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

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**Abstract**

This paper investigates the role of corporate taxation for cross-border real investment. We develop a conceptual framework to show that in an integrated market, the statutory rate, in addition to the usual METR, would impact the level of MNC investment. The influence of statutory rates outside the local jurisdiction highlights the spillover effect of taxes on cross-border investment. We employ a precise measure of real investment in physical capital by foreign affiliates of multinationals. Our empirical results confirm the strong spillovers in the statutory rate but not in the METR. We use these results to simulate the real investment effect of a global minimum tax.

**Keywords:** Corporate Tax, Multinational Investment, Tax Policy Spillovers

**JEL Classification:** H21, H25, H32

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# 1 Introduction

Spillovers in corporate taxation—the effects of one country's rules and practices on others—have become macro-critical by diverting flows of real capital, finance, tax revenue and profits on a global scale (IMF, 2014). Policy makers are increasingly, and rightly concerned about the extent of tax-related spillovers on domestic investment and revenues, and whether their own corporate tax system remains competitive in light of tax reforms elsewhere. The practical policy agenda on these issues is an active one. Awareness of the constraints that international considerations place on national tax policies is now a commonplace of budget (and campaign) speeches, with the downward trend of statutory corporate tax rates for advanced economies and developing countries alike (Keen and Konrad, 2013). The G-20/OECD-Inclusive Framework on Base Erosion and Profit Shifting (BEPS), including the Two-Pillar Approach to Address the Tax Challenges Arising from the Digitalisation of the Economy OECD (2020a,b), is a recent example of multilateral collaboration to mitigate tax spillovers in corporate tax revenue.[1] In contrast to the heightened focus to address tax spillovers in revenue, far less analytical attention has been paid to tax spillovers in real investment, despite of its impact on revenues and economic growth, and remarkable relevance for policy making.[2]

The paucity of analysis reflects two major challenges, the first being the absence of a conceptual framework with which to analyze the impact of corporate taxes on cross-border investment. Take the 2017 Tax Cut and Jobs Creation Act (TCJA) in the US for example. While it has likely increased the investment in the US—by lowering the marginal effective tax rate (METR) there[3]—it does not automatically imply a reduction in investment elsewhere. That may be the case, however, if companies are constrained in the overall amount

[1]The literature on profit shifting is large: recent reviews are in Beer et al. (2020a) and Dharmapala (2019). 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)).

[2]There is, however, ample evidence on the positive spillovers of foreign direct investment on, accumulation of know-how, and economic growth for capital-importing countries (for example Alfaro (2017) and Smarzynska Javorcik (2004)), and on domestic capital formation for capital-exporting countries (Desai et al. (2005)).

[3]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).

of capital they can deploy worldwide. Alternatively, if multinationals are serving integrated markets (within North America, for instance) from different locations, a drop in the statutory corporate income tax (CIT) rate in the US would affect their worldwide profits, and companies would effectively have to reallocate across locations. A reduction in the US statutory rate would also change the tax incentives for profit shifting for multinationals with a US footprint, which would further interact with the real effects of taxes for these companies.

To overcome this conceptual challenge, we develop a simple model to illustrate the key aspects of corporate tax structures that matter for multinational investment.[4] Our key observation is that under circumstances where a multinational serves multiple countries so that income of one affiliate depend on production by another, corporate taxation would affect the scale of investment in each location through two routes. One is through the usual METR in the local jurisdiction, which typically has a negative impact on investment (in the absence of profit shifting). The other is the statutory rate, and its exact impact depends on the level of statutory rate relative to the weighted average rate elsewhere. Investment in one location tends to be greater than the METR alone would imply if and only if the statutory rate there is lower than the weighted average rate elsewhere, since additional investment increases taxable profits there and reduces them elsewhere. This influence of statutory rates outside the local jurisdiction captures the tax spillovers for investment – the main focus in our empirical analysis –given that we also show that conditional on the tax differential and own-country METR, METR elsewhere has no impact in the local economy. The negative impact of own-country METR is alleviated, however, when multinationals can shift profits through tax planning strategies in addition to real investment.

The other major challenge lies in the lack of suitable measure on real investment by foreign affiliates.[5] The literature has typically relied on foreign direct investment (FDI) data to identify the impact of corporate taxation, including tax spillovers, on cross-border investment, acknowledging the important caveat that FDI is largely a measure of financial

[4]For summaries of taxation and investment decisions see Devereux (2007) and De Mooij and Ederveen (2008).

[5]Slemrod (1990) raised this issue and it remains important, though somewhat forgotten: "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. Unfortunately, no data exist on real investment made by foreign branches and subsidiaries."

flows that do not necessarily correspond to investment itself.[6] In addition, FDI statistics report the parent country for bilateral FDI by the location of its the *immediate* parent company. This creates two complications for studying spillovers. First, there is double counting in pass-through FDI, as the same underlying investment would 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), thus highlighting the prevalence of double counting in FDI statistics.[7] Mismeasurement of real investment location would in turn imply measurement error in the tax rates for the home country, for investment from intermediate countries, as well as in the host country tax rate, for pass-through investment in the intermediate countries. Mischaracterization of tax rates in the ultimate host and parent country would make it difficult to understand the true effects of tax spillovers for real investment.

