as implicit profit shifting: that is, taxation may affect real investment decisions even if artificial transactions are for some reason impossible. The simplest example would be that of a multinational which can serve a single market by producing in either of two countries, each of which levies a source-based tax: a higher tax rate in one may lead to production reallocating to ether other, implicitly shifting profits in the same direction but only as a consequence, and to the extent, of changes in real activities. Similar effects can arise through more complex commercial relations between the entities comprising a multinational group. To guide the analysis of the FAI data, we therefore begin by setting out a simply model that can help identify and quantify effects through these various channels.

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[7]The METR is the wedge between the pre- and post-tax return on an underlying investment which just yields the investor their required post-tax return (expressed as a proportion of the former).

Our work relates to several strands of literature.[8] First, we contribute to a growing literature on the international spillovers of fiscal policies that are motivated by national objectives (Auerbach and Gorodnichenko, 2013; IMF, 2014; Crivelli et al., 2015), by quantifying the extent of tax-related spillovers on multinational investment. The evidence on these international externalities provide the basis for policy coordination and multilateral cooperation. Second, and beyond the limitation noted above, the empirical literature on FDI and taxation, as recently surveyed in De Mooij and Ederveen (2003) and Feld and Heckemeyer (2011), focuses largely on the influence of host country taxation. This paper contributes to this literature by quantifying the influence of corporate taxes outside the host country, by carefully laying out the mechanisms for spillovers with supporting empirical evidence based on an improved measure for real investment by multinational. Moreover, it adds to the large literature studying the behavioral responses of multinationals to the taxation of cross-border income (Slemrod (1990), Hines and Rice (1994), Grubert and Slemrod (1998), Desai et al. (2001), Desai et al. (2007), Graham et al. (2010), Desai and Dharmapala (2011), Egger and Wamser (2015), Hasegawa and Kiyota (2017)), including those focusing on the real investment decisions of multinationals (Altshuler and Grubert (2001), Altshuler and Grubert (2003), Liu (2020)).

The paper is structured as follows. Section 2 sets out a broad framework that articulates potential channels for tax spillovers on real investment and their empirical implications. Section 3 describes the data, and in particular the differences between FAI and FDI statistics. Sections 4 and 5 present the estimation strategy and empirical findings, respectively. Section 6 provides an illustrative application of the results to assess the implications for the level and distribution of real investment of the October 2021 agreement towards a common minimum effective corporate tax rate. Section 7 concludes.

2   Channels of Tax Spillover Effects on Real Investment

To fix ideas, consider first a multinational operating in only two jurisdictions, A and B, and suppose for now that profit shifting through artificial transactions is impossible. Denoting

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[8]To be updated/reworked.

by K_j the tangible capital located in jurisdiction j (the choice of which is the central concern here), and by $F_j(K_j)$ some output associated with that capital, suppose that taxable receipts of the entity in A are of the form $R_A[F_A(K_A), F_B(K_B)]$, and similarly for B.[9] The key feature this allows for is the possibility that receipts of one entity depend on production by the other. This serves to capture a range of patterns of multinational activity, It might be, for instance, that either or both entities simply serves its own local and competitive market, so that $R_i = p_i.F_i$; or that one entity (A, for instance) provides some input used by the other, so that $R_A = c.F_A$ and $R_B = r(K_B, F_A) - c.F_A$ (for some function $r(.)$, and where c denotes the internal transfer price); or there may be spillovers in production between the entities (positive, such as shared knowledge by doing, or negative, such the use of scare management resources); or—a case of particular interest in analyzing the consequences of closer economic integration —they may serve a single integrated market in which they have some market power, so that $R_i = p(F_A + F_B).F_i$, where $p(.)$ denotes inverse demand, And there are of course many other possibilities.

The tax system in each country has two components. One, capturing the marginal effective tax rate (METR) familiar from the analysis of investment in closed economies, is a specific tax of M_j applied to the use of real capital.[10] The other is a source-based statutory tax rate on its profits (against which M_j is deductible) of T_j. The multinational's aggregate profit is thus

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\begin{aligned}
\Pi = &(1 - T_A)\left(R_A[F_A(K_A), F_B(K_B)] - (\rho + M_A)K_A \right) \\
&+ (1 - T_B)\left(R_B[F_B(K_B), F_A(K_A)] - (\rho + M_B)K_B \right)
\end{aligned}
\tag{1}
$$

where ρ denotes the required after tax return, assumed deductible where the associated capital is located, and assumed throughout to be fixed.

From (1), the necessary condition on the multinational's choice of K_A (that for K_B being

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[9]The $F_j(K_j)$ are assumed increasing and strictly concave, and profit maximizing use of intermediate goods supplied by third parties is taken to be subsumed in the revenue functions.

[10]This summarizes all taxes directly related to the employment of capital, and corresponds to the standard King-Fullerton concept.

symmetric) is

$$(1 - T_A)\frac{\partial R_A}{\partial F_A}F'_A - (1 - T_A)(\rho + M_A) + (1 - T_B)\frac{\partial R_B}{\partial F_A}F'_A = 0. \tag{2}$$

The first two terms are familiar, being the post-tax marginal revenue product of capital in A, but taking account only of the revenue accruing to the entity in A, and the tax adjusted cost of capital. The novelty is in the third term, which captures the impact on the incentive to invest in A of the cross effect on revenues in B, mediated by the difference in the statutory tax rates in the two jurisdictions. This is, in effect, profit shifting not through sham transactions but through real investment decisions. The direction of this effect, however, evidently depends not only on relative profit tax rates, but on the sign of the cross effect $\partial R_B/\partial F_A$.

The implications of this cross effect, and the structure of tax effects more generally, are most clearly seen by expressing the necessary condition (2) in terms of the marginal revenue product when account is taken of the revenue accruing to all entities in the group, denoted $R = R_A + R_B$. It then follows from (2)[11] that:

$$\frac{\partial R}{\partial F_A}.F'_A(K_A) = \frac{\rho + M_A}{1 + \Gamma_A(\cdot)} \tag{3}$$

where

$$\Gamma_A(\cdot) \equiv \frac{T_A - \sum_{j=A,B} T_j \gamma_{Aj}}{1 - T_A}, \tag{4}$$

in which the weight $\gamma_{Aj} \equiv \frac{\partial R_j/\partial F_A}{\partial R/\partial F_A}$ attached to the statutory tax rate in country j reflects the proportion of the marginal revenue associated with additional investment in A that accrues to the entity in j.

The dependence of $\partial R/\partial F_A$ on both capital stocks makes the comparative statics of K_A complex. But the key point is that taxation affects the multinational's investment in A through two routes. The first and most straightforward is through the usual METR in A:

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[11]By collecting terms in F'_A, noting that $\partial R_A/\partial F_A + \partial R_B/\partial F_A = \partial R/\partial F_A$ and adding and subtracting $T_A(\partial R_B/\partial F_A$ to find that

$$(1 - T_A)\frac{\partial R_A}{\partial F_A} + (1 - T_B)\frac{\partial R_B}{\partial F_A} = \frac{\partial R}{\partial F_A}\left(1 - T_A + T_A - \sum_{j=A,B} T_j \gamma_j\right)$$

if corporate tax rates are the same in all countries, or the receipts of each entity wholly independent of the activity of the other, this is the only tax consideration that matters. More notable, and in contrast to at least some public commentary, is that there is no direct cross-border effect from M_B, the METR in country B. Things would be different, of course, if the multinational faced a binding limit on the overall amount of capital available to it, $\sum_{j=A,B}^{N} K_i \leq K$. Adding such a constraint to the setting above, the direct effect of an increased METR outside A is easily seen to be to encourage investment there:[12] a lower METR in the U.S., for instance, would reduce investment in Canada. We explore this possibility in the empirics.

The second route for tax effects on real investment is through $\Gamma_A(T_A, T_B)$, with this difference between T_A and weighted average of all rates serving as a sufficient statistic for the impact of statutory tax rates (though one that is not as neat as it may seem, since the weights in general need not lie between zero and one. It is here that the cross effect $\partial R_B/\partial F_A$ becomes key. Consider first the effect on K_A of an increase in T_B. Treating the $\partial R_j/\partial F_A$ as constant, it is immediate from (3) that investment in A decreases with the tax rate in B if and only $\gamma_B < 0$, which is equivalent to $\partial R_B/\partial F_A < 0$. It is also straightforward to show that K_A decreases with the local tax rate T_A if and only if $\gamma_B < 0$, but we will see this is an artefact of the two country case: in the N-country case, own and cross effects need not be symmetric in this way.

In principle, the sign of this cross effect—and hence the direction of statutory rates on investment—is ambiguous. Strong complementarities in production, for example, could mean that $\partial R_B/\partial F_A > 0$, in which case a higher tax rate abroad in country B actually points to lower investment at home. Many of the possible structures mentioned above, however, suggest it to be be more likely that $\partial R_B/\partial F_A < 0$, so that a higher tax rate abroad increases investment at home. This will be the case in the integrated market case, for instance, since then $\partial R_B/\partial F_A = p'.F_B < 0$, and it is readily shown that, in the denominator of (3),

$$\frac{\partial R}{\partial F_A}\left(1 + \Gamma_A(T_A, T_B)\right) = 1 - e + e.\Delta_A(T_A, T_B) \tag{5}$$

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[12]Attaching a multiplier λ to such a constraint, and denoting the term on the left of (2) by L_j, the first order condition becomes $L_i + \lambda$; summing over i and solving for λ, this becomes $L_j = \sum_{i=A,B} L_i$. The generalization to the N-country case is trivial: see (A.5) in the Appendix.

where e denotes the inverse price elasticity of demand (as a positive number) and $\Delta_A(T_A, T_B) \equiv (\sum_{j=A,B} T_j \theta_j - T_A)/(1 - T_A)$, where $\theta_j \equiv F_j/(F_A + F_B)$:[13] the relevant weights in the tax rate differential term thus become simply relative production shares—and so in this case do all lie between zero and unity. The mechanism at work in this case is straightforward. Additional investment in A increases taxable profits there (because the investment directly increases earnings) but reduces them in B (because the consequent increase in total output reduces the price at which output is sold). In this sense, investing in A serves as an implicit profit shifting device, moving profits there and away from B—but differing from 'pure' shifting in that it is not simply a matter of moving paper profits across jurisdictions but one of inducing distortions to the cross-border allocation of capital. While, however, this case is of particular interest given the importance of integration issues, the sign of the cross effect is ultimately an empirical issue, and one taken up below.

It remains to consider the impact of profit shifting in the standard sense of artificial transactions intended to reduce the multinational group's total tax liability. This can take many forms. Prominent among these is the use of conduit countries—routing inter-group payments so as to take advantage of reduced withholding tax rates and other treaty provisions—which, as will be seen more closely below, is itself one of the drivers of the distinction between FAI and FDI. While FAI data looks though pure conduits to identify the ultimate parent of any entity in some host country, real investment of the latter may of course reflect any tax savings that the MNC enjoys by the use of such conduits: so conduits cannot be ignored in understanding FAI data. The tax savings to which the use of conduits gives rise, however, are unlikely to depend on the cross-country pattern of real investments: by their nature, they require only a limited substantive presence in these countries. While the savings may thus increase with the total of the group's real investment, in terms of the analysis above the effect is likely to be akin to a fixed reduction in the METR; and, given the absence of many conduit countries from our dataset, will in effect be treated in the empirics as an unobserved fixed effect. It may be, however, that—apart from the real commercial impact considered above—the cost of shifting profits into a jurisdiction is reduced by having a real presence there, one standard device being to suppose that the cost of shifting profits of S_j

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[13]Equation (5) follows from (3) on noting that in this case $\partial R_A/\partial F_A = p.(1 - e\theta_A)$ and $\partial R_B/\partial F_A = -pe\theta_B$.

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into jurisdiction j to be of the form $(S_i)^2/(2\phi\rho K_i)$.[14] The consequences of this, along with the extension of the analysis above to the N-country case, are explored in an Appendix.

