Playing Easy or Playing Hard to Get: When and How to Attract FDI*

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Abstract: We show the observed variation in corporate tax policies depends on each country's institutional quality in tax collection using a model of heterogeneous multinationals that can shift income using debt and transfer prices. Countries with weak institutional capacity are either worse off attracting foreign direct investment (FDI) or their optimal policies collect no tax revenues from foreign subsidiaries. Countries with moderate institutional capacity can gain from under-utilizing their ability to collect taxes, since the benefit of attracting more FDI outstrips the cost of less tax revenue. Countries with strong institutions benefit from attracting FDI that generates corporate tax revenues.

Keywords: FDI, thin capitalization rules, transfer pricing, institutional quality
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1 Introduction

Foreign direct investment (FDI) accounts for significant welfare gains in developed and developing countries[1] as well as the loss of billions of dollars in tax revenue through income shifting to low-tax countries.[2] In this paper, we develop a model that parsimoniously integrates key components of multinational tax policy in order to explain simultaneously three empirical puzzles regarding the corporate tax policies used to influence FDI and collect tax revenue: (1) substantial variation in statutory corporate tax rates across countries, with the highest rates in developing countries (OECD 2022), (2) substantial and discrete differences in the amount of income shifting countries permit (EY 2018), and (3) a significant proportion of foreign affiliates of multinational firms that shift 100% of taxable income out of their host countries.[3] We show that these empirical regularities can be understood as arising from variation in the institutional capacity in tax administration across host countries and a strategic incentive for some countries to under-utilize their institutional capacity.

In light of claims that tax competition leads to a race to the bottom, the substantial differences in statutory corporate tax rates across countries is puzzling because empirical studies find that income shifting by multinationals is mainly driven by differences in statutory tax rates (Huizinga and Laeven 2008 and Dowd et al. 2017). Statutory tax rates are, on average, highest in developing countries even though the corporate sector in developing countries is dominated by large multinational companies (IMF, OECD, UN and World Bank 2016 and OECD 2022) and the corporate tax rate is one of the main drivers in attracting FDI in developing countries (Mooij and Ederveen 2008).[4] These facts suggest that multinationals use income shifting to avoid paying

[1] See Ramondo and Rodrìguez-Clare (2013).

[2] Tørsløv, Wier, and Zucman (2023) estimate that about 36% of multinational profits are shifted to tax havens each year.

[3] See De Simone, Klassen, and Seidman (2017), Dharmapala and Hebous (2017), Bilicka (2019), and Johannesen, Tørsløv, and Wier (2020).

[4] In a recent survey paper, Hohmann, Riedel, and Zinke (2024) show that tax administrative capacity in developing countries is much lower than in developed countries (Figure 1) and that low-income countries on average levy a higher corporate tax rate of 30.5% relative to 26.2% in high-income countries (Figure 2).

statutory rates. Thus, countries may need to trade off the non-tax value of FDI against tax base erosion.[5] We show how a country's institutional capacity affects when we should think of FDI in combination with income shifting as a boon, resulting in better economic development, or as a bane as multinationals extract more than the benefit they create in a country.

Jurisdictions differ widely in their approach to curb income shifting (EY 2018). Some countries use the OECD (2013, 2015) toolbox to the fullest extent; others have in place lenient rules. A common method for income shifting involves financing an affiliate with a loan from another affiliate. Income is shifted to the lending affiliate because interest paid on debt is generally tax deductible. In 2018, 42 countries used a safe harbor thin capitalization rule to impose a ceiling on debt to capital ratios above which interest payments on debt are no longer tax deductible. The limits ranged from 0.5 to 0.8. In contrast, 95 (mainly developing) countries imposed no limit which is effectively a safe harbor limit of one.[6] Figure 1 plots the 2018 corporate tax rates and safe harbor limits for non-OECD countries (excluding 11 tax haven countries that all have zero tax rates and safe harbor limits of one). A puzzling feature of the data is the 20 percentage-point gap or bifurcation between countries that have no thin capitalization limit (i.e., a limit of 1) and those that have lower safe harbor limits starting around 0.8. Our paper pioneers the first economic rationale for this bifurcation.

We show this bifurcation arises because of a natural non-convexity in host country welfare caused by common tax loss rules that eliminate the tax benefit from income shifting when affiliate taxable income reaches zero. For a host country, the non-convexity means a country that benefits from attracting FDI must choose between two distinct locally-optimal policies: one that generates

[5]Crivelli, de Mooij, and Keen (2016) show that tax revenue losses from base erosion amount to 1% of GDP in developed countries and 1.5% of GDP in developing countries. For developing countries, World Bank Group (2018) estimates of fiscal losses from tax avoidance are as high as 5.9% of GDP.

[6]In addition, 23 predominately OECD countries used an earnings stripping rule that imposed a maximum limit, ranging from 10% to 60%, on interest payments to earnings ratios. Five countries used a combination of safe harbor and earnings stripping rules and four countries used some other type of rule (EY 2018).

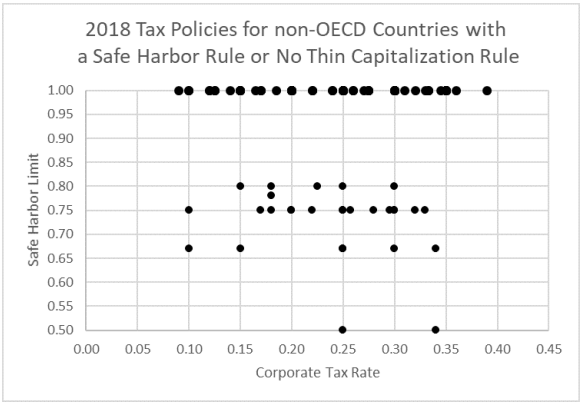

Figure 1: Safe Harbor Limits and Tax Rates
The figure includes all non-OECD countries with safe harbor rules or no thin capitalization rule except for those tax haven countries with a zero corporate tax rate and no thin capitalization limit: Bahamas, Bahrain, Bermuda, Bonaire, BVI, Cayman Is., Guernsey, Isle of Man, Jersey, Maldives, and UAE.

taxable income from the FDI and one that does not.[7] We show that generating taxable revenue from FDI is globally optimal for countries with robust tax administration capacity, while it is globally optimal for countries with weaker institutional capacity, typically developing nations, to adopt policies that do not yield taxable revenue from FDI. This is, however, only part of the explanation. Consistent with empirical data, our analysis additionally shows that some countries with a moderate capacity will under-utilize their capacity to curb income shifting and adopt the same policies as lower-capacity countries.

Although income shifting via debt financing with tax loss rules can create the bifurcation pattern seen in Figure 1, debt shifting alone cannot facilitate complete income shifting and explain the third empirical regularity (zero taxable revenue) unless the affiliate's production function yields no rents.[8] Full income shifting does arise for some tax policies when firms can also shift in-

[7]Thus, small differences in a country's administrative quality can result in large changes in its optimal policy, as suggested by Figure 1. For example, Tunisia's thin capitalization limit is 0.5 (at a corporate tax rate of 25%) while Morocco's limit is 1 (at a corporate tax rate of 31%).

[8]The papers in footnote 3 find 20-50% of affiliates reporting non-positive tax bases. See also footnote 24.

come via transfer prices.[9] When affiliates report zero taxable income, the host countries that induce such behavior only raise corporate tax revenues from relatively inelastic domestic investment at a high tax rate.[10]

To generate all three empirical regularities, we derive the optimal tax policy for a host country with an immobile domestic firm and multinationals that differ in terms of their fixed costs of operating a subsidiary. Multinational firms can use transfer pricing and debt shifting to shift income to a tax haven until a no-loss-offset rule binds. The country chooses a statutory corporate tax rate and a thin capitalization rule, given the institutional quality/capacity of its tax administration, to maximize a weighted sum of labor income, tax revenues, and domestic sector profit.[11]

In our model, the optimal tax policy in a country with low institutional capacity has a high corporate tax rate, no thin capitalization limit, and zero taxable affiliate income. Conversely, the optimal policy in a country with high institutional capacity has a low corporate tax rate, a thin capitalization limit less than one, and positive taxable affiliate income. We are aware of no other paper that simultaneously generates all three empirical regularities.