We overcome the challenge in data measurement 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 Statistics authorities. The FAI data is free from the typical measurement issues in FDI statistics, as it records tangible investment in physical capital assets undertaken by foreign affiliates in each host country and the location of their ultimate parent as the parent country. Along with FAI, the FAS data reports turnover, gross-value added, employment and other economic activities for foreign 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. We estimate the effects of taxes on FAI in a Poisson Pseudo Maximum Likelihood (PPML) model in order to address the issue of many zero observations in

[6] 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.

[7] Blouin and Robinson (2019) discuss a related issue of double counting in foreign profits, which is rooted in equity method of accounting.

the investment variable. We exploit the exogenous variation in the tax differentials due to non-host country tax rates, which should be independent of any contemporaneous changes in the host country's taxation.

Our main findings suggest that spillovers of statutory CIT on FAI is substantial, the equivalent of a semi-elasticity of approximately -3.0, similar in size to the semi-elasticity of -2.98 with respect to the statutory tax rate in the host country.[8] Spillovers in the statutory CIT rate are more pronounced in the EU single market, and are robust to a host of alternative specifications and samples, including controlling for profit shifting as well as aggregate macroeconomic shocks and other non-tax determinants of FAI, for example. Our analysis confirms that spillovers in corporate taxes are mainly concentrated in the statutory rate, as there is lack of evidence on any significant effect of METR in the parent country, or outside the host country in general, on FAI. Two other interesting findings are worth noting. First, FAI is more sensitive to tax rate changes than FDI, suggesting that measurement issues in FDI statistics are likely to mute the true effect of taxes on multinational investment. Second, our results show that accounting for profit shifting would alleviate the negative effect of host-country METR on inward FAI, which becomes positive and imprecisely estimated once adjusting the METR measure with a profit shifting component.

Overall our analysis, both theoretical and empirical, point to the presence of significant spillovers in CIT, mainly through the headline statutory tax, on real investment by multinationals. To quantify the extent of investment gain (or loss) from limiting international corporate tax competition, both in aggregate and for individual countries, we simulate the impact of a minimum tax that is agreed upon at the global level and is levied by the host rather than by the parent country.[9] Our results suggest that how aggregate FAI would respond to the minimum tax would depend on the rate. A minimum tax would increase

[8]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.

[9]This may appear to run counter to the rule order envisaged in Pillar Two, which gives primacy to the 'Income Inclusion Rule' (in effect, topping up to the minimum by the residence country) over the 'Undertaxed Payments Rule' (topping up at source). Source countries, however, have a strong incentive to preempt a foreign government's imposition of a minimum rate by imposing that minimum itself: this has no impact on the investor but transfers revenue to itself (Hebous and Keen, 2021).

aggregate FAI by up to 0.1 percent at a relatively low rate of between 15 and 19 percent, but will start to dampen aggregate FAI once reaching above 19 percent. While the impact on aggregate FAI is rather modest, for individual countries the impact of a minimum tax is more pronounced, especially for low tax countries for which the minimum rate is binding.

Our work relates to several strands of literature.[10] 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, there is a rich empirical literature on foreign direct investment (FDI) and taxation, as recently surveyed in De Mooij and Ederveen (2003) and Feld and Heckemeyer (2011), that 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 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))

In the remainder of the paper, Section 2 develops the conceptual framework to analyze the spillover effect of corporate taxes on multinational investment and derives the main empirical predictions. Section 3 describes the data. Sections 4 and 5 present the estimation strategy and empirical findings, respectively. Finally, Section 7 concludes.

# 2 Conceptual Framework

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 by $K_j$ the tangible capital located in jurisdiction $j$ (the choice of which is the central concern

[10] To be updated.

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 $B$.[11] 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.[12] 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

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

where $\rho$ 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

[11] 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.

[12] 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)[13] that:

$$\frac{\partial R}{\partial F_A}.F_A^{'}(K_A)=\frac{\rho+M_A}{1+\Gamma_A(T_A,T_B)} \tag{4}$$

where

$$\Gamma_A(T_A,T_B)\equiv\frac{T_A-\sum_{j=A,B}T_j\gamma_j}{1-T_A}, \tag{5}$$

in which the weight $\gamma_j \equiv \frac{\partial R_j/\partial F_A}{\partial R/\partial F_A}$ 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 $A$:

[13]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

$$(1-T_A)\frac{\partial R_A}{\partial F_A}+(1-T_B)\frac{\partial R_B}{\partial F_A}=\frac{\partial R}{\partial F_A}\left(1-T_A+T_A-\sum_{j=A,B}T_j\gamma_j\right) \tag{3}$$

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:[14] 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 (4) 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 (4),

$$\frac{\partial R}{\partial F_A}\Big(1 + \Gamma_A(T_A, T_B)\Big) = 1 - e + e.\Delta_A(T_A, T_B) \tag{6}$$

[14] Attaching a multiplier $\lambda$ 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 $\lambda$, this becomes $L_j = \sum_{i=A,B} L_i$.