It is shown there that, for this more general case, the key equation (3) above becomes, for the typical host country h,

$$\frac{\partial R}{\partial F_h}.F_h'(K) = \frac{\rho + M_h - \Omega_h(\boldsymbol{T}, \boldsymbol{\omega})}{1 + \Gamma_h(\boldsymbol{T}, \boldsymbol{\gamma_h})}, \tag{6}$$

in which $\boldsymbol{x}$ indicates the vector $(x_1, .., x_N)$, and

$$\Omega_j(\cdot) \equiv \frac{\phi\rho}{2}\left(\sum_{j=1}^{N} T_j\omega_j - T_h\right)^2 \tag{7}$$

where $\omega_j \equiv K_j/\sum_{i=1}^{N} K_i$, while now

$$\Gamma_h(\cdot) = \frac{\sum_{j=1}^{N} T_j\gamma_{hj} - T_h}{1 - T_h} \tag{8}$$

. The extension to many countries is thus straightforward, and the assumed form of shifting costs means that profit shifting acts as a reduction in the standard METR. That is, it makes investment more attractive in both low tax countries (to make it easier to shift profits in) and high tax ones (making it easier to shift profits out).[15] The two profit shifting terms that now appear in (6)—one, captured by Γ_h, related to underlying business realities; the other, $\Omega)h$, a matter of opportunistic relabeling—are evidently related, but (beyond the difference in weights) the squaring of the tax differential in relation to 'paper' profit shifting means that they operate in significantly different ways. Take, for instance, the integrated market case. Then a tax increase in some 'foreign' country, whatever its initial level, will unambiguously increase investment at 'home' through the business channel. Through the opportunistic channel, however, it will reduce home investment if this foreign rate was initially below the global weighted average.

One implication of moving to the N-country case is also worth noting. In the two country case, it was assured that the effects of tax increases at home and abroad have opposite

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[14]Essentially the same form is used by, for example, Huizinga and Laeven (2008) and Beer et al. (2020b).
[15]Recognition of this dates back to Hines and Rice (1994).

sign.This is not the case with many countries: the effects on investment in h of changes in domestic and average foreign tax rates may differ in sign.

To summarize, though simple and highly stylized, the model yields at least three novel insights for empirical testing. First, in an integrated market, the statutory rate, in addition to the usual METR, would impact the level of MNC investment, and its exact impact depends on the level of statutory rate relative to the weighted average rate elsewhere. The influence of statutory rates outside the local jurisdiction highlights the spillover effect of taxes on cross-border investment, which has important implications for policy makers. Second, the investment effect of statutory rate would also depend (though less so) on METR in the investing country, and vice versa, highlighting the important interactions between the statutory and marginal effective tax rates in a country. At the same time, conditional on the tax rate differential and own-country METR, the METR elsewhere has no impact on investment in this country, suggesting the spillover effect of taxes mainly concerns the statutory rate rather than the METR.[16] We bring these main takeaways from the model to empirical testing.

3   Data: Foreign Affiliate Investment and Other

This section describes and discusses the data used to apply the framework just set out.

3.1   The nature of FAI (and FDI) data

The key features of FAI data are that they report cross-border investment in physical capital while also seeing through conduit structures to identify the ultimate parent. We compile a comprehensive FAI dataset at bilateral country levels by combining inward Foreign Affiliate Statistics (FATS) provided by Statistics Canada, United States Bureau of Economic Analysis (BEA) and Eurostat. The dataset reports the gross investment of foreign affiliates (FAI) in each host country, together with their turnover, employment, exports, and other related activities, by country of their ultimate parents. Specifically, these data refer to foreign

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[16]As discussed above, in an alternative model where the total supply of capital by MNC is fixed, METR else would also have spillover effect on MNC investment. We test these competing hypothesis in section 5.2.

affiliates' gross investment in tangible assets, including in new and existing tangible capital goods (Eurostat, 2012). Foreign affiliates are majority owned by ultimate parents that reside in a different country and can determine their general economic policy.

Much of the literature on taxation and cross-border investment (as reviewd for instance by (De Mooij and Ederveen, 2003)) has used not FAI but foreign direct investment (FDI) data.[17] These, however, focus on financial flows rather than real investment, differing from FAI data in two main respects.

First, FDI data capture funds received by a foreign affiliate that may or may not correspond to its physical investment. These funds comprise (i) direct net transfers from the parent company, either through equity or debt, and (ii) retained earnings by the foreign affiliate. These amounts are recorded as FDI regardless of the end use. Retentions may for example be kept within the foreign affiliate as cash reserves, tending to overstate the amount of real investment by foreign affiliates. On the other hand, FDI statistics—unlike FAI—do not record investment through other ways of financing, for example through local borrowing or local issuance of shares. In this respect they may under represent foreign affiliate real investment.

The second key difference[18] is that while FAI data see though to the location of the ultimate parent company, in FDI data the 'parent' country refers to the location of the immediate investors. The reporting convention for the latter creates additional issues in measuring the underlying investment with FDI that involves pass-through funds. Whenever it passes through an intermediate country, for tax or non-tax considerations, the same underlying fund will be recorded twice in the FDI statistics, with the imtermediate country as the destination country for the first observation and as the 'parent' country for the second. Even if amount of investment in FDI and FAI is identical –the underlying fund is fully in-

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[17]Cross-sectional foreign affiliate statistics have been used in other studies including Tørsløv et al. (2018) to assess the extent of profit shifting by multinationals (for the year 2017), and Fukui and Lakatos (2012) and Ramondo et al. (2015) to study the pattern of multinational production activities. Earlier work on FDI and taxation, for US-based multinationals, has also used BEA foreign affiliates data (Desai et al. (2004)). Another source for activities of foreign affiliates is the OECD Activities of Multinational Enterprises (AMNE) Database, which also utilizes inward and outward FAS for 31 OECD countries between 2008 and 2016 (Cadestin et al., 2018).

[18]There is a third but less fundamental difference in the threshold for ownership/control: FDI data comprise all foreign interests with 10 percent or more voting power, while the FAI statistics has a higher threshold of 50 percent.

vested in tangible assets with no local financing involved—double counting of investment in FDI would introduce measurement errors in the true tax differential that is relevant for real investment. This double counting of FDI is rooted in the equity method of accounting, which also gives rise to double counting of profits for any company with immediate affiliates at the micro level (Blouin and Robinson, 2019). At the global level, double counting of multinational investments would imply a higher level of aggregate FDI, inflated by pass-through funds that are recorded multiple times.

Figure 1 illustrates these differences. The ultimate owner in country UO has a controlled affiliate in country H. It injects $2 of equity to the affiliate directly, and $1 of equity indirectly through another affiliate in country of intermediate ownership IO. which is the immediate parent of the affiliate in H. The $1 of equity reaches the affiliate from country IO via debt financing. Total FDI in country H would be $3, made up of $1 FDI from country IO and $2 FDI from country UO. There would be another $1 of FDI recorded in country IO from country UO, even if the fund only passes through without any real activities there. Aggregate FDI would be $4, double counting all the cross-border funds that pass through intermediaries.

In contrast, the total amount of FAI in H will be between $0 and $3, depending on how much these funds are invested in physical capital goods. All the FAI would be recorded in country H, with FAI in country IO being zero. Supposing that all the funds go to real investment, the respective FDI and FAI statistics associated with these flows are:

	UO to H	UO to IO	IO to H	Total
FDI	2	1	1	4
FAI	3	0	0	3

This discrepancy between the FAI and FDI highlights the key difference that FAI measures real investment in the local economy by multinationals while FDI rather focuses on their financial flows.

The two sets of statistics diverge further if there is local financing of real investment: real investment supported by a local injection of funds is part of FAI, but not FDI, In the example above, local borrowing to finance real investment of $0.5 increases FAI to $3.5 but leaves

the FDI numbers unaffected. On the other hand, any changes in the amount of retained earnings in the local affiliate that is not invested in real assets would change FDI, but not FAI: with uninvested retained earnings of 0.8, FAI in H remains at 3.5, while FDI into H increases to 3.8 and global FDI to 4.8.

At the bilateral level, the presence of pass-through FDI would introduce measurement errors in the tax differentials. Suppose the IO is a low-tax country comparing to both H and UO, then the statutory tax difference would be larger than their true levels for the observation recorded in the IO country, and would be smaller for the same FDI later recorded in the host country. This would suggest that the tax variables defined using FDI statistics would measure the true tax differential for the underlying FAI with considerable measurement errors, hence introducing attenuation bias if using FDI statistics to estimate the economic relationship between FAI and its tax and other economic determinants.

3.2 Other Data and Descriptives

The unit of observation for the FAI dataset is at the host-parent-year level, covering foreign affiliates from 187 parent countries in 32 host countries during the period 1997-2016 for the United States, and 2003-2016 for all other countries. While the sample of host countries is mainly limited to advanced economies, they account for close to half of the global economy. To systematically analyze the link between cross-border real investment and corporate taxation, we augment the FATS data with additional information on corporate tax rates and macroeconomic characteristics.[19] Statutory tax rates are headline corporation tax rates drawn from IMF World Tax Rate Database. Data on marginal effective tax rates are provided by Oxford University Centre for Business Taxation (OUCBT) Database. We scale the FAI relative to the lagged capital stock in order to account for serial correlations in FAI due to inertia. We estimate the stock of FAI (K) using the Perpetual Inventory Method, with an assumed depreciate rate of 0.195.[20]

At bilateral host-parent level, as FATS captures foreign affiliate activity in various di-

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[19]Given that we include the two-way host country-year fixed effects in the baseline regression, we utilize the host country characteristics mainly to analyze the role of METR, which only varies by host country over time.

[20]For the US we have measures of both FAI and capital stock, thus allowing us to validate the calculations.

mensions (including sales, exports, number of workers, value-added), this additional information allow us to control for non-tax determinants of investment by multinationals. We obtain information on macroeconomic indicators from the World Bank (World Databank, World Development Indicators), and bilateral gravity variables from CEPII's gravity dataset (Head and Mayer, 2014). We control for standard gravity variables such as physical distance between two countries, common language or colonial ties that may shape cross-border investment. In specifications that estimate the effect of the marginal effective tax rate we include several control variables which have been found to be important determinants of cross-border investment. These include country-level GDP, capital account openness, trade openness, exchange rate, inflation, and government expenditure, all of which vary over time for both host and parent countries.[21]

To better understand how the FAI statistics differ from FDI, Figure 2 shows the aggregate FAI and FDI flows during the sample period of 2003-2012.[22] Specifically, Panel (a) shows the aggregate FAI and FDI for all host countries in the sample. In general, FAI is lower in amount but less volatile. The gap has been widening toward the end of sample period. A similar pattern is observed in the EU host countries (panel b).

Figure 3 then compares FDI and FAI by parent countries of different characteristics, expressing each series in shares relative to their total value (capturing the difference that FAI is reported by ultimate parent while FDI is reported by immediate parent). Over the sample period, a larger share of FDI are from low-tax countries, defined as those with a statutory tax rate in the first quartile of the distribution (roughly around 20 percent), while there are moderate and gradual increases in both series from these countries (panel a). There is even larger share of FDI from investment hubs, defined as countries with an average FDI/GDP ratio of above 150 percent.[23] In contrast, the difference is much smaller for investment

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[21]Specifically, capital account openness is measured using the Chinn-Ito index, which is standardized between zero and one (Chinn and Ito, 2006). A value equal to one indicates openness, while an index closer to zero reflects for cross-border capital restrictions. Trade openness is defined as exports plus imports as a share of GDP. Inflation rate is CPI annual percentage change.

[22]In our regression results we combine FDI data from IMF CDIS and UNCTAD (bilateral CDIS data is available starting in 2009, while bilateral UNCTAD data is available up to 2012 only). We have slightly more observations for FAI than FDI, due to the way that the two series report missing and zero observations differently.

[23]On this test, the countries labeled as investment hubs are: Luxembourg, Mauritius, Malta, Cyprus, Netherlands, Hong Kong, Singapore, Ireland, Hungary, Switzerland and Belgium.

from developing countries (panel c) or treaty partners (panel d).[24] These patterns suggest substantial heterogeneity in FAI/FDI, which are further explored in regression analysis.