Our analysis reveals three key reasons for the observed empirical patterns. First, a host country's institutional quality influences its optimal tax policy. A country's institutional quality is a function of its tax administration capacity and its utilization of that capacity. Developed countries, with advanced tax administrations, generate strictly positive taxable income from FDI through their optimal policies. In contrast, developing countries, with less advanced tax administrations as documented by Hohmann, Riedel, and Zinke (2024), have optimal policies that induce lower tax revenues and lower domestic sector profit to get non-tax FDI benefits, such as higher wages or knowledge spillovers.

[9]Heckemeyer and Overesch (2017) find that both channels are also important for estimating the semi-elasticity of profits with respect to international tax differentials.

[10]This result is consistent with Hines (2010, p 120) who states, "tax avoidance opportunities presented by tax havens allow other countries to maintain high capital tax rates without suffering dramatic reductions in foreign direct investment."

[11]For simplicity, transfer pricing in our model involves setting the interest rate on internal loans. This assumption is consistent with the experience of one of the authors from court cases in which the primary issue was the interest rate on internal loans.

These theoretical results align with the empirical results in Fuest, Hebous, and Riedel (2011) on debt financing and in Johannesen, Tørsløv, and Wier (2020) on tax revenues in which countries with less tax administration quality adopt permissive tax policies in order to attract more FDI.[12]

Second, debt financing and transfer pricing jointly affect a host country's welfare. Lenient thin capitalization rules shift the corporate income tax towards a cash flow tax, fostering an increase in FDI because more affiliate income can be shifted to tax havens via debt financing. Aggressive transfer pricing allows firms to shift more supernormal profit to a tax haven, enabling a host government to tax relatively immobile domestic investment at a higher rate and highly mobile international investment at a lower effective rate.

Third, countries with intermediate institutional capacity may choose to under-utilize this capacity, adopting policies similar to those of lower-capacity countries. While under-utilization reduces affiliate tax revenues, the boost in FDI from under-utilization can more than offset the welfare losses from reduced revenue when full utilization yields little tax revenue. Austria, Ireland, Israel, and Sweden are examples of countries with good institutional capacity whose policies our theory would associate with low-capacity countries. This idea of strategic under-utilization by countries with intermediate levels of institutional capacity is consistent with observed policies and new to the FDI literature.

Our analysis further identifies conditions under which the welfare costs of FDI from lower tax revenues and lower domestic sector profit outweigh its benefits from higher wages so that the optimal tax policy attracts no FDI. The conditions are suggestive of developing countries, which tend to have a large informal sector, rely heavily on tax revenues from a small number of large firms, and have scarce tax administration resources.[13] Our finding that

[12]Investment tax credits (ITCs) exacerbate the income shifting problem because they shift income out of the host country before a multinational uses debt financing and transfer prices. Thus, ITCs complement lax enforcement by making tax avoidance more profitable on the margin. Adding ITCs to our model complicates the analysis without modifying the main conclusions of our analysis.

[13]Corporate tax revenue makes up a greater percentage of total tax revenue in developing countries than in developed countries (Avi-Yonah 2016). A large informal sector (see Dharmapala, Slemrod, and Wilson 2011) and weak institutional quality make it difficult

FDI can reduce a country's welfare if its institutional quality is weak is in line with NGO concerns about the possibility that FDI may be a burden to a country if multinationals can strip out most of the benefits of FDI, something to which developing countries are especially vulnerable. For example, OECD (2002) documents in a meta-study that the benefits of FDI hinge on appropriate host country policies and a basic level of development in a country. Several empirical studies also indicate that the net effect of FDI depends on country characteristics, particularly the strength of local financial markets and institutional quality.[14] Acemoglu, Johnson, and Robinson (2001) estimate that, if a country initially lies in the 25th percentile for institutional quality, and can improve its institutions so that it moved into the 75th percentile, national income would be increased sevenfold.

In section 2, we discuss the related literature. We set up the model in section 3. A motivating example is presented in section 4. Equilibrium firm choices for each possible host country policy are derived in section 5. In section 6, we analyze a host country's locally optimal tax policies, and in section 7, we identify and discuss its globally optimal policy. We then show how the globally optimal policy can vary with a country's institutional capacity, and when a country would choose to under-utilize its capacity. We offer concluding remarks in section 8.

2 Literature review

The literature on the welfare effects of FDI is large and spans several topics. We shall concentrate our review on those papers that study how corporate income tax policies affect welfare when multinationals can shift income to tax havens. Slemrod and Wilson (2009) prove that tax havens lower host country

for these countries to rely on personal income tax revenues. They rely instead on domestic firms. Fjeldstad and Moore (2008) report that 286 domestic companies contribute about 70 per cent of domestic tax revenue in Tanzania. The Corporate Tax Statistics database (OECD 2022) reports 2018 CIT revenue as a share of total tax revenues of 19.2% in Africa, 15.6% in Latin-America, and only 10% in OECD countries.

[14] See the survey by Alfaro and Chauvin (2018).

welfare when the country can charge domestic investors and foreign investors different tax rates, and workers can avoid wage taxes. Tax havens limit the power of a host country to tax the normal return on investment and indirectly tax workers. Positive welfare effects from tax havens are found in Desai, Foley and Hines (2006). They argue that while tax havens may allow multinationals to reduce income taxes paid in high-tax jurisdictions, tax havens also provide non-tax benefits to host countries by increasing the return to real investment. The effect stems from mitigating political or institutional constraints that prevent a country from levying different tax rates on mobile and immobile capital. Intuitively, when capital is perfectly mobile, a source-based tax on capital falls on immobile factors of production (Gordon 1986). Tax havens may help firms avoid the tax on mobile capital partly or wholly, and reduce the adverse effects of inefficient policies.[15]

However, this "tax havens are good" literature does not account for the combined effect of transfer pricing and debt shifting - the two most common income-shifting mechanisms - on a host country's welfare. Neither does this literature consider a country's institutional ability to curb income shifting. Our study bridges the above two literatures by showing how the welfare effects of tax havens depend critically on the interaction of both income shifting mechanisms, which constrains a country's ability to tax supernormal profits, and a country's institutional capacity to curb income shifting.

Our analysis is novel in four main ways. First, most previous studies of the welfare effects of income shifting only consider the use of debt to shift income (e.g., Hong and Smart 2010) or non-specific methods of income shifting (e.g., Slemrod and Wilson 2009 and Wang 2020).[16] We show that both debt financing and transfer pricing are essential income shifting channels for addressing the variation in thin capitalization rules and the incidence of full income shift-

[15]Wang (2020) estimates the welfare effects of corporate taxes in the presence of non-specific income shifting when income shifting creates no intensive margin production effects and full income shifting is assumed away. Spencer (2020) models the effect of repatriation taxes without income shifting.

[16]Gresik and Nelson (1994) derive optimal transfer price regulations of a monopolist. Gresik, Schindler, and Schjelderup (2017) derive the optimal thin capitalization rule given debt financing and transfer pricing, a representative firm, and a fixed host country tax rate.

ing when economic rents are present. Second, we explicitly account for the role of multinational affiliates that report zero taxable income because the marginal tax benefits of income shifting generally cease at this point. Despite the prevalence of such affiliates, the norm in optimal tax papers is to assume away the possibility of non-positive reported income. Third, we model heterogeneous fixed costs for setting up a subsidiary in a host country so that we can capture both intensive and extensive margin effects of corporate income tax policy on FDI.[17] Fourth, we model the ability of a host country's tax authority to audit and identify income shifting as an exogenous capacity, which takes significant time for a host country to improve, and an endogenous quality decision of how much of its capacity to utilize in deterring tax avoidance.

Hong and Smart (2010) show that a host country can benefit from adopting tax policies that attract FDI by allowing multinationals to shift some of their income to a tax haven using only debt financing. Their model has no role for transfer pricing, no firm heterogeneity, and no accounting for negative taxable income. Internal debt reduces a multinational's after-tax cost of capital and leads the multinational to increase its overall capital investment in the host country. Increased investment increases the demand for labor, which in turn increases the host wage rate and host welfare. The same forces are present in our model. The optimal host country policy in their paper is either a thin capitalization limit of one when there are no agency costs associated with internal borrowing or a limit strictly less than one when agency costs are present. Neither prediction is consistent with the variation seen in Figure 1. In contrast, we show in our model that differences in the ability of countries to deter income shifting in the presence of debt financing and transfer pricing generate the observed pattern of thin capitalization limits.