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 $\theta_j \equiv F_j/(F_A+F_B)$:[15] 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 $S_j$

[15] Equation (6) follows from (4) on noting that in this case $\partial R_A/\partial F_A = p.(1-e\theta_A)$ and $\partial R_B/\partial F_A = -pe\theta_B$.

into jurisdiction $j$ to be of the form $(1/2\phi\rho K_i)(S_i)^2$.[16] The consequences of this, along with the extension of the analysis above to the $N$-country case, are explored in an Appendix [to be written]. For this general case, the key equation (4) above becomes, for the typical host country $h$,

$$\frac{\partial R}{\partial F_h}.F_h^{'}(K) = \frac{\rho + M_j - \Phi(T_1, ...., T_N)}{1 + \Gamma(T_1, ..T_N)}, \tag{7}$$

where

$$\Phi \equiv (\phi/2)(\sum_{j=1}^{N} T_j\omega_j - T_h)^2 \tag{8}$$

where $\omega_j \equiv K_j/\sum_{i=1}^{N} K_i$ and now $\Gamma(.) = (\sum_{j=1}^{N} T_j\omega_j - T_h)/(1 - T_h)$. This form of profit shifting thus acts as a reduction in the standard METR: 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). The two profit shifting terms that now appear—one related to underlying business realities, the other a matter of opportunistic relabeling—are evidently related, but (beyond the difference in weights) operate in significantly different ways.**Need to check what follows** 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 in 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 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,

[16]Essentially the same form is used by, for example, Huizinga and Laeven (2008) and Beer et al. (2020b).

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.[17] 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 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.[18] These, however, focus on financial flows rather than real investment, differing from

[17] 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.

[18] 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)).

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[19] 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 invested 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

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).

[19]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.

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 **external** 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. **I STILL THINK WE C/SHOULD BE A BIT MORE PRECISE HERE**] 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.[20] 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.[21]

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

[20] 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.

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

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.[22]

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.[23] 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.[24] In contrast, the difference is much smaller for investment from developing countries (panel c) or treaty partners (panel d).[25] 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

[22]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.

[23]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.

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

[25]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.

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 (7) in Section 2 requires specifying the weights $\gamma_j$ in the tax differential term $\Gamma$. 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 $\Delta$ 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 $\Delta$ 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 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 $\beta_{MH}$ and $\beta_{AH}$ 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 (7) 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 $\theta$ is lagged to alleviate spurious correlations between market size and investment. Noting that $\Delta_{hpt}$ can be decomposed as:

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

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 $\theta$ as relative production shares (consistent with eq.(10) above), we explore two different weighting schemes: (1) sales-based,[26] 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, $\theta^{K}_{hpt} = \frac{K_{hpt}}{K_{pt}}$. 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 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.[27] Using these

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

[27] Sales share in EU is the share of bilateral foreign affiliate sales of country $p$ in EU country $h$ divided by

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 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

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.

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.[28] To control for the potential

[28]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*

impact of profit shifting on investment, Column (6) replaces the standard METR variable with "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. Column (7) adds the interaction between the adjusted METR and the tax differential to capture any potential non-linear effects.[29] 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 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

*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.

[29]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.

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.[30] 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 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.

## 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

[30] 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.

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 4 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 5). 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 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.[31] Note that we cannot restrict the sample to cover the same set of host or parent countries - doing so would defeat the purpose of this analysis. This is because even for the same underlying funds, double counting of FDI will imply that there would be multiply 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 6 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

[31] Without the measurement errors, FDI as financial flows are likely to be more responsive than FAI (Saez et al., 2012).

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

**Attenuation Bias in Tax Variables.** Table 7 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 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.[32]

While important detail remains to be clarified, two general features of the agreement stand out. One is that—following an agreed 'rule order'—topping up to achieve the minimum may be done by either the host country or the immediate parent. Which country does the topping up matters a good deal for the allocation of tax revenue, of course, but is immaterial for present purposes: 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

[32]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.

it is specified in terms of an *effective* rate, reflecting 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 rate (reflecting that base) and marginal effective tax rate: in the setting of Section 2, the (average) effective tax rate of the entity in country $j$, defined as the ratio of tax paid 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 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 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 $\Delta_j$ 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 an increase: this

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

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 countries, is relatively small, it increases markedly—and even changes sign—at higher levels of the minimum.[34] At a 15 percent minimum, aggregate FAI is projected to increase by a very modest 0.1 percent: the first of the effects above, increased FAI in countries not directly affected by the minimum, dominates. Things quickly reverse at higher minima, as more countries become obliged to raise their tax rate: at minima abve 17 percent reduced FAI in low tax countries that are affected comes to dominate. At a 25 percent, for example, total FAI in our host countries would decrease by 0.5 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 22 host countries in our sample, illustrated in Figure 6. At 15 percent, most countries other than Bulgaria would see a small increase in their FAI, given that the increase in the Bulgarian CIT rate would imply a smaller CIT differential for multinationals investing elsewhere, but has no impact on METRs outside Bulgaria. Higher minima of course bind more countries, and reductions in inward FAI become more prevalent. At a minimum of 21 percent, for example, close to half 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 Luxembourg would see reductions in inward FAI or 15 and 5 percent respectively, while FAI into Slovakia increased by over 2 percent.[35] Figure 7 shows the number of host countries in our sample that gain/lose FAI at each level of the minimum rate, where starting from 21 percent, more countries would lose FAI than those who gain. 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

[34]We plan to extent the analysis by applying our results to a larger sample of host countries.

[35]Note that Bulgaria is included in the dataset, though for the statutory CIT rate there is relatively low compared to the rest of the sample. For better visualization, in plotting these figures Bulgaria is omitted as the percentage loss of FAI is greater than 15 percent.