Table 1 reports the descriptive statistics for the main variables (including those defined in Section 4 below) used in our empirical analysis. The key variable for analysis, bilateral FAI, has lots of zero observations – close to 34% of all FAI observations. As bilateral investment tends to have many zeroes, the FAI ratio (I/K) is also skewed towards zero. This is also the case for FDI, where around 18.4 % of FDI takes the value of zero and the 75th percentile for the FDI ratio is around 0.21. This calls for an estimation strategy that deals with zero dependent variables, which we discuss in the next section.

4   Empirical Strategy

Operationaling equation (6) in Section 2 requires specifying the weights γ_j in the tax differential term Γ. Given the strong representation in our dataset of EU member states we take as our base case that of the integrated single market, so that $\Gamma = \Delta$. where Δ is defined along the lines of equation 10. From this starting point, we explore how suitable this specification is for investment from and outside, the EU. There is of course evident risk of introducing measurement error, and hence a bias towards zero on the associated coefficient.

These considerations lead to the most general form of estimating equation:

$$
\begin{aligned}
\mathbb{E}(FAI_{hpt}) = \exp(&\beta_\Delta \Delta \tau_{hpt} + \beta_{MH} M_{ht} + \beta_\Phi \Phi_{ht} + \beta_{MP} M_{pt} + \beta_{M\Delta}(M_{ht} \times \Delta \tau_{hpt}) \\
&+ \boldsymbol{\beta_1'} \mathbf{x}_{ht} + \boldsymbol{\beta_2'} \mathbf{z}_{pt} + \boldsymbol{\beta_3'} \mathbf{g}_{ph} + \varepsilon_{hpt}),
\end{aligned}
\tag{9}
$$

where FAI_{hpt} is the level of bilateral investment in tangible capital goods in host country h from parent country p in year t, scaled by their beginning-of-year capital stock K_{t-1}, and Δ is the tax differential term (on which, more below). Control variables comprise time-varying macro variables in the host (x_{ht}) and parent country (z_{pt}), and host-parent time-invariant bilateral variables (g_{ph}). In all specifications we include either a set of two-way host country-year fixed effect (a_{ht}) and parent country fixed effect (c_p) or—when estimating the impact of the host country marginal effective tax rate M_{ht}—a set of year fixed effects (b_t) and

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[24]The definition of developing countries follows the IMF's classification for country development levels, which divides the world into two major groups of advanced economies and emerging and developing economies. Developing countries here include both emerging and low-income developing countries.

parent country fixed effect (c_p). We cluster standard errors by host country to correct for over-dispersion.

The expectation from the analysis above is that a positive differential in statutory tax rates increases inward FAI, so that $\beta_\Delta > 0$, and that a higher METR in the host country, including through profit shifting effects, reduces it, so that β_{MH} and β_{AH} are both strictly negative; in the setting above the latter have identical effects (with opposite sign), so that $\beta_{MH} = -\beta_{\Phi H}$. In contrast, and given the other effects being controlled for, in the absence of capital constraints the marginal effective tax rate in the parent country (indeed in any country other than h) would be expected to have no effect on FAI into h, so that $\beta_{MP} = 0$. For the interaction term, the nonlinearity in (6) suggests $\beta_{M\Delta} > 0$: a more advantageous tax differential term dampens the adverse impact of a higher host METR.

That differential term is calculated as:

$$\Delta_{hpt} \equiv \frac{\sum_{j=1}^{N} T_{jt}\theta_{jp,t-1} - T_{ht}}{1 - T_{ht}}, \tag{10}$$

where the market share variable θ is lagged to alleviate spurious correlations between market size and investment. Noting that Δ_{hpt} can be decomposed as:

$$(1 - T_{ht})\Delta\tau_{hpt} = \sum_{j=1,j\neq h}^{n} T_{jt}\theta_{jp,t-1} - T_{ht}(1 - \theta_{hp,t-1}), \tag{11}$$

we also test for differences in effect from the host's own tax rate and those elsewhere by entering the two components separately.

In the absence of data enabling calculation of the weights θ as relative production shares (consistent with eq.(10) above), we explore two different weighting schemes: (1) sales-based,[25] weighting the statutory rate in country j, as it affects investment in h parented in country p, by the share of affiliates in h in all sales by affiliates parented in p: $\theta_{hpt} = \frac{sales_{hpt}}{sales_{pt}}$, where $sales_{hpt}$ is the sales in country h in year t by foreign affiliate from country p; and (2) capital-based, $\theta_{hpt}^{K} = \frac{K_{hpt}}{K_{pt}}$. The former would correspond to production shares if each entity sold into a final marker at a common price; in other cases, the latter may proxy production more

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[25]These are origin-based sales, not necessarily corresponding to which final sales are destined.

directly. In the baseline regressions we weight the tax differential by sales, while check the robustness of weighting by K in alternative specifications.

The single market notion being more persuasive for FAI between EU member states, we construct additional measures of sales-based and capital-based market shares within the EU as well as outside the EU. Specifically, for each EU host country we measure its scale relative to the EU market for all foreign affiliates from a given parent country, and for each non-EU host country we measure its scale size relative to the non-EU market.[26] Using these variants of the market share as weights, we construct the weighted tax differential term and its individual components as above in equations 10 and 11.

We estimate Equation 9 using the Poisson Pseudo-maximum likelihood (PPML) model. This approach handles the large number of cases where $I_{hpt} = 0$ in our data more naturally than a log-log specification. The PPML approach uses robust standard errors to correct for over-dispersion, leading to asymptotically correct confidence intervals. More importantly, consistency of this estimator requires no distributional assumptions, but only the correct specification of the conditional mean.(Silva and Tenreyro, 2006; Cameron and Trivedi, 2013).

5   Empirical Results

5.1   Spillovers in Statutory CIT

Table 2 reports the baseline results from regressions based on Equation 9. Columns (1)-(4) include the host country-year pair fixed effect and parent-country fixed effect. This set of specifications allow us to identify the effect of the CIT tax differentials independent of any country-specific macro-economic shocks.

Column (1) shows that the CIT differential term $(\Delta\tau)$ has a positive and statistically significant effect on FAI. A one percentage point reduction in the host-country tax rate implies around 0.01 increase in the CIT differential, leading to around 2.98 percent increase

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[26]Sales share in EU is the share of bilateral foreign affiliate sales of country p in EU country h divided by the sales of country p in all EU countries. Sales share in Non-EU is the share of bilateral foreign affiliate sales of country p into Non-EU country j divided by the sales of country p in all Non-EU countries. In our sample, there are few non-EU host countries including Bosnia and Herzegovina, Canada, Norway and the United States.

in the FAI ratio. To focus on the tax spillovers, Column (2) replaces the CIT differential with its two components—the market-share weighted CIT rate in the host country (Host CIT Component) and in non-host countries (Non-host CIT Component)—based on Equation 11. The two coefficient are estimated with opposite signs with similar effect size. As expected, a higher CIT rate elsewhere would increase the FAI in the host country, whereas a higher host-country CIT rate would depress FAI in the same country. Focusing on the spillover effects, a one percentage point increase in the weighted average of CIT rates elsewhere would on average lead to 3.02 percent increase in the FAI ratio for a given host country, implying a semi-elasticity of around 3 with respect to non-host CIT rates.

Following discussions in Section 2, the tax considerations are more relevant for cross-border investment and associated earnings *within* an integrated market. For example, for investment into an EU host country, the CIT rates elsewhere within the EU should matter more than those outside the single market. Column (3) tests this hypothesis by including two tax differentials that are weighted separately by market shares in the EU and by market shares outside EU. The former captures the differential impact of host-country CIT rate relative to all those within the EU, while the latter captures the impact of host-country CIT rate with respect to those outside the single market. The results in Column (3) suggest that the effect of the tax differential in the EU is much stronger, with an estimated coefficient 2.5 times larger than that for the non-EU tax differential. Column (4) repeats this test by including the non-host tax components that are separately weighted by market shares in the EU and outside EU, along with the host-country tax component. The results confirm that the tax spillovers on FAI are stronger within the single market, given that the estimated coefficient for the non-host component of the CIT differential in the EU is significantly larger than that outside the EU. These findings are also consistent with earlier evidence documented in Gorter and de Mooij (2001) that intra-European investment flows tend to be more responsive to tax rate differentials than do intercontinental flows.

The remaining columns in Table 2 examine the effect of CIT tax differentials conditioning on the host country METR. As there is no variation in the host-country METR across parent countries, the regressions replace the host-country fixed effect with a set of macroeconomic controls including GDP, capital account openness, trade openness, inflation rate, and

exchange rate, along with year and parent-country fixed effects. The METR coefficient thus captures the average effect of METR on FAI with the inclusion of time-variant host-country controls. Specifically, Column (5) reports a negative and significant effect of the METR on FAI. Controlling for the host-country METR leads to a smaller CIT differential coefficient of around -1.5, which remains significant at the 1 percent level.[27] To control for the potential impact of profit shifting on investment, Column (6) replaces the standard METR variable with the "profit-shifting adjusted" METR. This leads to a positive and insignificant coefficient for the adjusted METR, suggesting that profit shifting may alleviate the negative impact of METR on FAI. On the other hand, our sample of potential host countries do not include the typical zero or low-tax jurisdictions that are popular destinations for profit shifting, and may therefore understate the overall impact of profit shifting on real investment. Column (7) include the standard METR and the profit-shifting adjustment term separately in the regressions (as in eq (9)). As theory suggests, their coefficients are equal in magnitude but opposite in sign. Column (8) adds the interaction between the adjusted METR and the tax differential to capture any potential non-linear effects.[28] Figure 4 summarizes the results and show that the investment response to the CIT differential is highly dependent on the level of METR, and vice versa. In particular, FAI is more sensitive to the statutory CIT differential in countries with a relatively low METR.

Robustness Table 3 assesses whether the main findings in Table 2 are robust to a number of alternative specifications and samples. In Column (1), the CIT differential is weighted using the capital-based market shares. This is to address the concern that total sales of

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[27]Without including the host METR the CIT differential coefficient is around -1.7 in this specification. De Mooij and Ederveen (2003) conduct a meta-analysis of empirical work on FDI and taxation, which provides us the opportunity to compare our estimate semi-elasticity for METR to the literature. De Mooij and Ederveen (2003) includes 91 semi-elasticities for METR (from 8 studies, published between 1990 and 2004). In these 91 semi-elasticities, the mean is -4.51, with a standard deviation of 11.86 (the range of semi-elasticities spans between -84.47 and 17.83). Reducing the semi-elasticities to those are *statistically significant* reduces the mean to -7.51, standard deviation of 14.404, and range between -84.47 and 15.46. In the statistically significant sample, there are only 40 coefficients (from 6 studies). It should further be noted that none of the studies used for meta-analysis include METR as a tax variable *and* use a measure of "Property, Plant, Equipment" together (which is a closer measure to FAI). Therefore, it does not seem that there is a directly comparable estimate in the current literature.

[28]Non-linear effects of taxation have been demonstrated in existing studies including Bénassy-Quéré et al. (2005), Dowd et al. (2017) and Bratta et al. (2021), by typically focusing on the higher order terms of the tax rates.

foreign affiliates may include exports which are not part of output in the domestic market. If so, sales-based market shares would measure the size of prospective market with noise. When replaced with the CIT differential weighted by capital-based market shares, the results remain quantitatively similar in Column (1). Column (2) includes the host CIT component and non-host CIT component separately, each weighted using the capital-based market shares. The results show a strong spillover effect as indicated by the coefficient for the non-host CIT term.

Our analysis of the spillover effects of CIT on FAI has focused on the integrated market case and straightforward variants of that. But as we saw in Section 2, there are other possible structures of MNC activity. One, mentioned there, is of extensive vertical integration, with affiliates producing in various stages of the supply chain and trading with one another. Weighting tax rates by sales (including within the group) would seem appopriate in this case too, but we also explore in column (3) an alternative measure of weighting CIT differentials by bilateral-exports. The results show that the CIT differential measured this way has a small and insignificant effect on FAI. Column (4) continues testing this alternative hypothesis by including the host CIT component and non-host CIT component separately, both weighted using the export-based market shares. Interestingly, both tax coefficients are estimated with the wrong sign than what would have been predicted by the integrated chain hypothesis, which we interpret as lack of evidence for the alternative hypothesis.