Besides Hong and Smart (2010), there is a small theoretical literature on the optimal design of thin capitalization rules.[18] Haufler and Runkel (2012)

[17] In models with a representative multinational, the tax loss rule can also imply that no pure-strategy market equilibrium exists.

[18] The empirical literature on thin capitalization rules focuses on their effects on capital structure (e.g., Fuest et al. 2011, Büttner et al. 2012, and Blouin et al. 2014) and on the location of affiliates (e.g., Merlo et al. 2019) but not optimality.

study tax competition equilibria when countries compete in tax rates and thin capitalization levels and countries can differ in population. Their paper does not include transfer pricing effects. Mardan (2017) focuses on the role of capital market imperfections. Gresik, Schindler, and Schjelderup (2017) and Kalamov (2020a) study the choice of safe harbor vs. earnings stripping rules using the Hong and Smart (2010) model. Kalamov (2020a) also assumes that capital investment takes time. All of these papers assume a representative multinational. They also ignore extensive margin effects and the effect of negative taxable income, both of which we show are important for understanding the variation in tax policy choices across host countries.

Mardan (2023) models country variation in the level of economic development. A country chooses its level of tax administration, where the cost is a function of the country's development. Firms shift income in a non-specific manner. The model includes no labor or wage effects, no firm heterogeneity, no entry costs, and no negative income provisions. Mongrain, Oh, and van Ypersele (2023) model a cost of tax administration a host country can control. Their focus is on tax rate competition but they also provide a condition based on endogenous variables under which a tax-revenue maximizing country does not want to completely shut down income shifting. Income shifting is generic and generates no intensive margin effects. They do not consider tax losses.

Gordon and Li (2009) examine whether tax enforcement challenges in poorer countries explain the gap between optimal tax model predictions and real-world data. They assume that governments rely on bank records to identify taxable entities, leading firms to choose between the economic benefits of using the financial sector as a formal firm or avoiding tax liabilities by operating as an informal firm. Their model captures both an intensive and an extensive margin in the formal/informal sector choice for domestic firms in a developing country. While we also embed an extensive margin for the formal/informal sector, our model, in contrast, focuses on optimal tax policy for both developing and developed countries, the intensive and extensive margins of multinationals, and how multinational decisions affect the intensive and extensive margins of domestic firms.

Gordon and Li (2009) do not model multinational firms, profit shifting, or FDI, but speculate on how corporate taxes and tax revenue would change if these features were included in their model. A key limitation of their model is that it assumes constant returns to scale, which implies that the corporate income tax is a unit tax on capital income. Therefore, it excludes supernormal multinational profits. In contrast, our model allows decreasing returns to scale, supernormal profits, and profit shifting through transfer pricing and debt. We demonstrate that these elements combined with a country's institutional ability to curb profit shifting are essential to explain the observed variation in tax policies across developing and developed countries.

Finally, our paper informs a literature in development economics that estimates the effects of improving tax administration quality. Basri et al. (2021) exploit a natural experiment in Indonesia and find that improving tax administration increased tax revenues by turning previously unrecognized revenues into taxable income. Gadenne (2017) finds that a program to improve tax capacity in Brazilian municipalities also improved tax revenues. In contrast, Brockmeyer et al. (2021) show that increasing the property tax rate dominates better tax enforcement in Mexico. This empirical literature does not analyze the effect of institutional quality on broader welfare dimensions such as investment levels and wages. In contrast, our theoretical analysis identifies the precise link between the welfare effects of tax revenues, FDI, and wages and optimal corporate income tax policies.

3 The model

There is a single host country whose economy consists of workers who inelastically supply one unit of labor, a representative entrepreneur who owns a domestic firm, and possible multinational activity. The host country has a competitive labor market from which all firms operating in the host country hire labor at a market-clearing wage, w. There are no non-traded goods. The host country levies a corporate income tax rate of t on the taxable income of the domestic firm and any multinational firms.

The profit-maximizing domestic firm makes two decisions. It chooses the amount of labor to employ, taking the wage rate w, as given. If the domestic firm employs l_d units of labor, it produces $G(l_d)$ units of output. The production function $G(\cdot)$ is strictly increasing and strictly concave in l_d. The output price is fixed at one so that the domestic firm's pre-tax income is

$$\pi = G(l_d) - wl_d. \tag{1}$$

Second, it chooses to operate in the formal sector or the informal sector of the host economy. If it operates in the formal sector, it earns post-tax profit of $(1-t)\pi$. If it operates in the informal sector, it avoids paying any corporate income tax but incurs an opportunity cost of $\phi_i + \xi\pi^2$, where $\phi_i > 0$ and $\xi \geq 0$, to avoid notice from the tax authorities. The more gross operating profit it generates, the more costly it is to operate in the informal sector. Define the dummy variable D_i to be equal to one if the firm elects to operate in the formal sector and zero otherwise. Thus, the net profit of the domestic firm is

$$\Pi^d = \begin{cases} (1-t)\pi & \text{if } D_i = 1 \\ \pi - \phi_i - \xi\pi^2 & \text{if } D_i = 0. \end{cases} \tag{2}$$

According to (2), for the same level of employment the domestic firm will elect to operate in the formal sector if, and only if, $t\pi \leq \phi_i + \xi\pi^2$.

One can think of the opportunity cost from operating as an informal firm as a reduction in firm profitability needed to avoid detection, not unlike the practice observed in countries with presumptive income tax systems. The practical import of this decision is that it endogenously bounds the maximum tax rate the host government can charge that generates tax revenue from the domestic firm.

There exists a continuum of multinational firms of mass one that maximize after-tax global profit and are headquartered outside the host country. To introduce an extensive margin effect of host tax policy, each multinational may open an operating subsidiary in the host country by incurring a fixed cost $\phi \geq 0$. The value of ϕ for a multinational is independently drawn from a

uniform distribution on $[\underline{\phi}, \bar{\phi}]$, where $0 \leq \underline{\phi} < \bar{\phi}$. This variation in fixed entry costs is consistent with the empirical evidence in Arkolakis (2010) and Eaton, Kortum, and Kramarz (2011), and is used in Bucovetsky and Haufler (2008). The operating subsidiary is endowed with the production function $F(l_m, k)$, where l_m denotes the amount of host country labor it employs and k denotes the amount of capital invested in the subsidiary. $F(\cdot, \cdot)$ is strictly increasing and strictly concave, and is homogeneous of degree $\eta \in (0, 1)$ in capital and labor. The subsidiary pays the same competitive wage rate as the domestic firm and sells its output in a competitive market whose price is also normalized to one. The domestic firm and the subsidiaries do not compete in any product market.

Each operating subsidiary is capitalized by a parent-owned financing subsidiary located in a tax haven. The parent's economic cost of capital is r. The capital takes the form of equity, E, and/or internal debt, B, so that $k = E + B$. Following most corporate income tax codes, we assume interest expenses are tax deductible, but equity costs are not. For simplicity we do not allow any subsidiary to take on external debt.[19] We assume each multinational's economic cost of capital reflects a country-firm-specific risk so that r need not simply equal a worldwide interest rate.[20] The idiosyncratic cost of capital allows each multinational to charge its host country subsidiary an interest rate R that can differ from r and implies that a multinational's taxable income in the host country, denoted by Π_T, equals

$$\Pi_T = F(l_m, k) - w l_m - RB. \tag{3}$$

That is, R is the transfer price of internal debt. Allowing multinationals to use their transfer prices on debt to shift income out of the host country is a simple way to see the linkages between debt shifting and transfer pricing.

[19] Davies and Gresik (2003) study the role of debt borrowed from host country investors.

[20] While the tax competition literature tends to assume multinationals can finance investments at a worldwide interest rate, our assumption adopts a corporate finance view in which each subsidiary's economic cost of capital varies with its CAPM β, which will depend on country-specific factors such as the strength of the host country's legal system.