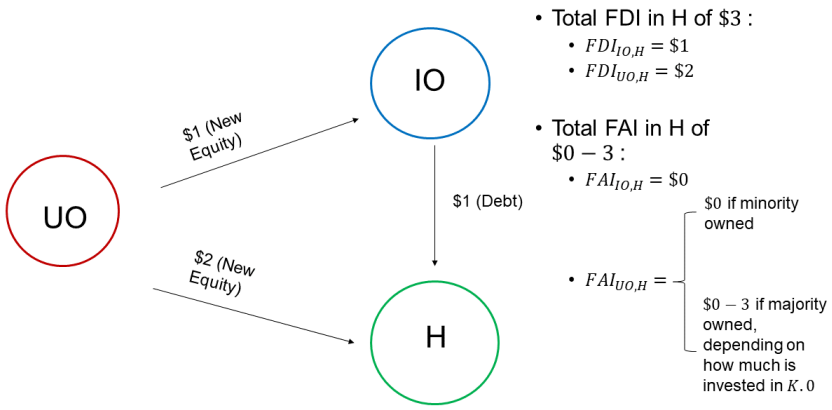
process over time which we do not capture in our analysis.

# 7 Conclusions

Despite increased global interest in spillovers of corporate tax policy that are motivated by national objectives, there is few empirical evidence on their implications for real investment. This paper fills this gap. It examines the spillover effects of corporate taxes by exploiting a new data set on real economic activities of multinational affiliates. Guided by a simple theoretical model, it is argued that statutory CIT rate in other countries should affect multinational investment in a given country within an integrated market, while the marginal effective tax rate should have no spillovers for investment by unconstrained multinationals. Our data reports real investment and other economic activities for foreign affiliates from 187 origin countries in 32 host countries during the period of 2003 to 2016. The estimates suggest that, on average, 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. Spillovers in corporate taxes are mainly concentrated in the statutory rate, as our results suggest that there is lack of evidence on any significant effect of origin-country METR on FAI.

Our results have important policy implications. For example, national reform in corporate tax policy may well distort the international allocation of capital, implying a larger dead weight loss than considered in the absence of tax spillovers. The evidence on the spillovers in real investment may exacerbate tax competition, as countries formulate how to respond through changes in their own tax system. Binding international coordination can prevent this, but might not be beneficial for all countries.

Figure 1. No Direct Correspondence between FAI and FDI



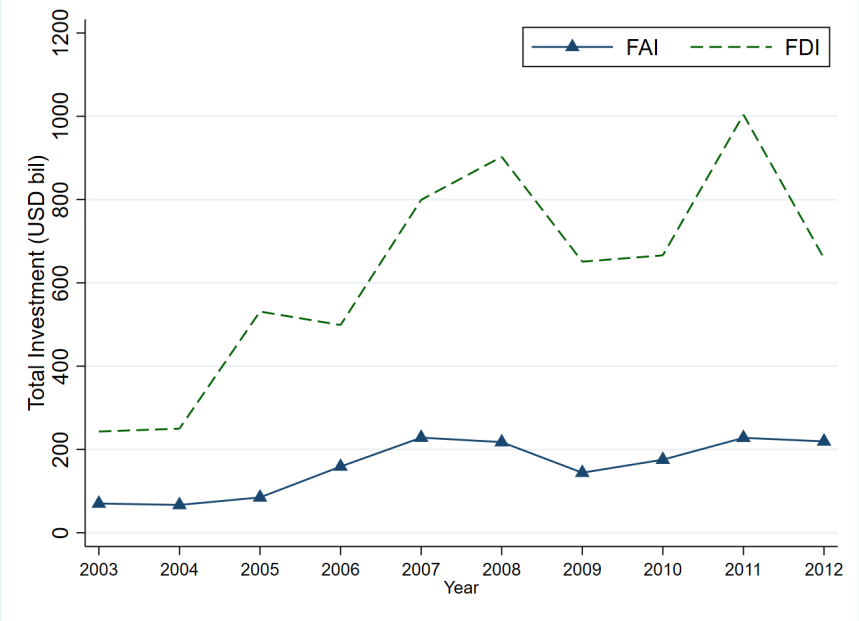

Notes: UO is the country of ultimate ownership, IO is the country of immediate ownership and H is the host country of investment.