Column (5) and (6) check the robustness of the results by using an alternative dependent variable, the ratio of FAI relative to value added of multinationals. The results remain very similar, for the overall CIT differential (column 5) and its individual components (column 6). To address the concern of potential endogeneity in the host-country statutory CIT and METR, to the extent that countries may reduce their CIT rates in times of languishing FAI, the last two columns present instrumental variables estimates of our baseline specification. One strategy is to use lags of the respective tax variables as instruments.[29] Column (7) shows that the coefficient on the non-host component of the differential is robust to instrumenting, suggesting that the impact of the differential on FAI is dominated by the role of

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[29]On the other hands, serial correlations in the tax rates may not render the lagged variables valid IVs. We will explore alternative IVs including contemporaneous VAT and PIT rates/revenue, which should determine the relative importance of CIT rate and revenue in total revenue, but are less relevant for FAI considerations.

tax rates in potential destinations rather than the actual host. Column (8) confirms that the overall differential term is robust to instrumenting, while instrumenting host country METR produces a small, statistically significant coefficient.

Heckman selection model   Finally, we check the robustness of the results in a Heckman style model, which allows us to separately examine the effect of CIT differential on the probability of undertaking any FAI in a country (the first-stage selection equation) and on the scale of FAI conditioning on entry (the second-stage investment equation). Given the dependent variable is bilateral FAI, the first stage captures the extensive margin for FAI where none of the foreign affiliates from a particular parent country invest in the host country, and the second stage captures a combination of both extensive and intensive margins at the micro level. We assume that the variables determining whether multinationals undertake any investment in a particular country are separate from variables determining how much they invest, once they decide to invest at all. Therefore, the first equation will regress dummy equal to 1 when some multinationals from a parent country invest in a host country and 0 otherwise on determinants of discrete investment. The second equation involves estimating a regression of log FAI on its determinants and the lagged capital stock in logs, conditional on undertaking positive FAI. We estimate the two equations jointly using the maximum likelihood technique, with error terms from both equations assumed to be bivariate normal. For identification purposes estimating Heckman selection model requires at least one variable in the first stage of discrete investment that is not a determinant in second stage of how much investment to undertake. We thus use the following selection of variables in the first stage, all at the host country level: the main rate of the Value-Added Tax (VAT), the top Personal Income Tax (PIT) rate, total non-CIT tax revenue as share of GDP, and government expenditure as share of GDP.

The results from Heckman selection model provide additional insights to our baseline findings. In Table 4 we show that the effect of the CIT differential on FAI is driven by both the extensive and intensive margin. The results from first stage regressions on the determinants of undertaking positive investments are statistically significant across specifications, including the positive coefficients on the CIT differential, and the negative coefficients on

the METR. The magnitude of these effects is larger here than in the PPML, suggesting a stronger effect of tax on discrete investment at the macro level. The second stage coefficients on the CIT differential remain significant but much smaller, while the coefficients on the METR become positive in most specifications. The net impact of METR on FAI, however, needs to account for its impact through the inverse mills ratio, which tends to be negatively correlated with the METR in our sample. On its own, the inverse mills ratio is estimated to have a positive and strong impact on the level of FAI, confirming the presence of selection bias.

5.2   Exploring Spillovers in METR

In this section, we examine the potential spillover of METR in the parent country as well as the average effect of METR in non-host countries. We focus on METR in the parent country primarily because it is the most salient METR for outbound investment by multinationals headquartered there. Tax competition considerations also highlight the political salience of METR in the parent country, which often serves as benchmark for national governments before changing taxes at home (Keen and Konrad, 2013), especially in times of sizable change in the METR of their major FDI investing countries. As a prominent example, following the recent TCJA reform that substantially lowered METR by way of lowering statutory CIT rate and full expensing for equity-financed investment in the US, a direct comparison of METR there with that in the host country often features prominently in policy debate in many non-US host countries.

Conceptually, there are two possibilities concerning the impact of parent country METR on foreign investment. With no capital constraints and free mobility (as in the case of our baseline model in Section 2), parent country METR (and other non-host METRs) should not directly affect multinational investment. In this case, only the host country METR would matter. Alternatively, in the presence of capital constraints, we would expect a positive effect of the parent country METR on its outbound investment, as a lower METR in the parent country would increase domestic investment at the expense of investment abroad.

Table 5 reports regressions results analyzing the potential spillover effect of METR. The estimation sample is considerably smaller than the baseline sample, as information for METR

variables are only available for 46 parent countries (out of 187). Column (1) uses the same specification in Table 2 Column (1) to check if the baseline results still hold for the smaller sample. The loss of power leads to an insignificant CIT differential coefficient, thought the effect of host METR remains negative and significant. Column (2) adds the parent METR and reports a negative and insignificant coefficient. The negative effect is the opposite of what the capital constraint scenario would predict. Columns (3) adds the average METR in other non-host countries, for which the positive coefficient also goes against the capital constraint hypothesis. The negative effect of parent METR is also robust to the inclusion of minimum METR among all other non-host countries in Column (4). Columns (5)-(7) repeat the tests by replacing the host METR with profit-shifting adjusted METR, and report similar results concerning the spillover effect of METR. These findings are consistent with the lack of evidence for any significant spillovers in METR.

Summary of Main Findings

In summary, our findings show that there is strong spillover in the statutory CIT rate: the semi-elasticity of FAI with respect to the weighted-average of non-host CIT rate is around 3 and highly significant. The magnitude of the semi-elasticity is comparable with that with respect to the host-country CIT rate (Table 6). The size of the FAI tax elasticity estimates is on the larger side of what has been found in the literature, especially for those that use FDI as proxies for real investment. For example, De Mooij and Ederveen (2003) show that the consensus semi-elasticity of FDI with respect to the own-country statutory tax rate is -1.2, and increases to -2.0 when using physical investment in Property, Plant and Equipment as an alternative measure for FDI. Our analysis also show that there is lack of evidence on the spillovers in METR. While we estimate a small semi-elasticity of -0.06 to -0.07 for the host-country METR, the impact of non-host country METR, including that from parent country, is always imprecisely estimated and not significantly different from zero in all specifications.

5.3   Attenuation Bias in FDI Regressions

In this section, we explore the extent of attenuation bias in FDI regressions. As discussed in Section 3, FDI that pass through multiple jurisdictions would generate measurement errors

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in the economic variables, including taxes, in standard FDI regressions. This in turn would cause attenuation bias in measuring the effect of FDI determinants. To see the extent of attenuation bias, we compare regression results using FDI and FAI as alternative dependent variables for the same sample period of 2003-2016.[30] Note that we cannot restrict the sample to include the same set of host or parent countries - doing so would defeat the purpose of this analysis. For the same underlying funds, double counting of FDI will give rise to multiple flows/observations, each associated with a different host-parent country pair. The sample for FDI would thus differ substantially from that for FAI.

Attenuation Bias in Gravity Variables. Table 7 shows the extent of attenuation bias in gravity factors, using FDI and FAI as alternative dependent variables. The first two columns estimate the following simple gravity model with OLS:

$$logI_{hpt} = \alpha + \gamma_1 logGDP_{ht} + \gamma_2 logGDP_{pt} + \gamma_3 logDistancehp + +\boldsymbol{\beta'_4}\mathbf{X}_{ht} + e_{hpt}, \qquad (12)$$

where $\mathbf{X}$ is a vector of dummies including contiguity, common language, colonial links etc. for host economy h, parent economy p in year t. To address the potential bias in OLS estimations with zero FDI dropped, the next two columns estimate the model on its multiplicative form with a PPML to retain zero observations. Doing so yields estimates that are considerably larger than the OLS regressions, together with a larger R-squared.

Focusing on the PPML results, the estimated semi-elasticities of FDI with respect to the GDP of the host economy and to the GDP of the immediate parent economy are less than unity, suggesting that the relative importance of FDI decreases quickly with market sizes, and a pseudo-R-squared of 0.55 (column 3). Estimating the same model for FAI yields very different results. Most strikingly, the elasticity of FAI to the GDP of host economy is almost twice the size of that for FDI; the elasticity of FAI to the GDP of parent economy is also 60 percent larger than that for FDI. These differences are consistent with the notion that standard FDI statistics systematically underestimate the real investment links between large economies because much of the investment is channeled through small offshore financial centers(Damgaard et al., 2019), whereas the associated measurement errors in the gravity

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[30]Without the measurement errors, FDI as financial flows are likely to be more responsive than FAI (Saez et al., 2012), although its dependence on taxes may take a different form.

variables would lead to downward bias in their estimated impact on FDI.

Attenuation Bias in Tax Variables. Table 8 continue to examine the extent of attenuation bias in tax variables, including in the CIT tax differential and host-country METR, in FDI regressions. For initial comparison on the overall effect of taxes, columns (1) and (2) replicate the baseline PPML regression for the years 2003-2016 during which the coverage of bilateral FDI and FAI overlaps. The CIT differential continues to exert a strong impact on FAI (column 1), with an estimated coefficient of 1.8 and is almost five times larger than that for FDI. For the latter the effect of CIT differential is estimated to be insignificant (column 2). The impact of host-country METR, although remaining as marginal insignificant, is also estimated twice as large for FAI than for FDI. To disentangle the effect of host and non-host country CIT rates, Columns (3) and (4) include the host-country and non-host country CIT component separately. The estimated coefficients on the tax components remain significant with the correct sign for FAI, but again are much smaller and insignificant for FDI. We interpret these findings as evidence for sizable attenuation bias in estimating the effect on taxes in standard FDI regressions.

In additional analysis that are unreported for this version, we look at whether there are any heterogeneous effects for FAI from parent countries with a worldwide system comparing to a territorial system. The results generally point to a similar effect of the CIT differential for FAI from territorial and worldwide parent systems, a finding that has been documented in earlier studies for aggregate investment including Devereux and Freeman (1995) and Bénassy-Quéré et al. (2005) but quite different from those based on firm-level data Liu (2020). One possible explanation could be that profit shifting might alleviate the difference of parent tax system on aggregate FAI.

6 An Application: Real Investment Effects of a Minimum Tax

Tax spillovers have been at the heart of the G20/OECD-led efforts over the last few years to reform the international tax system, culminating in a historic multilateral agreement in

October 2021. A centerpiece of this ('Pillar 2') is adoption of a minimum effective corporate tax rate of 15 percent. The primary motivation behind this is to limit the shifting of paper profits and the tax competition that it induces, but there is concern too at the possibly adverse impact, as collateral damage, on productive investment—a concern that the analysis and results above are well-suited to illuminate.[31]

While important detail remains to be clarified, two general features of the agreement stand out. One is that topping up to achieve the minimum may be done by either the host country or the immediate parent. The rules on this are complex.[32] But they need not detain us here: which country does the topping up matters a good deal for the allocation of tax revenue but is immaterial for present purposes since the impact on investors, and hence on FAI, depends only on the fact of the minimum, not on who imposes it.

The second key feature of the minimum is that it is specified in terms of an *effective* rate, which will reflect not only the nominal rate of tax but also the base. This means that the 15 percent minimum can in principle be met by many alternative combinations of the statutory and marginal effective tax rates: in the setting of Section 2, the (average) effective tax rate of the entity in country j, defined as the ratio of tax liability to pre-tax profit, is $ETR = T_j + (1 - T_j)M_j \cdot r_j$, where $r_j \equiv \{R_j - \rho K\}/K$ denotes the average return on tangible capital.

These differing combinations, as the analysis above makes clear, have potentially quite different implications for FAI. This also implies the need for countries to consider what combination best serves their interests: the results above, suggest, for example, that if the

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[31]A few other studies assess the impact of a global minimum tax (GloBE) on investment incentives, through its impact on their effective average tax rate and METR. Englisch and Becker (2019) argue that conceptually the GloBE should improve global economic efficiency since it would reduce the spread of EATRs across different locations. Devereux et al. (2020) show that, in a stylized model with one low-tax jurisdiction and one high-tax jurisdiction, a minimum tax has no discernible impact on investment incentives for levels of the threshold below the tax rate in the low-tax jurisdiction. For thresholds above that, both EATR and EMTR move closer together and will become aligned when the threshold is at, or above, the tax rate in the high-tax jurisdiction. Incorporating the features of actual CIT system for 66 countries, Hanappi and Cabral (2020) estimate that a minimum tax rate of between 10 and 15 percent would increase global EATR by 0.26 to 0.46 percentage points, and global METR by 1.08 to 1.98 percentage points. A global minimum tax would reduce the dispersion of effective tax rates across jurisdictions, and are most marked for those below the minimum tax threshold.