The host country can limit the firm's choice of R by auditing the firm. Each multinational incurs tax administration auditing costs of $\alpha C(R-r)B$. The cost function $C(\cdot)$ satisfies $C(0)=0$ and $C'(0)=0$, and is strictly convex in $R-r$, as we take r to be the arm's-length interest rate.[21] The auditing costs are proportional to the amount of debt. They are linear in B to coincide with the standard Comparable Uncontrolled Price (CUP) method most countries use to test if a company's transfer price is effectively an arm's-length price. While the size of any non-compliance penalties is proportional to B, the auditing costs per dollar of debt will depend on $R-r$ in a non-linear way.[22] The parameter $\alpha > 0$ reflects different levels of auditing sophistication/intensity by the host country. In practice, α is chosen by a host country to reflect marginal welfare benefits and costs of stronger administration. Initially, we treat α as an exogenous country characteristic reflecting its institutional capacity to administer its tax code due to factors such as auditing expertise, court system quality, or the level of corruption. These are characteristics that are not easily or quickly changed. Lower values of α correspond to a country with higher marginal administrative costs or less expertise to audit transfer prices and impose non-compliance penalties. We then endogenize the host country decision to under-utilize its institutional capacity and show how the choice of institutional quality can be driven by strategic factors.

As the host country levies the same tax rate on domestic firm income and subsidiary host country income, a multinational's global after-tax profit equals

$$\Pi = \begin{cases} (1-t)\Pi_T + RB - rk - \alpha CB - \phi & \text{if } \Pi_T \geq 0 \\ F(l_m,k) - wl_m - rk - \alpha CB - \phi & \text{if } \Pi_T < 0. \end{cases} \tag{4}$$

The first line of (4) is the sum of a multinational's after-tax operating profit

[21] If $C(\cdot)$ is linear, the multinational will either shift no income with R or the maximum amount possible. This would make the firm's transfer price independent of t, which is not consistent with the empirical evidence in Cristea and Nguyen (2016), Davies et al. (2018), and Flaaen (2017).

[22] Under the common CUP method, the probability that a firm is non-compliant, and subject to tax avoidance penalties, depends in an increasing way on the difference between a firm's transfer price and its actual cost. See Gresik and Osmundsen (2008) for more details.

plus the profit realized in the tax haven affiliate net of capital costs, income shifting costs, and the fixed cost of entry.[23] The second line of (4) reflects a host country policy that disallows a tax deduction for subsidiary losses. The term $-\alpha CB$ still appears in this second line because transfer pricing remains costly for multinationals, even when the marginal benefit is zero. Regardless of the value of Π_T, the fixed entry costs are not tax deductible.

We show in the Appendix that without additional regulation each multinational has the incentive to finance its subsidiary entirely with debt, i.e., $B = k$, to take advantage of the preferred tax treatment of debt costs. However, debt financing alone is insufficient to shift all subsidiary income out of the host country because the subsidiary production function is homogeneous of degree less than one. Thus, the full income shifting we see in practice requires a combination of debt financing and transfer pricing. No multinational will want to shift so much income that $\Pi_T < 0$ because income shifting is costly.[24] At fixed values of l_m and k for which $F(l_m, k) - wl_m - rk \geq 0$, $\Pi_T < 0$ implies that Π is strictly decreasing in R for $R > r$. This means that at an optimum a multinational will always set its transfer price so that $\Pi_T \geq 0$.[25]

The host country can adopt a thin capitalization rule to discourage multinationals from financing foreign operations entirely with debt. Safe harbor rules are the most common type of thin capitalization rule in practice. Thus, as in Hong and Smart (2010) and Büttner et al. (2012), a subsidiary can claim

[23] In reality, income shifting costs incurred in the host country from spending resources on audits (e.g., hiring consultants and lawyers) are tax deductible from host income whereas the part that falls on (expected) penalties for non-compliance cannot be deducted. For simplicity and without loss of generality, we assume that all income shifting costs are incurred in the tax haven and thus are not tax deductible. Tax-deductible income shifting costs can have a quantitative level effect on income shifting as the after-tax shifting costs decrease, but tax deductibility does not generate qualitative effects.

[24] Many countries allow losses to be carried forward to offset taxable income in future years or to be eventually repatriated to the parent company. These options have no effect in a single period model. In practice, loss offsets are still imperfect because they can expire and because they are not adjusted for inflation.

[25] Adding a term to the firm's profit function to reflect costs associated with the amount of subsidiary debt would alter a firm's mix of transfer pricing and internal debt to shift income but would not alter the host country's main economic trade-offs because the cost function αCB already captures some regulatory cost that is proportional to B.

a full tax deduction for the interest payments it makes to its parent as long as its debt to total capital ratio does not exceed, $b \in [0,1]$, that is, $B/K \leq b$. Interest payments on any debt in excess of this limit are not tax-deductible. The choice of $b = 1$ is equivalent to choosing no rule at all. For any $b < 1$, if the multinational were to choose $B > bk$, the interest payments on $B - bk$ of the parent debt would not be tax deductible but the higher debt level would increase total transfer price costs if $R > r$. Given the incentive for a multinational to set $B = k$ in the absence of a safe harbor rule, the imposition of a safe harbor rule for any $b \leq 1$ when $t > 0$ will imply $B = bk$ and a subsidiary debt-equity ratio of $b/(1-b)$.[26]

For each host policy (b,t), the domestic firm's problem is to choose l_d and D_i to maximize (2). As long as $\pi < 1/2\xi$, the domestic firm's optimal level of employment solves $G_L(l_d) = w$ regardless of D_i. Let $L_d(b,t)$ denote this equilibrium level of employment.

A multinational that establishes a subsidiary in the host country will choose l_m, k, and R to maximize[27]

$$\Pi = (1-t)\Pi_T + (Rb - r - \alpha Cb)k - \phi \text{ s.t. } \Pi_T = F(l_m, k) - wl_m - Rbk \geq 0. \quad (5)$$

Multinationals can exhibit extensive margin differences. A multinational with sufficiently large entry costs may choose not to enter because the multinational can always guarantee itself zero global profit from its host country operations by not entering. By the Envelope Theorem, there exists $\hat{\phi} \in [\underline{\phi}, \bar{\phi}]$ such that multinationals with $\phi \leq \hat{\phi}$ will enter and those with $\phi > \hat{\phi}$ will not. Denote the measure of multinational firms that enter by $M = (\hat{\phi} - \underline{\phi})/(\bar{\phi} - \underline{\phi})$.

Host country welfare is the weighted sum of labor income, after-tax domestic firm profit, and tax revenues.[28] Labor income can also proxy for other non-tax benefits associated with FDI such as knowledge spillovers. Let $\beta_w \geq 0$

[26] We discuss the implications of adopting an earnings stripping rule in Section 7.

[27] One can think of l_m, k, and R as solving a representative multinational's problem because the intensive margins are the same for all multinationals. Heterogeneity in terms of productive efficiency would generate a distribution of labor and capital demands across entrants but would not affect our main results.

[28] In contrast, studies such as World Bank Group (2020) focus only on jobs benefits.

denote the welfare weight on domestic labor income. Let $0 \leq \beta_\pi \leq 1$ denote the welfare weight on domestic firm profit net of taxes or the avoidance costs of operating as an informal firm. The welfare weight on tax revenue is normalized to 1. Assuming $\beta_\pi \leq 1$ eliminates the desirability of subsidizing firms with tax revenues. Thus, host country welfare is defined as

$$\begin{aligned} \Omega = \beta_w w &+ \beta_\pi(\pi - (1 - D_i)(\phi_i + \xi\pi^2)) + (1 - \beta_\pi)t\pi D_i \\ &+ t(F(l_m, k) - wl_m - Rbk)M. \end{aligned} \tag{6}$$

The host country will choose its thin capitalization parameter b and its tax rate t to maximize its welfare. If $\beta_w < 1$ and $\beta_\pi < 1$, then the host country prefers a dollar of tax revenue over a dollar of wage gains or after-tax domestic profit (see footnote 13). The welfare weights β_w and β_π can be understood to measure the importance of private income (or private consumption) relative to government spending (or public good consumption).[29] Our formulation allows us to consider optimal tax policy for countries with a wide range of welfare functions including national income maximization ($\beta_w = \beta_\pi = 1$) and tax revenue maximization ($\beta_w = \beta_\pi = 0$).