Figure 2. FAI vs. FDI: In Aggregate

(a) In Aggregate



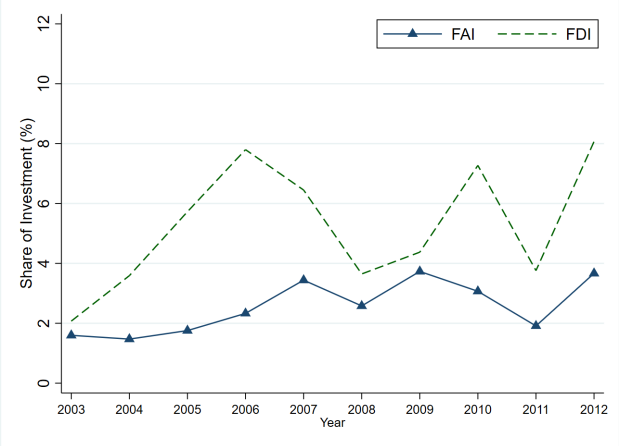

(b) EU Host Countries




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

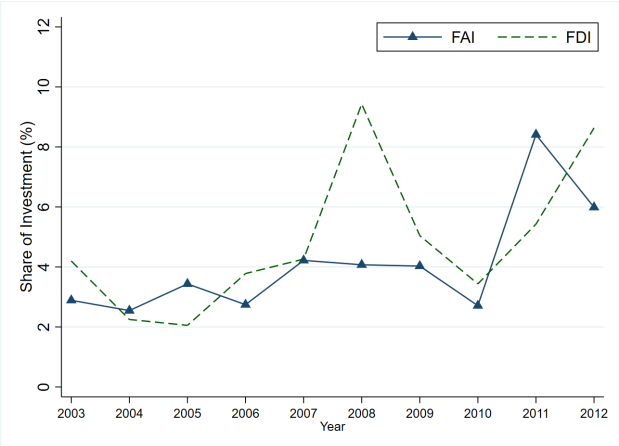
(a) Low-Tax




(b) Investment Hubs




(c) Developing



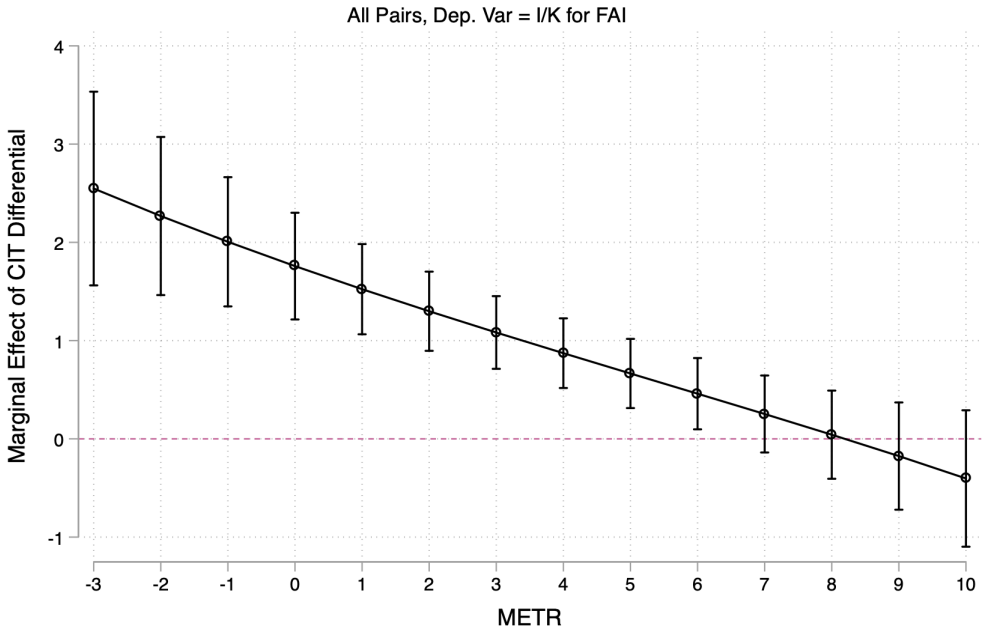

(d) Treaty Partners



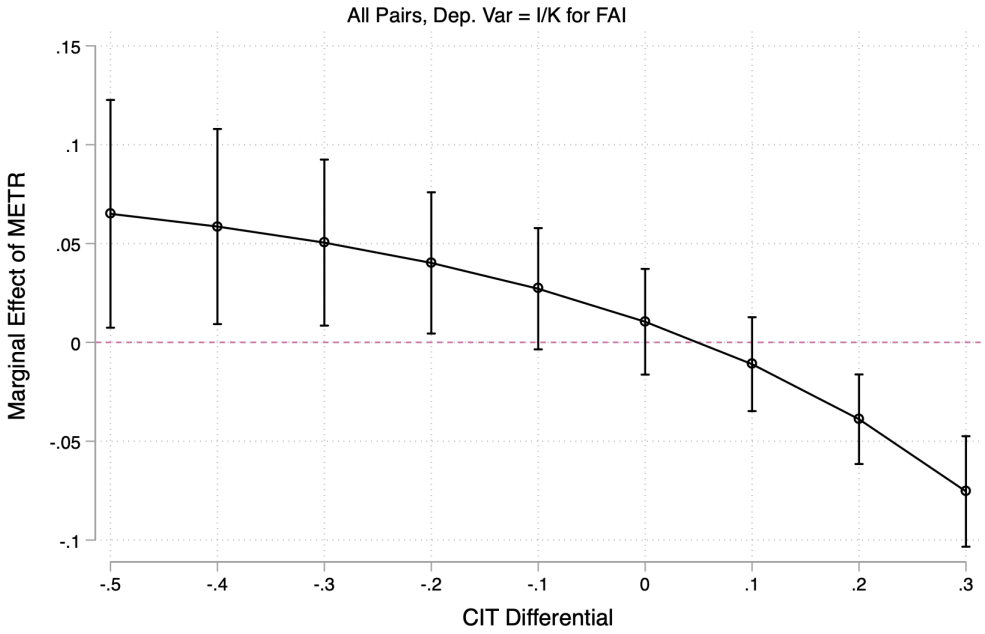

Notes: This figure compares the share of FAI/FDI relative to total FAI/FDI by origin country characteristics, including in origin countries that are low-tax (defined as with statutory CIT rate less than 20 percent, panel (a)), developing countries (panel (b)), investment hubs (panel(c)) and treaty partners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