[32]Broadly: the underlying rule order gives primacy to the parent company's residence country (the 'Income Inclusion Rule') over the source country (the 'Undertaxed Payment Rule'), but the final model rules in OECD (2021) envisage a 'Qualified Domestic Minimum Top-up Tax' levied by the source country to top up to the minimum.

concern is to support inward FAI then, given the apparently relatively limited effect of the METR, it may make sense to do so by amending the base rather the statutory rate. We leave this issue aside here, however, and in the simulation exercise here for clarity simply take the response to the minimum to be that countries with statutory rates of less than 15 percent—and similarly to other higher minima that we also consider—raise to that level, while recognizing that the implied ETR may exceed the required minimum. With the reduction in tax competition implied by adoption of a minimum rate, higher tax countries, not directly affected by the minimum, might be expected to adjust their tax rates;[33] we do not attempt, however, to model this, but assume their (marginal effective and statutory) tax rates to remain unchanged. We thus proceed, for the latest year in our sample (2016), by simply raising the statutory rate to alternative levels, between 15 and 25 percent, in all countries initially having lower rates, compute (using the OUCBT dataset) the implied change in their METR, and predict (holding constant statutory and hence also METRs elsewhere) predict the new FAI for each host-parent country pair using the regression results in our baseline specification (Column 5, Table 2).

In the setting above, the increased statutory rate in low tax countries affects inbound FAI through two channels. The more direct effect is by reducing the tax rate differentials Δ_j between the low tax countries and all high tax host countries j: it becomes more attractive to produce in the high tax countries rather than the low tax. The indirect effect is through the METR in the low tax countries, which a higher statutory rate tends to increase: this tends to reduce inward FAI in the low tax countries, but, the results above suggest, has no significant effect on investment into the high tax countries. The expectation is thus that inward FAI will increase in high tax countries and fall in low.

Figure 5 shows that while the overall impact of a minimum tax on aggregate FAI, summing over all 32 host countries, is relatively small, it increases markedly at higher levels of the minimum. At a 15 percent minimum, aggregate FAI is projected to increase by a very modest 0.66 percent: the first of the effects above, increased FAI in countries not directly affected by the minimum, dominates. Aggregate FAI continues to increase at higher minima, as the number of high-tax countries outweighs the number of low-tax countries that become

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[33]See, for example, Hebous and Keen (2021).

obliged to raise their tax rate. At a 25 percent, total FAI in our host countries would increase by 4.14 percent. This is still, of course, a very modest effect, a result that is consistent with findings in Devereux et al. (2020) and Hanappi and Cabral (2020).

Underneath these aggregate effects are more marked effects at the level of the 32 host countries in our sample, illustrated in Figure 6. At 15 percent, countries other than Bulgaria, Bosnia and Herzegovina, Ireland, and Cyprus would see a small increase in their FAI, given that the increase in the CIT rate of the latter group would imply a smaller CIT differential for multinationals investing elsewhere, but has no impact on METRs outside the respective low-tax country. Higher minima bind more countries, though remains as minorities among all host countries. Increases in inward FAI outside these countries become more prevalent. At a minimum of 21 percent, for example, around one third of the sample—low tax countries, as one would expect—see a reduction in their FAI. The effects are in several cases quite pronounced. At that 21 percent, Bulgaria and Ireland would see reductions in inward FAI of 19.33 and 16.19 percent respectively, while FAI into Spain would increase by over 9.27 percent. Figure 7 shows the number of host countries that gain/lose FAI at each level of the minimum rate, where only at 25 percent, the number of countries that would experience a net FAI gain is equal to the number of countries that would lose FAI. Furthermore, as the minimum rate increases, Figure 7 indicates that the remaining winning gain more more FAI (both an average and in aggregate), while the growing number of losing countries, lose more FAI (also on average and in aggregate). Notably these are "static" or initial effect of a minimum tax on cross-border investment, as there may be reallocation of investment after a minimum tax is implemented leading to more investment, a dynamic process over time which we do not capture in our analysis.

7   Conclusions

The analysis and results above cast new light on one of the less understood aspects of international corporate tax arrangements: the nature and extent of cross-border spillovers on the real economic activities of multinational affiliates. Most immediately striking of these is that spillovers related to statutory corporate tax rates outside the host country

appear to be large— equivalent of a semi-elasticity of approximately -3.0—and similar in size to the semi-elasticity with respect to the statutory tax rate in the host country itself.[34] Indeed these effects are even larger than those commonly found with FDI literature: the deficiencies of those data, which (for present purposes) our use of a newly constructed FAI dataset overcomes may have led to an underestimation of the significance of real investment spillovers. No less notable is that these effects are consistent with a channel that does not appear to have been fully recognized: an implicit profit shifting that arises from real commercial decisions rather than the use of paper profit shifting through transactions lacking real substance. As one might expect, such spillovers are notably more pronounced in the EU single market. In sharp contrast, there is no sign of significant impact from one channel that has received much attention: the METR in alternative host countries. Nor do we find much evidence of an effect through the impact of paper profit shifting on the cost of capital: this seems, at best, to offset an adverse but imprecisely estimated effect through the traditionally-defined METR in the host country itself.

The multilateral agreement of October 2021 has the potential to lead to an international tax architecture that is fundamentally different from that which was in effect during the sample period of our data. That, however, makes understanding the spillover on real investment not less important but more. Take, for instance, the impact of a global minimum corporate tax rate. If countries were to implement this by adjusting their tax base so as to raise sufficiently the METR, the results here suggest that the spillover effect would be limited; if they were instead to do so by raising their statutory tax rate, they suggest that the effects through implicit profit shifting could be sizable. In our preliminary and illustrative calculations here, the latter effect means that at moderate levels of the minima, up to something like 25 percent, FAI may actually increase aggregate.

There remain, of course, many open questions, both theoretical and empirical. Quite how source countries should respond to a minimum tax, for example, is unclear. It also remains difficult to encompass neatly in empirical work the potentially very different commercial

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[34]More specifically, a one percentage point increase in the CIT differential would imply around 2.8 percent in the level of FAI (relative to the corresponding beginning-of-period capital stock) for a given host country. Focusing on the tax spillovers, a one percentage point increase in the weighted average of statutory CIT rates outside the host country would lead to 2.75 percent increase in the FAI ratio there.

structures of multinational enterprises, to tease out possible real investment effects from the use of conduit entities, and to distinguish between implicit and paper profit shifting. We hope, nonetheless, to have helped lay some groundwork and set out an agenda for understanding international tax effects on real investment—a topic that, as countries come to terms with a new architecture that has emerged with remarkable rapidity, seems set to become a more prominent priority in the years ahead.

A Appendix: Channels of Tax Spillover in the More General Case

Denoting by S_i the profit artificially shifted into (if $S_i > 0$) or out of ($S_i < 0$) jurisdiction i at a (tax-deductible) cost of $C(S_i, K_i)$, and attaching multipliers μ to the constraint that $\sum_{i=1} N = 0$ and λ to the constraint that $\sum_i K_i \geq 0$, the Lagrangean for the multinational's problem in the N-country case is

$$\Pi = \sum_{i=1}^{N}(1 - T_i)\left\{ R_i\big(F_1(K_1), ..., F_N(K_N)\big) + S_i - (\rho + M_i)K_i - C(S_i, K_i)\right\} \tag{A.1}$$

$$+ \mu \sum_{i=1}^{N} S_i + \lambda(\sum_{i=1}^{N} K_i - K). \tag{A.2}$$

Its choice variables are the capital stocks K_i and profits shifted S_i, $i = 1, .., N$

The necessary condition on K_h is that

$$\frac{\partial R}{\partial F_h}F_h'(K_h) - F_h'(K_h)\sum_{i=1}^{N} T_i \frac{\partial R_i}{\partial F_h} - (1 - T_h)\left(\rho + M_h + \frac{\partial C}{\partial K_h}\right) + \lambda = 0. \tag{A.3}$$

Combining the first two terms by defining

$$\gamma_{hi} \equiv \frac{\partial R_i/\partial F_h}{\partial R/\partial F_h}, \tag{A.4}$$

and subtracting and adding $T_h(\partial R/\partial F_h)F_j'$, rearranging (A.3) gives

$$\frac{\partial R}{\partial F_h}F_h' = \frac{\rho + M_h + (\frac{1}{1-T_h})\frac{\partial C}{\partial K_h}}{1 + \Gamma_h(\cdot)} \tag{A.5}$$

where it is assumed that the constraint $\sum_i K_i \leq K$ does not bind, and $\Gamma_h(\cdot)$ is as in (8) of the text.

With shifting costs assumed to be of the form

$$C(S_i, K_i) = \left(\frac{1}{2\phi\rho K_i}\right) S_i^2, \tag{A.6}$$

the necessary condition on S_i requires that

$$(1 - T_h)\phi\rho K_i - S_i + \mu\rho K_i. \tag{A.7}$$

Summing (A.7) over i, using $\sum_i S_i = 0$ and defining $\omega_i \equiv K_i / \sum_j K_j$, gives $\mu = -\sum_i (1 - T_i)\omega_i$; substituted back into (A.7), this implies that $S_h = \phi\rho K_h(\sum_i T_i\omega_i - T_j)$. Using this in the implication of (A.6) that

$$\frac{\partial C}{\partial K_h} = -\left(\frac{1}{2\phi\rho}\right)\left(\frac{S_h}{K_h}\right)^2. \tag{A.8}$$

gives, when used in (A.5), (6) of the text.

Figure 1. No Direct Correspondence between FAI and FDI

- Total FDI in H of $3 :
  - $FDI_{IO,H} = \$1$
  - $FDI_{UO,H} = \$2$

- Total FAI in H of $\$0 - 3 :$
  - $FAI_{IO,H} = \$0$

- $FAI_{UO,H} = \begin{cases} \$0 \text{ if minority owned} \\ \$0 - 3 \text{ if majority owned, depending on how much is invested in } K.0 \end{cases}$
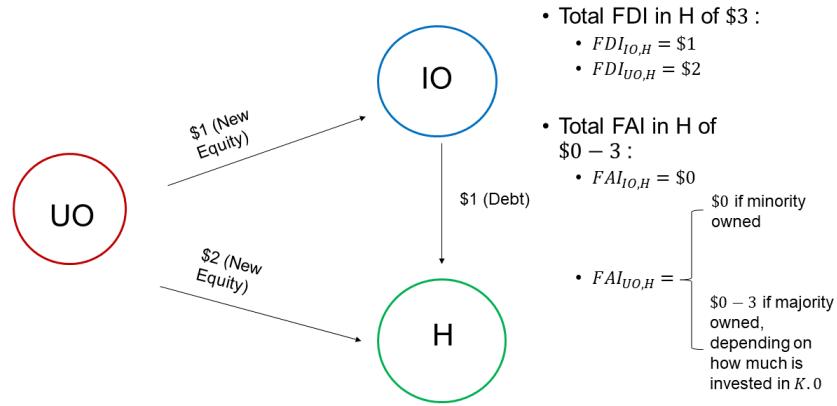
Notes: UO is the country of ultimate ownership, IO is the country of immediate ownership and H is the host country of investment.