4 A motivating example

We begin with an example to highlight the economic trade-offs that yield two properties of the policies seen in Figure 1: Many countries adopting no thin capitalization rule and the bifurcation gap between countries with $b < 1$ and those with $b = 1$. Figure 2 graphs host country welfare, Ω, as a function of the thin capitalization parameter, b, holding t fixed, for two slightly different host countries in which both the multinational and domestic sectors generate rents. In the graph on the left, the host country has less institutional capacity, reflected by a lower value of α. The specific values used are not meant to

[29] In this sense, the welfare weights are related to the Pareto weights in the optimal tax literature. The Pareto weights measure social marginal utility of income and decrease with (private) income. If we used endogenous weights, our welfare weights would be decreasing in tax revenue. Such an effect would only reinforce our results.

reflect calibrated values but only to illustrate the range of possible welfare effects from different thin capitalization rules.

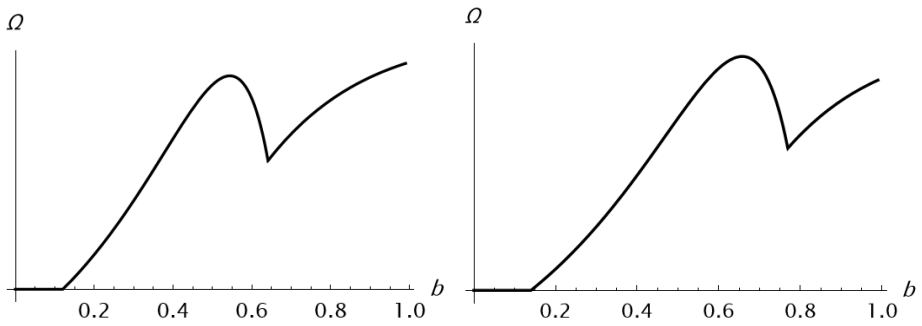

Figure 2: Host country welfare, Ω, is plotted as a function of the thin capitalization parameter, b, when $F(l_m, k) = k^{0.3} l_m^{0.5}$, $r = 0.08$, $t = 0.45$, $G(L_d) = L_d^{0.85}$, $C(R - r) = (R - r)^2$, $\phi \in [0.1, 10]$, $\beta_\pi = 0.3$, and $\beta_w = 1$. In the left graph, $\alpha = 2$. In the right graph, $\alpha = 3$.

In both graphs, the observed welfare patterns are due to three multinational responses to a host country's tax policy. First, the constant welfare region corresponds to low values of b at which the host country attracts no FDI. This region only exists for sufficiently high tax rates. The limited amount of income shifting allowed via debt financing and transfer pricing is insufficient to permit any multinational to cover its fixed cost of entry. At low enough rates, the host country can attract FDI without allowing for income shifting via debt. Second, the middle region in which welfare is quasi-concave in b corresponds to values of b at which the host country attracts strictly positive levels of FDI and the subsidiaries report strictly positive taxable income. The quasi-concave shape of the welfare function reflects a trade-off between the benefits of increased wage income from multinational employment and losses from lower domestic sector profits and lower tax revenues. Initially, increases in b attract enough FDI to generate a net increase in welfare through wage increases. At some point, the wage gains from further increases in b are not sufficient to outweigh the welfare losses.[30] Third, in the strictly increasing region at high values of b the host country attracts FDI but none of the subsidiaries report taxable

[30] At low tax rates, one observes behavior consistent only with this region.

income. They are successful in shifting all of their income into the tax haven through a combination of transfer pricing and debt financing. Host welfare is increasing in b in this region as the gains from higher wages dominate the tax revenue losses from the domestic sector.

The non-convexity in the host country's preferences is caused by the tax loss provision because increases in b no longer reduce subsidiary tax revenues.[31] It creates two local optima. On the left, the global optimum occurs at $b = 1$ while on the right, the global optimum occurs at $b = 0.66$. At $\alpha \approx 2.3$, the optimal value of b jumps from 1 down to 0.59. Thus, the graphs show that a small change in institutional capacity can generate a large difference in the optimal thin capitalization rule. In the next sections, we will determine optimal firm behavior and how it influences optimal host country tax policy.

5 Equilibrium firm choices

In this section, we characterize the complete range of equilibrium firm behavior given a host country's tax policy. We then use our results in the next section to derive a host country's optimal tax policy. For each tax policy, (b, t), an equilibrium consists of a profit-maximizing choice of labor, capital, and a transfer price by each multinational that chooses to enter, the set of entering firms defined by $\hat{\phi}$ (with mass M), an optimal labor choice and an optimal choice to operate as a formal or informal firm by the domestic firm, and a market-clearing wage. We denote these equilibrium values by $L_m(b,t)$, $K(b,t)$, $R(b,t)$, $\hat{\phi}(b,t)$, $L_d(b,t)$, $D_i(b,t)$, and $w(b,t)$. Thus, aggregate multinational labor demand equals ML_m, aggregate FDI equals MK, and the host country's tax base is $\pi + M\Pi_T$. Also let $\Pi^*(b,t,\phi)$ denote a multinational firm's indirect profit when its entry cost is equal to ϕ.

We will show that the resulting equilibrium for each (b,t) must fall into one of three cases: (1) $M > 0$ and $\Pi_T > 0$, (2) $M > 0$ and $\Pi_T = 0$, and (3) $M = 0$. We denote the set of values of (b,t) associated with each of these cases by $\mathcal{M}_{++}$, $\mathcal{M}_{+0}$, and $\mathcal{M}_0$. These regions are independent of the decision

[31] Recall that convex preferences differ from a function being convex.

of the domestic firm whether or not to operate as a formal firm. This decision will affect host welfare; thus, we defer more discussion of this decision until section 6.

In cases 1 and 2, the amount of FDI is positive because some multinational firms enter. In case 1, the subsidiaries report strictly positive income. In case 2, the subsidiaries shift all of their taxable income out of the host country. In case 3, no multinational firms enter so there is no FDI in equilibrium. Our goals in this section are to describe the tax policies that generate each type of equilibrium and derive the comparative statics associated with tax policy changes. The sets of tax policies that generate each type of equilibrium are illustrated in Figure 3. It is constructed by analyzing multinational behavior for each type of equilibrium. We now turn to this analysis to explain the elements of Figure 3.

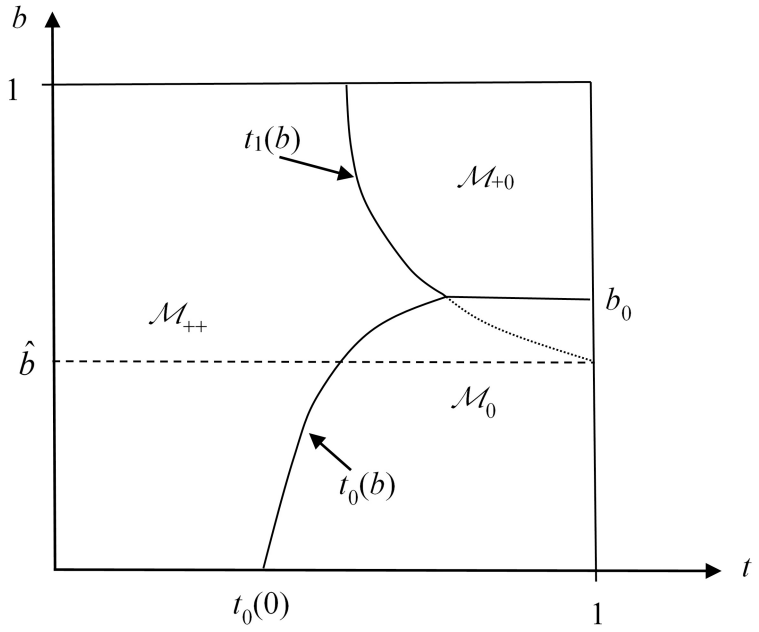

Figure 3: Equilibrium Regions

For each multinational, L_m, K, R, and $\hat{\phi}$ not only solve (5), they also max-

imize aggregate multinational profit.[32] With μ denoting the multiplier on the constraint, $\Pi_T \geq 0$, the associated Lagrangian is

$$\Lambda = M(\hat{\phi})\left[(1-t)\Pi_T + (Rb - r - \alpha Cb)K\right] - \int_{\phi=\underline{\phi}}^{\hat{\phi}} \phi dM(\phi) + \mu M(\hat{\phi})\Pi_T. \quad (7)$$