Figure 4. Non-linear Effects of Corporate Tax Rates

(a) Marginal Effects of CIT Differentials

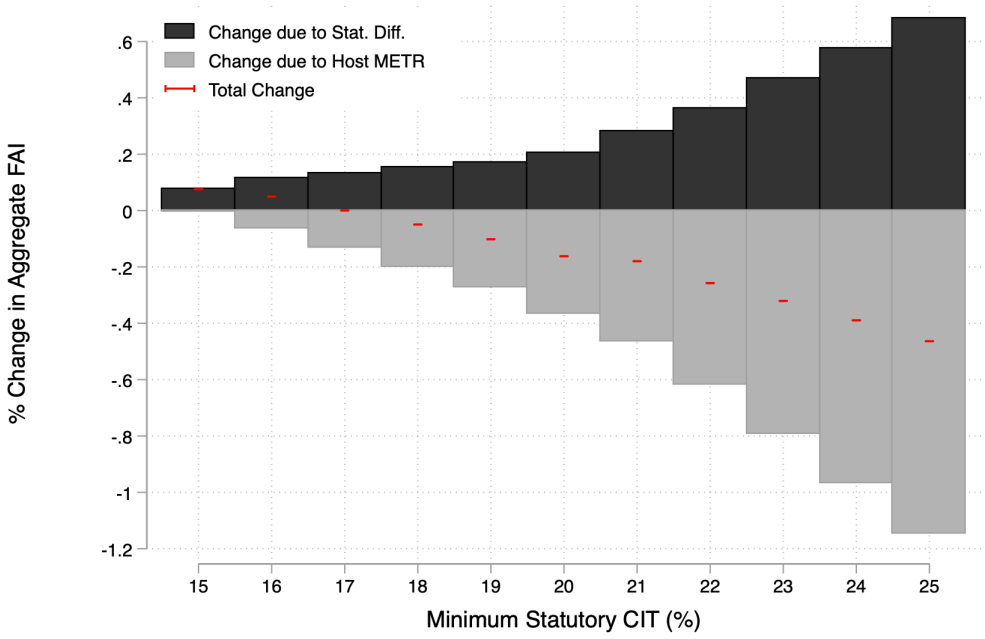



(b) Marginal Effects of Adjusted-METR



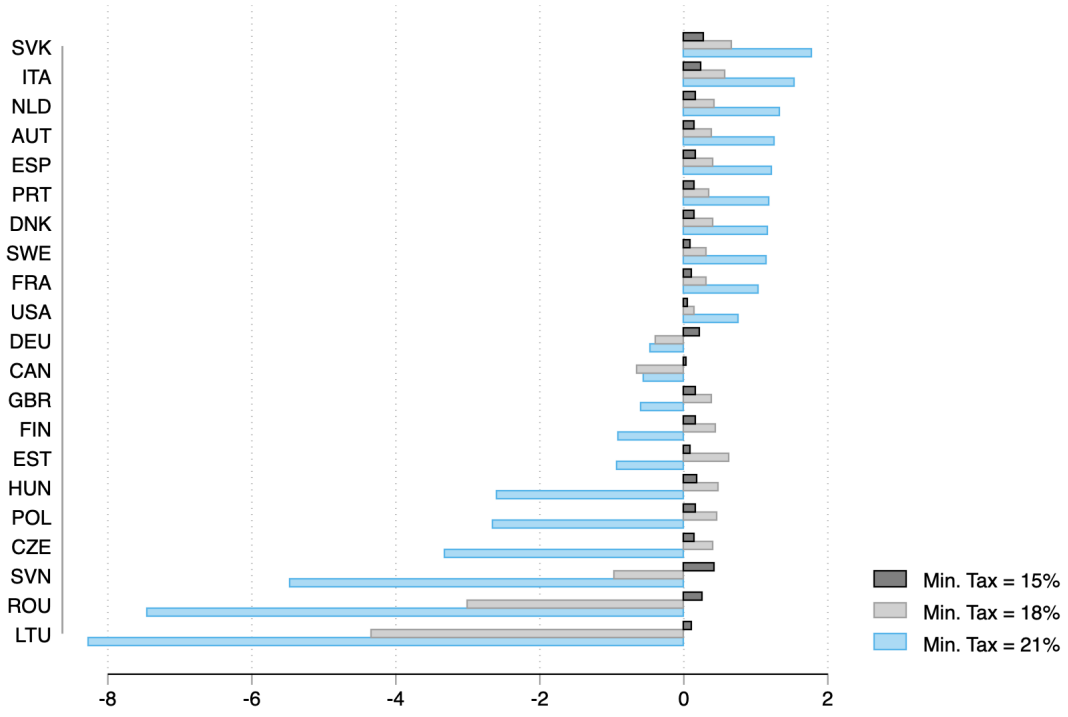

Notes: The top panel shows the marginal effect of the CIT differential along the distribution of adjusted-METR values; the bottom panel shows the marginal effect of METR along the distribution of CIT differential values.