Figure 2. FAI vs. FDI: In Aggregate

(a) In Aggregate
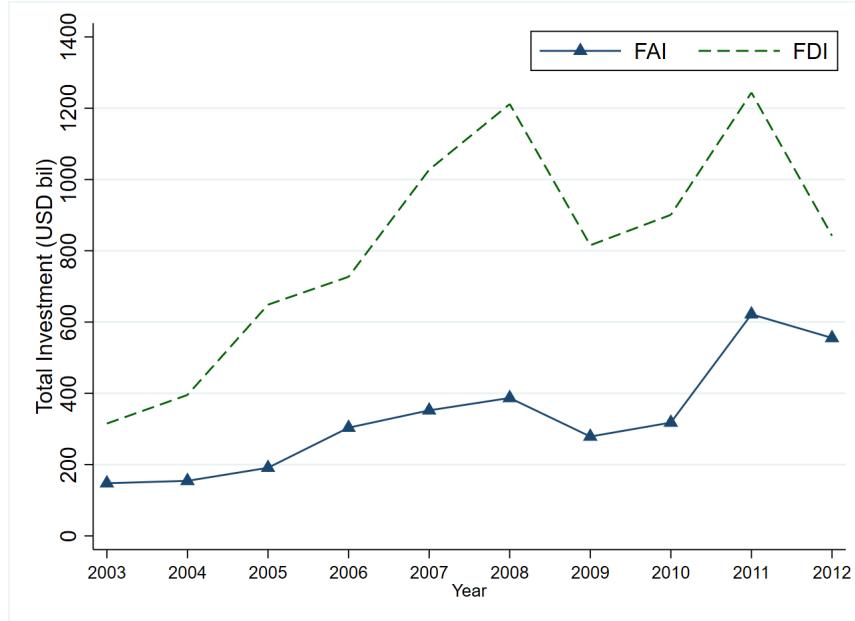
(b) EU Host Countries
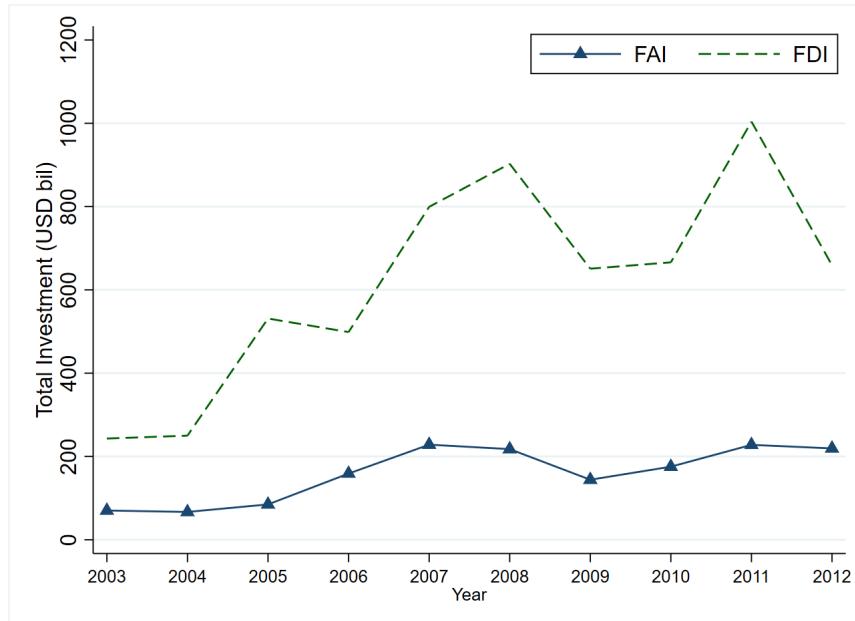
Notes: These figures compare the FAI and FDI series for the sample period of 2003-2012. Panel (a) shows the time series of FAI and FDI in aggregate for the full sample. Panel (b) shows the time series of FAI and FDI in aggregate in the EU.

Figure 3. FAI vs. FDI: By Origin Economy Characteristics

(a) Low-Tax

(b) Investment Hubs

(c) Developing

(d) Treaty Partners
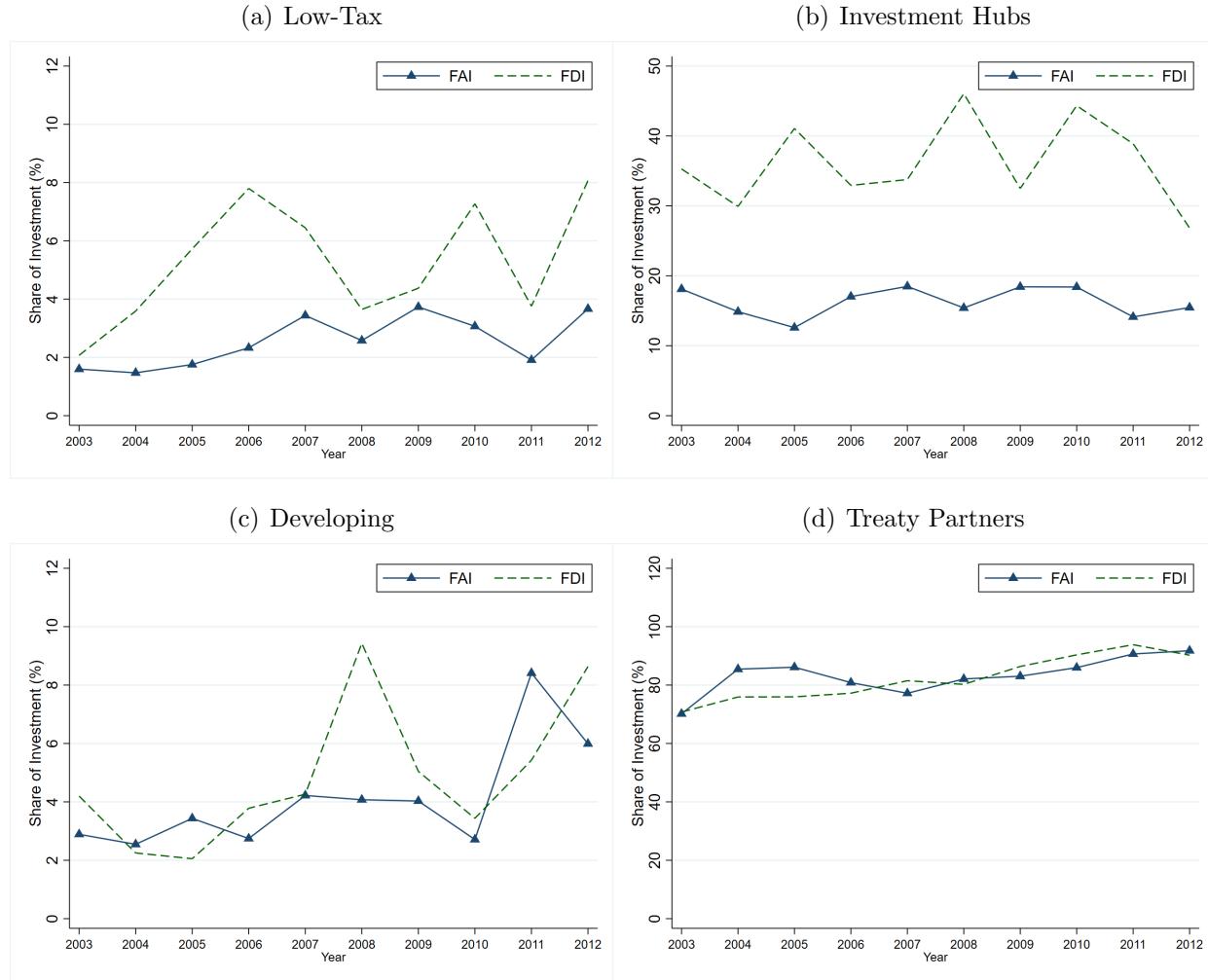
Notes: This figure compares the share of FAI/FDI relative to total FAI/FDI by origin country characteristics, including in origin countries that are low-tax (defined as with statutory CIT rate less than 20 percent, panel (a)), developing countries (panel (b)), investment hubs (panel(c)) and treaty partners with the host country (panel(d)).

Figure 4. Non-linear Effects of Corporate Tax Rates

(a) Marginal Effects of CIT Differentials

All Pairs, Dep. Var = I/K for FAI
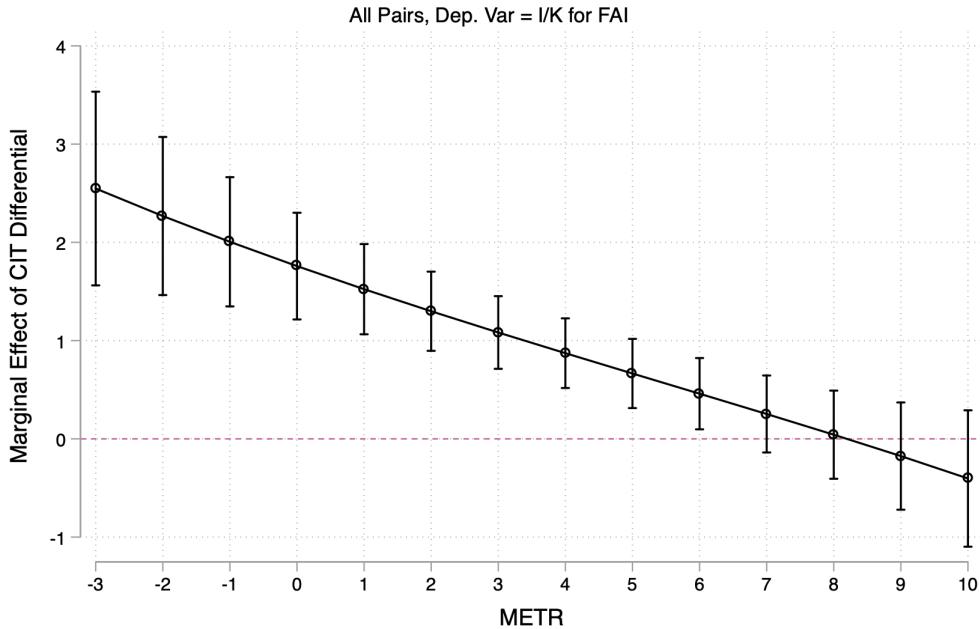
(b) Marginal Effects of Adjusted-METR

All Pairs, Dep. Var = I/K for FAI
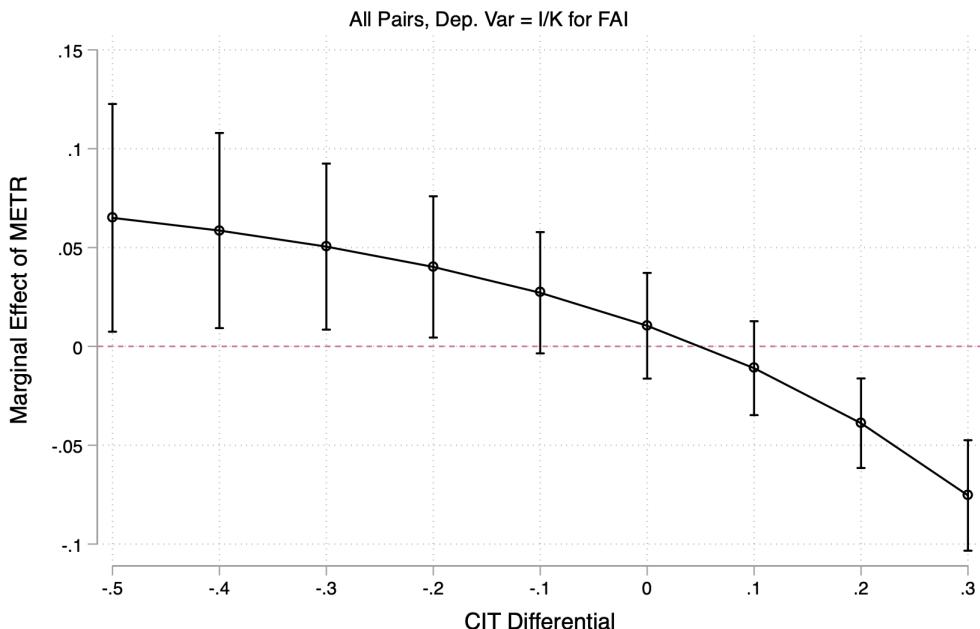
Notes: The top panel shows the marginal effect of the CIT differential along the distribution of adjusted-METR values; the bottom panel shows the marginal effect of METR along the distribution of CIT differential values.