The first-order conditions associated with (7) differ if $t < 1$ and if $t = 1$. If $t < 1$, the firm's first-order conditions in any positive-FDI equilibrium imply

$$F_L(L_m, K) = w, \quad (8)$$

$$F_K(L_m, K) = \frac{(\mu - t)Rb + r + \alpha Cb}{1 - t + \mu}, \quad (9)$$

$$t - \alpha C' = \mu, \quad (10)$$

$$\hat{\phi} = (1-t)\Pi_T + (Rb - r - \alpha Cb)K + \mu\Pi_T, \quad (11)$$

and

$$\mu\Pi_T = 0 \quad (12)$$

where $\mu \geq 0$. By (8), each multinational will equate its marginal product of labor, F_L with the wage rate. By (9), it will equate its marginal product of capital, F_K with its effective cost of capital, which is defined by the right-hand side of (9) and is affected by α and (b, t). With positive taxable income, (10) implies each multinational's transfer price will equate its marginal tax savings, t, with its marginal cost of income shifting, $\alpha C'$. If this transfer price implies negative taxable income, each multinational will lower its transfer price until $\Pi_T = 0$. In either situation, the profit from income shifting per dollar of debt net of income shifting costs, $R - \alpha C$, is increasing in R and at least equal to r because the marginal cost of transfer pricing, $\alpha C'$, is less than one. By (11), the marginal multinational to enter will earn zero after-tax global profit. Eq. (12) is the complementary slackness condition.

[32] Maximizing aggregate profit transforms a discrete entry choice into a continuous choice and makes evaluating the comparative statics simpler. See Mas-Colell, Whinston, and Green (1995), section 5.E.

If $t = 1$, a multinational benefits only from income shifted to the tax haven. We define a multinational's net income shifting profit as the tax haven affiliate's interest income net of financing (r) and income shifting costs (αCbK) or $(Rb - r - \alpha Cb)K$. Per unit of capital, this net income shifting profit is maximized when R solves $\alpha C' = 1$, which we denote by $R^*(1)$. For a multinational to invest in the host country, its optimal net income shifting profit must be greater than or equal to its fixed entry cost, ϕ. Define $\hat{b} = r/(R - \alpha C)$ at $R^*(1)$ as the value of $b \leq 1$ above which a multinational's optimal net income shifting profit is positive. For any $b \leq \hat{b}$, net income shifting profit is non-positive. No multinational will enter because none will be able to cover the fixed cost of entry.[33] For any $b > \hat{b}$, a multinational earns strictly positive net income shifting profit on each unit of capital. If it could, a multinational would invest an infinite amount of capital just to shift income out of the host country. However, for a large enough value of K, the subsidiary's taxable income will be strictly negative, i.e., $\Pi_T < 0$. Thus, for a multinational that enters, K, L_m, and R imply $\Pi_T = 0$, $F_L = w$, and $\mu = 1 - \alpha C' > 0$.[34]

An equilibrium also requires the domestic firm to employ labor until the marginal product of labor equals the wage rate,

$$G_L(L_d) = w, \tag{13}$$

and for the labor market to clear,[35]

$$L_d + M(\hat{\phi})L_m = 1. \tag{14}$$

Thus, a positive-FDI equilibrium with $t < 1$ is defined by the solution to (8)

[33] If for some $b \leq \hat{b}$, $R^*(1)$ implies $\Pi_T < 0$, any $R < R^*(1)$ still results in no entry.

[34] For α close to zero, $R^*(1)$ goes to infinity and $\hat{b} = 0$. The host country is unable to deter transfer prices that shift all subsidiary income out of the host country. If instead $\alpha \to \infty$ so that a host country can detect any transfer price deviation, then $R^*(1)$ goes to r, $\hat{b}$ goes to 1, net income shifting profit goes to $rK(b-1) \leq 0$, and there is no FDI at $t = 1$.

[35] Without heterogeneous firms, the tax loss restriction will imply generically that no pure-strategy market-clearing wage rate exists.

- (14). A no-FDI equilibrium for $t < 1$ is defined by $L_m(b,t) = K(b,t) = 0$, $\hat{\phi}(b,t) = \underline{\phi}$, $L_d(b,t) = 1$ and $w(b,t) = G_L(1)$. The value of $R(b,t)$ is not relevant. For $t = 1$, the host tax is a pure profit tax in the absence of FDI. We assume that the domestic firm maximizes its pre-tax income, in this case so that the equilibrium is still defined by $L_d(b,t) = 1$ and $w(b,t) = G_L(1)$.

To ensure that each type of equilibrium arises for some tax policies, we make two assumptions:

$$\text{(A1) } F(L_m(0,0), K(0,0)) - w(0,0)L_m(0,0) - rK(0,0) > \underline{\phi} \text{ and}$$

$$\text{(A2) } (R(1,1) - r - \alpha C(R(1,1) - r))K(1,1) > \underline{\phi}.$$

Assumption (A1) requires that some multinationals enter when $b = t = 0$. It is sufficient for the existence of Case-1 tax policies for $\underline{\phi}$ to be sufficiently small or output to be sufficiently large. Assumption (A2) ensures that some multinationals will enter when $b = t = 1$ despite subsidiary taxable income equal to zero. Case-2 equilibrium tax policies will exist as long as net income shifting profit is large enough to cover the lowest fixed entry costs. It defines an upper bound on α because, as α goes to infinity, transfer price profit goes to zero when $b = 1$. Thus, $\mathcal{M}_{+0}$ is empty if transfer price costs are sufficiently large. Case-3 equilibria always exist.

Case 1: Positive FDI and positive multinational tax revenues, $\mathcal{M}_{++}$

To understand multinational behavior in this region, we begin by describing how $\Pi_T > 0$ varies with respect to changes in b and t near a boundary with each of the other two regions. We refer to the boundary between $\mathcal{M}_{++}$ and $\mathcal{M}_0$ as $t_0(b)$. We refer to the boundary between $\mathcal{M}_{++}$ and $\mathcal{M}_{+0}$ as $t_1(b)$.

Because $\Pi_T > 0$ on $\mathcal{M}_{++}$, $\mu = 0$ and (9), the first-order condition with respect to K, simplifies to

$$(1-t)(F_K - Rb) = r - Rb + \alpha Cb. \tag{15}$$

The left-hand side of the equation is marginal after-tax subsidiary income from FDI and the right-hand side is the after-tax unit cost of capital. A firm's

after-tax unit cost of capital is positive only when the firm's net income shifting profit is negative, which simply means that income shifting reduces the firm's cost of capital below r without becoming an actual source of profit.

Decreasing returns to scale of the subsidiary production function implies

$$\Pi_T > F_K K + F_L L_m - wL_m - RbK = (F_K - Rb)K. \tag{16}$$

For $b < \hat{b}$ and $t < 1$, net income shifting profit, $-(r - Rb + \alpha Cb)K$, is negative, so $F_K - Rb$ must be positive from (15) and an increase in t can only transition the equilibrium from one with positive FDI and positive subsidiary tax revenue to one with no FDI. In order for an increase in t to transition the economy from an equilibrium with positive FDI and positive subsidiary tax revenue to one with positive FDI and zero subsidiary tax revenue, b must be strictly greater than $\hat{b}$. The shape of both boundaries will be determined below.

Next, we use Proposition 1 to report the key comparative statics on $\mathcal{M}_{++}$, which we denote using b and t subscripts on $K, \hat{\phi}, w$ and R. All proofs are in the Appendix.

Proposition 1 *Assume (b, t) yields an equilibrium with strictly positive FDI and strictly positive taxable subsidiary income. (i) $K_b > 0$, $\hat{\phi}_b > 0$, $w_b > 0$, $R_b = 0$, and $R_t > 0$. (ii) For $M \approx 0$, $w_t < 0$ and $\hat{\phi}_t < 0$. (iii) For $b \leq \hat{b}$, $w_t < 0$ and if Π_T is sufficiently close to zero, then $K_t < 0$ and $\hat{\phi}_t > 0$. (iv) For $b > \hat{b}$ and $t < t_1(b)$, if Π_T is sufficiently close to zero, then $K_t > 0$, $w_t > 0$, and $\hat{\phi}_t < 0$.*

According to Proposition 1(i), a weaker thin capitalization rule (larger b) reduces the net cost of capital by inducing more income shifting, attracting more capital and more multinationals (consistent with the estimates in Merlo et al. 2019), and raising the host wage. However, a tax rate change can have ambiguous effects because an increase in t encourages higher transfer prices even as it may encourage less capital investment. Such a trade-off would not be present in a model without both transfer pricing and debt financing.