Figure 5. Aggregate FAI and Minimum Tax Rates



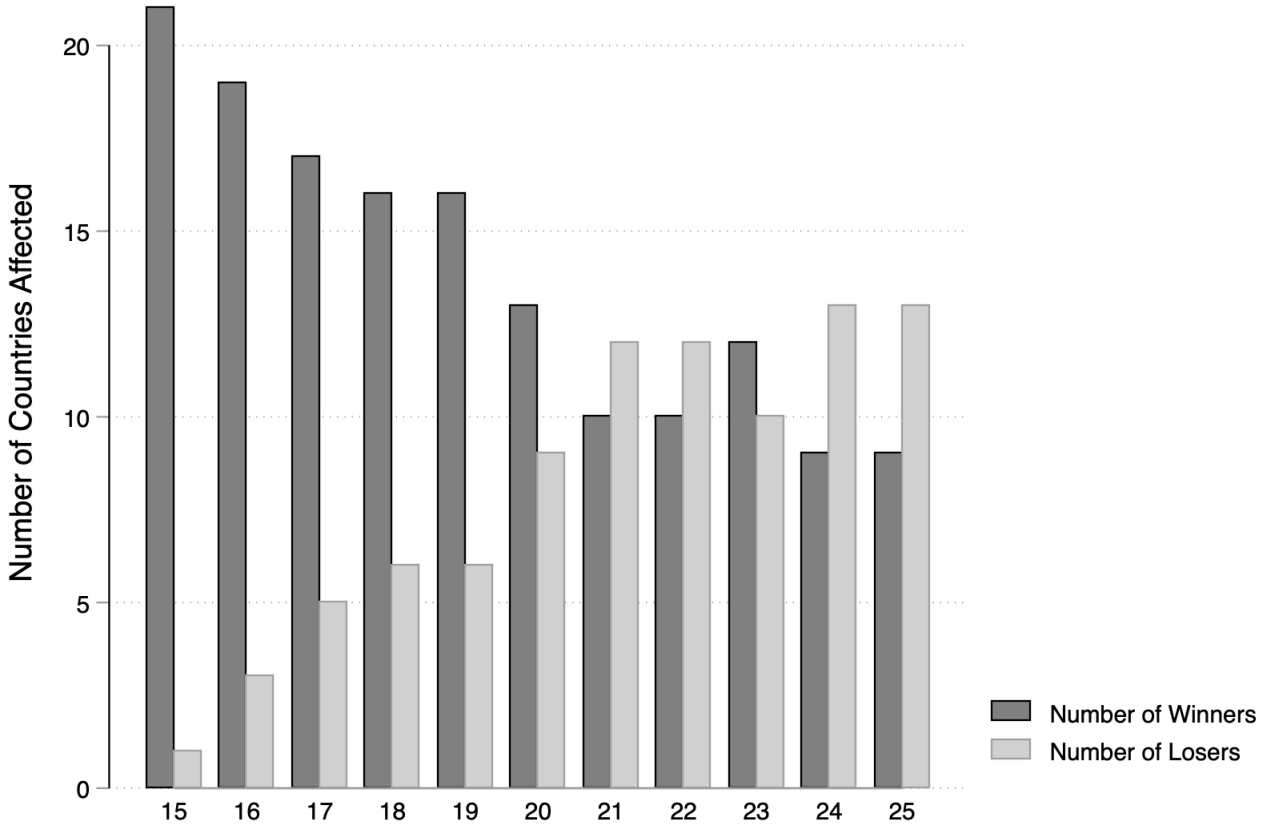

Notes: This figure plots the percentage change in aggregate FAI received in our sample of host countries, along the distribution of minimum corporate tax rates ranging between 15% and 25%. These results correspond to corporate tax rates and FAI for the year 2016. The dark grey bars show the impact of a statutory minimum rate through the statutory differential, the grey bars show the impact through METR and the red lines show the total impact. Note that Bulgaria is the only host country directly affected by a minimum tax of 15 or 16 percent.

Figure 6. Distribution of Investment Impact and Minimum Taxation




Notes: This figure plots the percentage change in FAI received per host country, along the distribution of minimum corporate tax rates set to 15%, 18%, and 21%. These results correspond to FAI for the year 2016. Bulgaria is omitted from the graph, as the impact is -15 percent.

Figure 7. Number of Winners and Losers at Different Minimum Rates




Notes: This figure shows the number of countries that win and lose at different values of a minimum rate, along the x-axis.

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** | **Mean** | **SD** | **P10** | **P50** | **P90** |
| $I_{FAI}/K_{FAI}$ | 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** | **Mean** | **SD** | **P10** | **P50** | **P90** |
| 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 12,047 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 5). 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=16,226). 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

| Dependent Variable: FAI Ratio | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| CIT Differential | 2.984*** | | | | 1.477*** | 1.713*** | 4.535*** |
| | (0.729) | | | | (0.476) | (0.463) | (0.749) |
| Host CIT Comp. | | -2.845*** | | -2.266* | | | |
| | | (1.096) | | (1.247) | | | |
| Non-Host CIT Comp. | | 3.023*** | | | | | |
| | | (0.623) | | | | | |
| CIT Differential, EU | | | 1.928*** | | | | |
| | | | (0.650) | | | | |
| CIT Differential, Non-EU | | | 0.764*** | | | | |
| | | | (0.234) | | | | |
| Non Host Component, EU | | | | 2.001*** | | | |
| | | | | (0.588) | | | |
| Non Host Component, Non-EU | | | | 0.816*** | | | |
| | | | | (0.224) | | | |
| Host METR | | | | | -0.063* | | |
| | | | | | (0.036) | | |
| Adjusted Host METR | | | | | | 0.001 | 0.028 |
| | | | | | | (0.027) | (0.037) |
| Adjusted Host METR × | | | | | | | -0.568*** |
| CIT Differential | | | | | | | (0.113) |
| Observations | 12,047 | 12,047 | 12,047 | 12,047 | 12,047 | 12,047 | 12,047 |
| Pseudo-$R^2$ | 0.166 | 0.166 | 0.167 | 0.167 | 0.128 | 0.128 | 0.132 |
| Controls: | Parent, Bilateral | Parent, Bilateral | Parent, Bilateral | 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 |

*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.