Figure 5. Aggregate FAI and Minimum Tax Rates
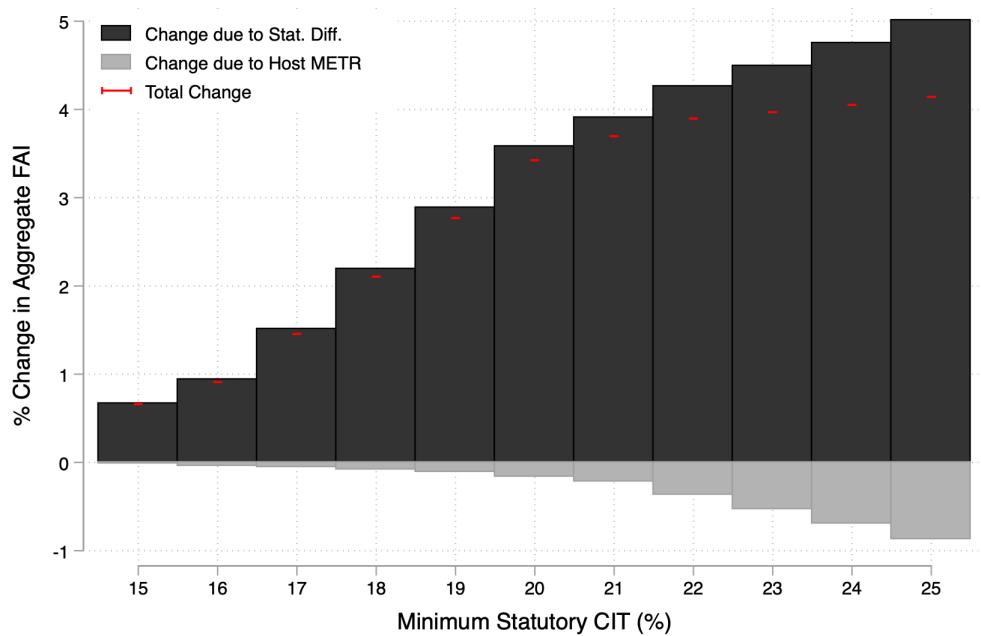
Notes: This figure plots the percentage change in aggregate FAI received in our sample of host countries, along the distribution of minimum corporate tax rates ranging between 15% and 25%. These results correspond to corporate tax rates and FAI for the year 2016. The dark grey bars show the impact of a statutory minimum rate through the statutory differential, the grey bars show the impact through METR and the red lines show the total impact.

Figure 6. Distribution of Investment Impact and Minimum Taxation
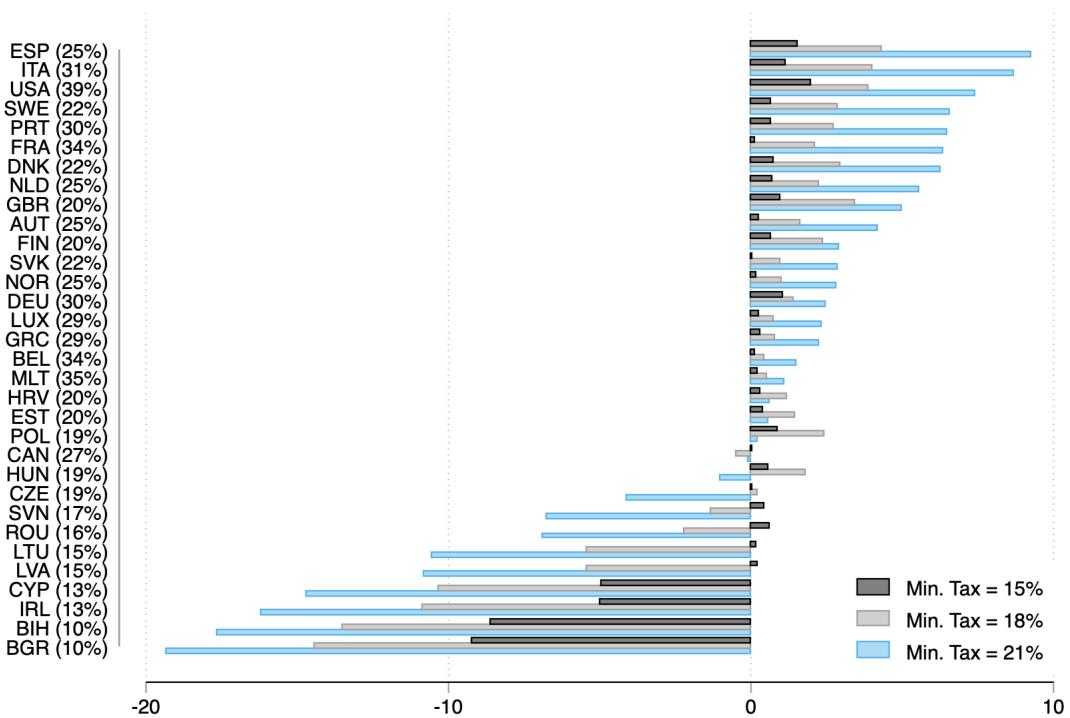
Notes: This figure plots the percentage change in inward FAI across 32 host countries in our sample, along the corresponding minimum corporate tax rates of 15, 18 and 21 percent, respectively. The simulation uses FAI for the year 2016. The statutory CIT rate in each country is shown in parentheses on the vertical axis.

Figure 7. Extent of Winners and Losers at Different Minimum Rates
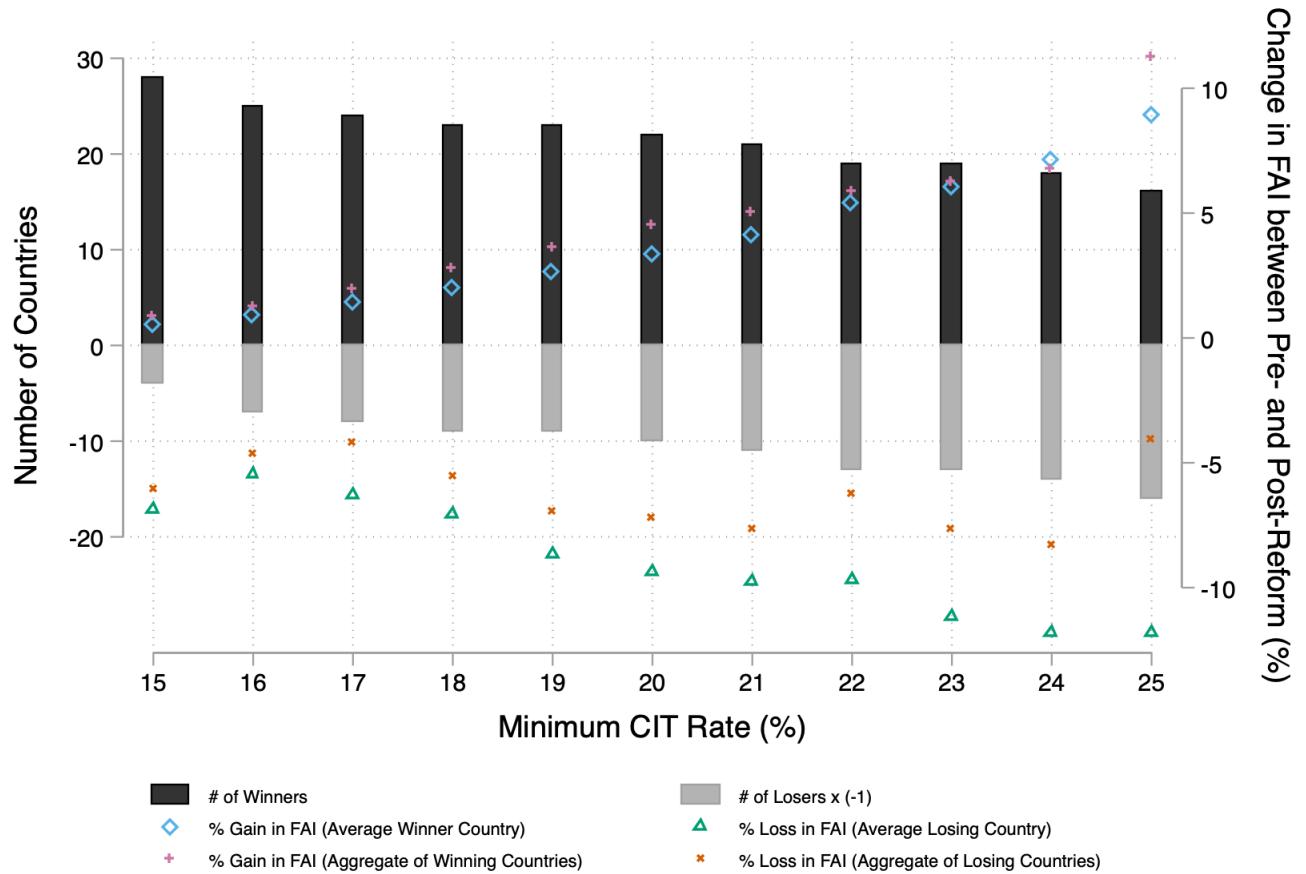
Notes: This figure shows the number of countries that would gain or lose inward FAI at each minimum tax rate of between 15 and 25 percent. Corresponding to the y-axis on the left-hand side, the number of winning countries is denoted by the black bars, while the number of losing countries is denoted by the grey bars. The y-axis on the right-hand side provides a scale to measure the percentage change in FAI. The blue diamonds denote the percentage gain in FAI for an average winning country, while the pink +'s denote the aggregate percentage gain in FAI across all winning countries. The green triangles denote the percentage loss in FAI for an average losing countries, while the red x's denote the aggregate percentage loss in FAI across all losing countries.

Table 1. Summary Statistics

Panel A: Tax Variables	Mean	SD	P10	P50	P90
CIT differential	0.009	0.164	-0.217	0.037	0.182
CIT differential, EU Hosts	-0.052	0.176	-0.299	-0.006	0.121
CIT differential, Non-EU Hosts	0.002	0.248	-0.379	0.108	0.248
Non-Host Component	0.318	0.151	0.000	0.353	0.484
Non-Host Component, EU	0.237	0.189	0.000	0.297	0.400
Non-Host Component, Non-EU	0.292	0.238	0.000	0.418	0.529
Host Component	0.309	0.128	0.166	0.316	0.460
Statutory CIT Rate	25.064	7.201	16.000	25.000	35.430
METR	6.639	1.007	5.673	6.335	7.740
METR (Adjusted)	5.470	1.969	2.523	5.858	7.493
Panel B: Investment Variables					
I_{FAI}/K_{FAI}	0.418	0.871	0.000	0.193	0.948
I_{FDI}/K_{FDI}	0.437	1.638	0.000	0.069	0.811
FAI	748.889	3423.008	0.888	42.558	1335.273
Lag FAI	2910.009	22377.657	2.410	113.215	4230.854
Log(FAI)	3.634	2.755	-0.119	3.751	7.197
Panel C: Weights					
Sales Share (Lagged)	0.082	0.201	0.000	0.005	0.228
Capital Share (Lagged)	0.118	0.263	0.000	0.005	0.425
Export Share (Lagged)	0.104	0.231	0.000	0.014	0.246
Panel D: Zeroes	Share				
I/K (FAI)	33.7 %				
I/K (FDI)	18.4 %				

Notes: There are 12,630 observations in our main sample. Panel A shows summary statistics for tax-related variables. The CIT Differential term is defined as the weighted difference scaled by (100-CIT in the host country) as introduced in the theory section (Equation 4) and implemented the data section (Equation 10). The Statutory CIT Rate, METR and Adjusted METR are shown in percentages. Panel B shows summary statistics for investment variables. I/K ratios are investment flow divided by lagged capital, for the type of investment indicated (foreign affiliate investment and foreign direct investment, respectively). The summary statistics for I/K (FDI) are associated with a different sample (N=16,636). For FDI, restricting to the same set of bilateral pairs as FAI yields a much smaller sample size of approximately 6,000. Panel C summarizes the data we use to construct the CIT differential: weights by sales, capital and exports. Panel D shows the share of observations for FAI and FDI in our main sample that are zeroes.