The ambiguous effect on capital arises through (15) because an increase in t reduces a firm's after-tax marginal product of capital while lowering its

net income shifting margin. If b is small and taxable income, Π_T, is close to zero, the firm's marginal tax haven profit is negative ($r - Rb + \alpha Cb > 0$). Accordingly, the firm responds with less capital investment in order to increase its marginal subsidiary profit $F_K - Rb$. If b is large and Π_T is close to zero, an increase in t now generates strictly positive marginal tax haven profit via increased income shifting. A multinational responds by investing more capital in order to lower its marginal taxable subsidiary income. Thus, different values of b can influence how affiliate capitalization responds to tax rate changes.

To understand the comparative statics results with respect to $\hat{\phi}$ and w, notice that differentiating (11) implies

$$\frac{d\hat{\phi}}{dt} = -\Pi_T - (1-t)L_m w_t.$$

An increase in t directly reduces global after-tax multinational profit at a rate proportional to the taxable income of subsidiaries and it generates a general equilibrium effect through the host wage. If $\Pi_T \approx 0$, the equilibrium wage and global after-tax profit will change in opposite directions. When b is small, an increase in t lowers K for the same measure of multinationals, which results in a lower wage and more entry when $\Pi_T \approx 0$. When b is large, larger income shifting incentives increase K and w. As long as $\Pi_T \approx 0$, the wage effect will dominate and fewer multinationals will enter. However, part (ii) indicates that if there are few multinationals operating in the host country and $\Pi_T > 0$, then both the wage and the measure of entering firms are decreasing in t.

The above focus on equilibria with $\Pi_T \approx 0$ is helpful because $\Pi_T \approx 0$ for t just below $t_1(b)$, the boundary between $\mathcal{M}_{++}$ and $\mathcal{M}_{+0}$. It consists of both the solid curve and its dotted extension in Figure 3. For each $b > \hat{b}$, $\Pi_T = 0$ for all $t \geq t_1(b)$, and $t_1(b) \to 1$ as $b \to \hat{b}$. For $b < \hat{b}$, $t_1(b)$ is not defined because $\Pi_T > 0$ for all t that attracts FDI. Thus, $t_1(b)$ is decreasing in b because both an increase in b and an increase in t lower affiliate taxable income. We state this result as Lemma 1.

Lemma 1 *Assume (b,t) yields an equilibrium with strictly positive FDI. For $b > \hat{b}$, $t_1(b)$ is strictly decreasing in b.*

Case 2: Positive FDI and zero multinational tax revenue, $\mathcal{M}_{+0}$

Equilibria will fall into this case when b and t are sufficiently large. With $\Pi_T = 0$, multinational choices for this case no longer depend on t. Thus, $K_t = R_t = \hat{\phi}_t = w_t = 0$ and $\Pi^*(b,t,\phi) = \Pi^*(b,t_1(b),\phi)$ for all $t \geq t_1(b)$. Moreover, the above discussion of equilibria for Case 1 implies that the policy $(b,1)$ results in $K > 0$ and $\Pi_T = 0$ as long as $b > \hat{b}$, conditional on entry. The next proposition summarizes the comparative statics on this region.

Proposition 2 *Assume (b,t) yields an equilibrium with strictly positive FDI and zero taxable subsidiary income. Then $w_b > 0$ if M is close to zero. K_b and R_b are ambiguous in sign but $\hat{\phi}_b > 0$, which means that multinational profit increases with b in this region.*

For policies that attract FDI but result in no taxable subsidiary income, an increase in b increases the incentive for multinationals to shift income out of the host country per unit of capital for the same transfer price. However, to maintain zero taxable income at a fixed wage multinationals must either increase K and decrease R or vice versa. These two possible adjustments are the reason for the ambiguous signs on K_b and R_b. One of these adjustments must increase global after-tax profit and lead to the entry of more multinationals.

Case 3: No FDI, $\mathcal{M}_0$

The above analyses of Cases 1 and 2 were conditional on entry by multinational firms, but not all tax policies will attract FDI in a market equilibrium. The set $\mathcal{M}_0$ is non-empty because at $b = 0$ and $t = 1$, $\Pi^* = -rK - \phi < 0$ so no firm will enter. Thus, tax policies near $b = 0$ and $t = 1$ will also attract no FDI. The boundary between $\mathcal{M}_0$ and $\mathcal{M}_{++} \cup \mathcal{M}_{+0}$ is $t_0(b)$, as illustrated in Figure 3. The next lemma describes this boundary.

Lemma 2 *(i) For $\alpha > 0$, there exists $b_0 \in (\hat{b},1)$ such that for all $b > b_0$, any policy (b,t) will attract FDI. (ii) For $b < b_0$, $t_0(b)$ is the boundary between $\mathcal{M}_0$ and $\mathcal{M}_{++}$ and is strictly increasing in b. (iii) For $b = b_0$, $t_0(b)$ is the boundary between $\mathcal{M}_0$ and $\mathcal{M}_{+0}$ and is a horizontal line.*

The boundary $t_0(b)$ has two parts. The first part divides policies that result in positive FDI and positive subsidiary tax revenue from those that attract no FDI. The second part divides policies that result in positive FDI and zero subsidiary tax revenues from those that result in no FDI. For $b < \hat{b}$, some firms will enter when $t = 0$ by (A1) and no firms will enter at $t = 1$. Thus, by continuity the host country will attract FDI with any $t < t_0(b)$ and it will attract no FDI with any $t \geq t_0(b)$. At $t_0(b)$, an increase in b or a decrease in t increases entry ($\hat{\phi}_b > 0$ or $\hat{\phi}_t < 0$). Thus, $t_0(b)$ is strictly increasing for all $b < \hat{b}$. By continuity, this trade-off must continue as b rises just above $\hat{b}$. The first part of $t_0(b)$ will continue for $b > \hat{b}$ until $t_0(b)$ and $t_1(b)$ intersect. This occurs at b_0. Each multinational earns only net income shifting profit equal to $\underline{\phi}$ at $(b_0, t_1(b_0))$. At $(b_0, t_1(b_0))$, an increase in b will attract more firms while an increase in t will have no effect on entry. Because firm choices are independent of t beyond this point, the second part of $t_0(b)$ must be a horizontal line. For any $t \geq t_1(b_0)$, an increase in b above b_0 will attract FDI.[36]

6 (Locally) Optimal tax policies

We now turn our attention to a host country's optimal tax policy, which exists because equilibrium host welfare is continuous in (b, t). To identify the optimal policy we must identify a host country's optimal tax policy for each region in Figure 3 separately. We then compare host welfare at each of the local optima to find the global optimum in the following section.[37]

The domestic firm's decision to operate as a formal or informal firm is relevant for this welfare analysis. For a given value of b and $\pi(b,t) = G(L_d(b,t)) - w(b,t)L_d(b,t)$, let $t^* > 0$ be a solution to

$$\phi_i + \xi\pi(b,t)^2 - t\pi(b,t) = 0. \tag{17}$$

[36] A special case arises when transfer pricing is costless due to a host country's inability or unwillingness to detect transfer price deviations. With $\alpha = 0$, all policies with $b > 0$ and $t > 0$ will attract strictly positive FDI but will collect no taxes from the subsidiaries.

[37] One cannot rule out any of the types of equilibria without ignoring the phenomenon of full income shifting or the range of thin capitalization rules observed in practice.

If $\phi_i + \xi\pi(b,t)^2 > t\pi(b,t)$ for all t, the domestic firm would never want to operate as an informal firm. In this case, define $t^* = 1$. We will restrict attention to values of ϕ_i and ξ which imply for all b, that all t^* are strictly less than one, (17) has a unique solution denoted by $T^*(b)$; and $T^*(b) \in \mathcal{M}_0 \cup \mathcal{M}_{+0}$.[38] As long as the opportunity cost parameter associated with operating in the informal sector, ξ, is sufficiently small, so that $\pi < 1/2\xi$, $D_i = 1$ if, and only if, $t \leq T^*(b)$. $T^*(b)$ can be increasing, constant, or decreasing in b.