Table 3. Robustness of Baseline Results

| Specification: | CIT Differential Weighted by K | | CIT Differential Weighted by Exports | | FAI / Value Added | | Host Country IV with Lags | |
|---|---|---|---|---|---|---|---|---|
| Dept Var: FAI Ratio | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| CIT Differential | 1.344*** | | 0.217 | | 2.735*** | | | 3.595*** |
| | (0.341) | | (0.502) | | (0.600) | | | (1.102) |
| Host CIT Comp. | | 0.246 | | 1.178*** | | -2.976*** | -3.495 | |
| | | (0.349) | | (0.247) | | (1.039) | (2.218) | |
| Non-Host CIT Comp. | | 1.346*** | | 0.955*** | | 2.665*** | 3.038** | |
| | | (0.286) | | (0.302) | | (0.572) | (1.503) | |
| Host METR | | | | | | | | 0.0128 |
| | | | | | | | | (0.047) |
| Observations | 12,047 | 12,047 | 12,047 | 12,047 | 8,462 | 8,462 | 9,653 | 11,213 |
| Pseudo-$R^2$ | 0.17 | 0.17 | 0.16 | 0.17 | 0.22 | 0.22 | 0.16 | 0.17 |
| 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 | 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 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. (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 | Host, Parent Bilateral | Host, Parent Bilateral | Host, Parent Bilateral | Host, Parent Bilateral | Host, Parent Bilateral | Host, Parent Bilateral |
| 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 5. 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 4) due to a smaller sample size, which is restricted due to parent METR data availability.

Table 6. Gravity Model: FAI vs FDI

| Dept Var: | log FDI | log FAI | FDI | FAI |
|---|---|---|---|---|
| Model: | OLS | OLS | PPML | PPML |
| | (1) | (2) | (3) | (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 7. Responding to Corporate Taxes: FAI vs FDI

| Dept Var: | FAI | FDI | FAI | FDI |
|---|---|---|---|---|
| | (1) | (2) | (3) | (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, |
| | Bilateral | Bilateral | Bilateral | Bilateral |
| FEs: | 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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# A Supplementary Figures and Tables

Table A.1. Host Countries and the CIT Rates in 2016

| Host Country | Statutory CIT Rate | Average Differential | METR |
|---|---|---|---|
| Bulgaria | 10.00 | 0.17 | 5.15 |
| Lithuania | 15.00 | 0.12 | 5.09 |
| Romania | 16.00 | 0.11 | 5.33 |
| Slovenia | 17.00 | 0.10 | 5.50 |
| Czechia | 19.00 | 0.09 | 5.45 |
| Hungary | 19.00 | 0.09 | 5.71 |
| Poland | 19.00 | 0.09 | 5.60 |
| Estonia | 20.00 | 0.09 | 7.24 |
| Finland | 20.00 | 0.11 | 5.74 |
| United Kingdom | 20.00 | 0.09 | 6.10 |
| Denmark | 22.00 | 0.08 | 5.82 |
| Slovakia | 22.00 | 0.07 | 5.72 |
| Sweden | 22.00 | 0.07 | 5.75 |
| Austria | 25.00 | 0.02 | 5.76 |
| Netherlands | 25.00 | 0.05 | 5.44 |
| Spain | 25.00 | 0.04 | 6.67 |
| Canada | 26.70 | 0.05 | 5.85 |
| Portugal | 29.50 | -0.02 | 5.65 |
| Germany | 30.18 | -0.07 | 6.11 |
| Italy | 31.29 | -0.06 | 4.31 |
| France | 34.43 | -0.12 | 6.19 |
| United States | 38.92 | -0.18 | 6.51 |

Notes: Our sample is restricted to European countries with FAS data, Canada and the United States. The countries here are ordered from lowest to highest statutory CIT rates in 2016. The only host country in our sample which is directly affected by the minimum rate of 15 percent is Bulgaria, which has had a statutory CIT rate of 10 percent since 2007, which was previously set to 15 percent between 2005-2006. The average statutory differential is reported for each host country (it is an average because the differential term term varies by host and parent per year) and the host country's METR is also reported.

Table A.2. Number of Host Countries Directly Affected (By Year and per Minimum Rate)

| Min. Tax Rate | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
|---|---|---|---|---|---|---|---|
| 2005 | 0 | 1 | 3 | 3 | 3 | 4 | 4 |
| 2006 | 0 | 1 | 2 | 3 | 3 | 4 | 4 |
| 2007 | 1 | 1 | 2 | 2 | 2 | 3 | 4 |
| 2008 | 1 | 1 | 2 | 2 | 2 | 4 | 5 |
| 2009 | 1 | 1 | 2 | 2 | 2 | 4 | 6 |
| 2010 | 1 | 1 | 2 | 2 | 2 | 6 | 7 |
| 2011 | 1 | 1 | 2 | 2 | 2 | 6 | 7 |
| 2012 | 1 | 1 | 2 | 2 | 3 | 7 | 7 |
| 2013 | 1 | 1 | 2 | 3 | 3 | 6 | 6 |
| 2014 | 1 | 1 | 2 | 3 | 3 | 6 | 7 |
| 2015 | 1 | 1 | 2 | 3 | 3 | 6 | 9 |
| 2016 | 1 | 1 | 2 | 3 | 3 | 6 | 9 |

Notes: Our sample is restricted to European countries with FAS data, Canada and the United States. The only host country in our sample which is directly affected by the minimum rate of 15 percent is Bulgaria, which has had a statutory CIT rate of 10 percent since 2007, which was previously set to 15 percent between 2005-2006. More countries are directly impacted once we test the impact of higher minimum rates.