Table 2. Baseline Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CIT Differential	3.039*** (0.712)			-2.793* (1.460)	1.633*** (0.490)	1.743*** (0.464)	1.950*** (0.604)	4.114*** (0.767)
Host CIT Comp.		-2.939*** (1.106)						
Non-Host CIT Comp.		3.066*** (0.608)						
CIT Differential, EU			2.477*** (0.864)					
CIT Differential, Non-EU			0.720*** (0.237)					
Non-Host CIT, EU				2.555*** (0.802)				
Non-Host CIT, Non-EU				0.770*** (0.235)				
Host METR					-0.054 (0.064)		-0.031 (0.050)	
Adjusted Host METR						0.012 (0.030)		0.031 (0.041)
Profit-shifting adjustment (phi)							0.035 (0.035)	
Adjusted Host METR × CIT Differential								-0.587*** (0.144)
Observations	12,630	12,630	12,630	12,630	12,630	12,630	15,097	12630
Pseudo-R^2	0.166	0.166	0.166	0.167	0.129	0.129	0.169	0.132
Controls:	Parent, Bilateral	Parent, Bilateral	Parent, Bilateral	Parent, Bilateral	Host, Parent Bilateral	Host, Parent Bilateral	Host, Parent Bilateral	Host, Parent Bilateral
FEs:	Host-Year, Parent	Host-Year, Parent	Host-Year, Parent	Host-Year, Parent	Year Parent	Year Parent	Year Parent	Year Parent

Notes: All specifications are estimated in Poisson QML regression using an unbalanced panel of all available host-parent-year observations. Specification (1) to (4) include host country-year pair fixed effect and parent country fixed effect, and the following characteristics of the multinational firm's parent country: GDP (in log), capital account openness index, trade openness, inflation rate, government expenditure share, and exchange rates. Standard errors in parentheses are clustered by host. ***, ** and * indicate significance at the 1%, 5% and 10% levels. Specification (5) to (7) include host country, year, and parent country fixed effects, and the following characteristics of the multinational firm's host/parent country: GDP (in log), capital account openness index, trade openness, inflation rate, government expenditure share, and exchange rates. All specifications control for bilateral host-parent characteristics including distance (in log) and an indicator for common official language.

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Table 3. Robustness of Baseline Results

Specification:	CIT Differential Weighted by K		CIT Differential Weighted by Exports		FAI / Value Added		IV Regressions	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dept Var: FAI Ratio								
CIT Differential	1.344***		0.217		2.735***			2.600**
	(0.341)		(0.502)		(0.600)			(1.046)
Host CIT Comp.		0.246		1.178***		-2.976***	-6.817***	
		(0.349)		(0.247)		(1.039)	(1.568)	
Non-Host CIT Comp.		1.346***		0.955***		2.665***	7.524***	
		(0.286)		(0.302)		(0.572)	(1.742)	
Host METR								-0.087
								(0.070)
Observations	12,047	12,047	12,047	12,047	8,462	8,462	8,649	8,005
Pseudo-R^2	0.17	0.17	0.16	0.17	0.22	0.22	0.16	0.12
Controls:	Host, Parent Bilateral	Host, Parent Bilateral	Host, Parent Bilateral	Host, Parent Bilateral	Host, Parent Bilateral	Host, Parent Bilateral	Host, Parent Bilateral	Host, Parent Bilateral
FEs:	Host-Year, Parent	Host-Year, Parent	Host-Year, Parent	Host-Year, Parent	Host-Year, Parent	Host-Year, Parent	Host-Year, Parent	Host-Year, Parent

Notes: All specifications are estimated in Poisson QML regression using an unbalanced panel of all available host-parent-year observations. Specification (1)-(2) use the CIT differential weighted using shares of fixed capital (lagged). Specification (3)-(4) use the CIT differential weighted using shares of exports (lagged). Specification (5)-(6) uses the FAI relative to value-added as the dependent variable. Specifications (7)-(8) use the first lag of each tax variables, together with contemporaneous VAT and PIT tax rates, as instruments. All specifications include host country-year pair fixed effect and parent country fixed effect, and the following characteristics of the multinational firm's parent country: GDP (in log), capital account openness index, trade openness, inflation rate, government expenditure share, and exchange rates. Standard errors in parentheses are clustered by host. ***, ** and * indicate significance at the 1%, 5% and 10% levels.

Table 4. Evidence on Spillovers in CIT: Heckman Selection Model

	(1)	(2)	(3)	(4)
First stage results				
CIT Differential	5.048***	4.723***	5.145***	5.145***
	(1.273)	(1.371)	(1.315)	(1.315)
Host METR	-0.230***	-0.224**	-0.212**	-0.212**
	(0.083)	(0.088)	(0.094)	(0.094)
Observations	9,958	9,958	9,958	9,958
Second stage results				
CIT Differential	1.897***	1.844***	1.923***	1.351*
	(0.506)	(0.499)	(0.518)	(0.657)
Host METR	0.145**	0.147**	0.144**	
	(0.059)	(0.057)	(0.059)	
IMR	0.410***	0.370***	0.413***	0.433***
	(0.110)	(0.109)	(0.115)	(0.105)
Observations	4,487	4,487	4,487	4,487
Control variables: First Stage				
VAT standard rate	x		x	x
PIT top rate	x		x	x
Tax Revenue/GDP		x	x	x
Govt Expenditure/GDP	x	x	x	x
Control variables: Both Stages	Host, Parent	Host, Parent	Host, Parent	Parent
	Bilateral	Bilateral	Bilateral	Bilateral
FEs:	Year, Parent	Year, Parent	Year, Parent	Host-Year, Parent

Notes: These are Heckman selection results using an unbalanced panel of all available host-parent-year observations. In all specifications the inverse mills ratio (lambda) is significant and positive at 5% level. First stage results are from regression of the likelihood of undertaking positive investment on its determinants. Second stage results are from OLS specification using the FAI ratio as a dependent variable on the restricted sample of positive FAI only. In all specifications we include year and parent country fixed effects. Standard errors are clustered at the host country level. In both stages we include the following determinants of investment for the respective multinational firm's host/parent country: GDP (in log), capital account openness index, trade openness, inflation rate, government expenditure share, and exchange rates. ***, ** and * indicate significance at the 1, 5, and 10 percent levels.

Table 5. (Non-)Spillovers in METR

Dept Var: FAI Ratio	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Host METR	-0.078**	-0.079**	-0.055	-0.080**			
	(0.033)	(0.033)	(0.042)	(0.034)			
Host METR Adjusted					-0.040**	-0.028	-0.041**
					(0.019)	(0.019)	(0.020)
Parent METR		-0.08	-0.039	-0.078	-0.059	-0.01	-0.057
		(0.108)	(0.130)	(0.108)	(0.108)	(0.113)	(0.109)
Mean Non-Host METR			1.752			2.468	
			(2.586)			(2.062)	
Min Non-Host METR				-0.145			-0.141
				(0.128)			(0.127)
CIT Differential	0.49	0.47	0.48	0.451	0.607	0.532	0.59
	(0.706)	(0.703)	(0.717)	(0.708)	(0.656)	(0.673)	(0.659)
Observations	7,260	7,260	7,260	7,260	7,260	7,260	7,260
Pseudo-R^2	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Controls:	Host, Parent Bilateral Year, Parent	Host, Parent Bilateral Year, Parent	Host, Parent Bilateral Year, Parent	Host, Parent Bilateral Year, Parent	Host, Parent Bilateral Year, Parent	Host, Parent Bilateral Year, Parent	Host, Parent Bilateral Year, Parent
FEs:	Year, Parent	Year, Parent	Year, Parent	Year, Parent	Year, Parent	Year, Parent	Year, Parent

Notes: All specifications are estimated in Poisson QML regression using an unbalanced panel of all available host-parent-year observations with parent-country METR. All specifications include parent country and year fixed effects, and the following characteristics of the multinational firm's host/parent country: GDP (in log), capital account openness index, trade openness, inflation rate, government expenditure share, and exchange rates. Standard errors in parentheses are clustered by host. ***, ** and * indicate significance at the 1%, 5% and 10% levels.

Table 6. Summary of Estimated Coefficients on Tax Variables

	Statutory CIT Rate	METR
CIT Tax Differential	-2.98	
	(0.729)	
Host Country	-2.85	-0.078
	(1.096)	(0.033)
Non-Host Country	3.02	1.752
	(0.623)	(2.586)
Parent Country		-0.08
		(0.108)
Adjusted Host		0.001
		(0.027)

Notes: This table summarizes the estimated coefficients with respect to statutory CIT rate and METR. Standard errors are shown in parentheses. While the METR coefficients can be interpreted as semi-elasticities for FAI, the CIT differential is scaled by a factor of (100-Host Country Statutory CIT). Note that adjusted host METR is small and statistically insignificant in the baseline regression table (which is the coefficient reported in the summary table). However, adjusted-METR is negative and statistically significant in the METR spillovers table (Table 5) due to a smaller sample size, which is restricted due to parent METR data availability.

Table 7. Gravity Model: FAI vs FDI

Dept Var: Model:	log FDI OLS (1)	log FAI OLS (2)	FDI PPML (3)	FAI PPML (4)
Host GDP	0.481***	0.569***	0.534***	0.935***
	(0.089)	(0.070)	(0.206)	(0.098)
Parent GDP	0.575***	0.685***	0.705***	1.017***
	(0.056)	(0.059)	(0.050)	(0.069)
Bilateral Distance	-0.814***	-0.743***	-0.776***	-0.581***
	(0.072)	(0.072)	(0.090)	(0.046)
Common Language	1.102***	0.975***	0.933**	0.764***
	(0.265)	(0.301)	(0.363)	(0.256)
Contiguity	0.135	0.492*	-1.310***	-0.209
	(0.283)	(0.287)	(0.266)	(0.204)
Former Colony	0.482	0.173	0.465**	0.165
	(0.330)	(0.292)	(0.194)	(0.133)
Formerly Same Country	-0.659*	-0.770**	1.802***	0.537
	(0.376)	(0.360)	(0.275)	(0.591)
FDI Source	-0.003		1.763***	
	(0.440)		(0.393)	
Observations	7,440	11,830	27,010	44,302
Pseudo-R^2	0.39	0.41	0.55	0.82
FEs:	Year	Year	Year	Year

Notes: The table shows the results from OLS regressions (Columns 1-2) and PPML regressions (Columns 3-4) for the period 2003-2016. The dependent variable is FDI in Columns 1 and 3 and FAI in Columns 2 and 4. The explanatory variables are: *Host economy GDP* is the GDP of the economy hosting the investment; *Parent economy GDP* is the GDP of the economy of immediate parent for FDI, and ultimate parent for FAI; *Bilateral distance* is the Euclidean distance between the economy of the parent and the economy of the host; *Contiguity* is a dummy indicating whether the economy of the host and the economy of the parent share a border; *Common language* is a dummy indicating whether the economy of the host and the economy of the parent share an official language; *Former colony* is a dummy indicating whether the economy of the host and the economy of the parent or vice versa. *Former same country* is a dummy indicating whether the economy of the host and the economy of the parent were formerly part of the same country. *FDI source* is a dummy indicating whether the FDI statistics is reported by the IMF CDIS series or the UN.

Table 8. Responding to Corporate Taxes: FAI vs FDI

Dept Var:	FAI (1)	FDI (2)	FAI (3)	FDI (4)
CIT Differential	1.991***	0.067		
	(0.609)	(0.496)		
Host CIT Comp.			-1.895***	-0.255
			(0.688)	(0.670)
Non-Host CIT Comp.			2.253***	-0.169
			(0.513)	(0.388)
Host METR	-0.005	-0.278	-0.008	-0.273
	(0.055)	(0.182)	(0.057)	(0.184)
FDI Source		1.585***		1.565***
		(0.326)		(0.321)
Observations	14,303	16,636	14,303	16,636
Pseudo-R^2	0.17	0.16	0.17	0.16
Controls:	Host, Parent	Host, Parent	Host, Parent	Parent,
FEs:	Bilateral	Bilateral	Bilateral	Bilateral
	Year	Year	Year	Host-Year,
	Parent	Parent	Parent	Parent

Notes: All specifications are estimated in Poisson QML regression. All specifications include parent country and year fixed effects, and the following characteristics of the multinational firm's host and parent country: GDP (in log), capital account openness index, trade openness, inflation rate, government expenditure share, and exchange rates. Standard errors in parentheses are clustered by host. ***, ** and * indicate significance at the 1%, 5% and 10% levels.

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