From (6), host welfare drops discontinuously when the tax rate exceeds $T^*(b)$ for a fixed value of b because the host country loses all tax revenue from the domestic firm. Host welfare in each of these regions is thus maximized at $(b, T^*(b))$ for some b.

Thus, for all three types of equilibria and $t \leq T^*(b)$, totally differentiating (6) yields

$$\begin{aligned} d\Omega &= t\Pi_T dM - tMbKdR + tM(F_K - Rb)dK - tMRKdb \\ &- ((t + (1-t)\beta_\pi)L_d - \beta_w + tML_m)dw + ((1-\beta_\pi)\pi + \Pi_T M)dt \end{aligned} \tag{18}$$

Eq. (18) reveals that host welfare is increasing in its tax rate and the measure of multinational firms that enter, M, and decreasing in the transfer price and the thin capitalization limit. The effect of a change in subsidiary capital and the host wage can be positive or negative.

Case 1: $FDI > 0$ **and** $\Pi_T > 0$

Among host tax policies that attract positive FDI and allow the host country to collect tax revenue from the multinationals, denote the optimal tax policy on $\mathcal{M}_{++}$ by (b_{++}, t_{++}) and define $\Omega_{++} = \Omega(b_{++}, t_{++})$. Because this case is defined by strict inequalities, an optimal policy on $\mathcal{M}_{++}$ need not exist. For example, a policy of the form $(b, t_0(b))$ is no longer in $\mathcal{M}_{++}$ but in $\mathcal{M}_0$.

$\mathcal{M}_{++}$ adjoins both of the other regions. Near the boundary with $\mathcal{M}_0$, the

[38] For any policy $(b,t) \in \mathcal{M}_0 \cup \mathcal{M}_{+0}$, there can be at most one solution to (17) because $w_t = 0$ so $\phi_i + \xi\pi^2$ is constant and $t\pi$ is strictly increasing in t.

measure of entrants is close to zero so (18) simplifies to

$$d\Omega = t\Pi_T dM + (\beta_w - (t + (1-t)\beta_\pi))dw + (1-\beta_\pi)\pi dt. \tag{19}$$

Proposition 1 implies that decreasing t or increasing b attracts more firms and raises the wage. If the host country seeks to maximize national income ($\beta_w = \beta_\pi = 1$), these changes improve host welfare through changes in M. An increase in t has no effect on host national income. However, if $\beta_w = \beta_\pi$ are just below one, a decrease in t will still increase host welfare through changes in M, while an increase in t will increase host welfare because the host country prefers a dollar of tax revenue more than a dollar of wages or after-tax domestic firm profit. Thus, the host country's preferences with respect to a tax rate change are non-convex preferences.

Near the boundary with $\mathcal{M}_{+0}$, Π_T is close to zero. By collecting together terms that affect Π_T, (18) simplifies to

$$d\Omega = tMd\Pi_T + (\beta_w - (t + (1-t)\beta_\pi)L_d)dw + (1-\beta_\pi)\pi dt. \tag{20}$$

Now Proposition 1 implies that $d\Pi_T/db < 0$, $w_b > 0$, $d\Pi_T/dt < 0$, and $w_t > 0$. The opposing effects on w and Π_T make the welfare effects ambiguous. Thus, a host country that seeks to maximize national income may not have a locally optimal policy on $\mathcal{M}_{++}$ if the marginal welfare benefits of an increasing wage are strong enough to encourage attracting FDI that yields no taxable income.

If the host country seeks to maximize tax revenues ($\beta_w = \beta_\pi = 0$), then countervailing effects arise at each boundary with respect to changes in b and t. A host country that is focused largely on raising tax revenues may prefer not to attract any FDI in order to avoid tax revenue losses from its domestic sector, a possibility we return to below.

Case 2: $FDI > 0$ **and** $\Pi_T = 0$

Next, we focus on the host tax policies that attract FDI but do not contribute to host tax revenues. We show in the next section that if the host country puts sufficient welfare weight on private income (i.e., wages), such

policies can improve welfare relative to those that attract FDI and contribute to host tax revenues. Denote the optimal tax policy on $\mathcal{M}_{+0}$ by (b_{+0}, t_{+0}) and define $\Omega_{+0} = \Omega(b_{+0}, t_{+0})$. As noted above, $t_{+0} = T^*(b_{+0})$.

An optimal policy on $\mathcal{M}_{+0}$ will not exist when the policy $(b_0, T^*(b_0))$, which attracts no FDI, dominates all policies in $\mathcal{M}_{+0}$. The right panel of Figure 4 below illustrates this possibility.

When (b_{+0}, t_{+0}) exists, it will reflect a trade-off between wage income and tax revenues paid by the domestic firm. Note that for each $b > b_0$,

$$\Omega(b, T^*(b)) = \beta_w w + [\beta_\pi(1 - T^*(b)) + T^*(b)](G(L_d) - wL_d) \tag{21}$$

and

$$\frac{d\Omega(b, T^*(b))}{db} = [\beta_w - L_d + L_d(1-\beta_\pi)(1-T^*(b))]w_b + (G - wL_d)(1-\beta_\pi)(T^*)'(b). \tag{22}$$

For b just above b_0, $L_d \approx 1$ and the first term in (22) is approximately equal to $[\beta_w - 1 + (1 - T^*)(1 - \beta_\pi)]w_b$. When $\beta_w < 1$[39] and T^* is close enough to one, an increase in b increases the host wage by Proposition 2 and leads to a reduction in welfare. If, in addition $(T^*)'(b) < 0$, the tax revenue effect will also be negative and welfare will be initially decreasing in b.

In order for a locally optimal policy on $\mathcal{M}_{+0}$ to exist, host welfare must begin to increase as b increases. This can happen when higher values of b increase multinational employment and crowd out domestic employment. At some point, reduced domestic employment can change the sign of the bracketed term in (22) so that increased wages improve welfare. If $w_b > 0$ on all of $\mathcal{M}_{+0}$, the locally optimal policy will be $(1, T^*(1))$; otherwise the locally optimal policy will be $(b_{+0}, T^*(b_{+0}))$ for some $b_{+0} \in (b_0, 1)$.

Case 3: $M = 0$

Finally, we focus on tax policies that attract no FDI. Among these policies, the equilibrium wage and all equilibrium firm choices except the domestic

[39]This will be the case if the host country seeks to maximize tax revenues ($\beta_w = \beta_\pi = 0$) or if the host country with an unproductive group of residents who earn no wage income has a Rawlsian welfare function.

firm's formal/informal operation decision are independent of b and t. $T^*(b)$ is independent of b because there is no FDI to affect the equilibrium wage. Thus, welfare is also independent of b and independent of t for all $t > T^*(b)$. By (18), $\Omega_t = (1 - \beta_\pi)\pi \geq 0$ for all $\beta_\pi \leq 1$ and all $t \leq T^*(b)$, so $t = T^*(b)$ is optimal because it maximizes tax revenues from the domestic firm. Thus,

Proposition 3 *The set of optimal host policies that attract no FDI consists of the policies* $(b, T^*(b))$ *for* $0 \leq b \leq b_0$ *and maximal host welfare on* $\mathcal{M}_0$ *is* $\Omega_0 \equiv \Omega(b_0, T^*(b_0)) = G(1)[\beta_\pi + (1 - \beta_\pi)T^*(b)] - G_L(1)(1 - \beta_w) > 0$.

7 Identifying the globally optimal policy

The above welfare analysis identifies up to three distinct host tax policies that can be globally optimal for the host country: (b_{++}, t_{++}), $(b_{+0}, T^*(b_{+0}))$, and $(b_0, T^*(b_0))$.[40] In this subsection, we (i) show with an example that attracting no FDI can be globally optimal for a host country, (ii) prove how an infinitesimal cross-country difference in α can generate discrete cross-country differences in tax policies, and (iii) prove how endogenizing the host country's institutional quality parameter, α, affects the globally optimal host policy.

7.1 When a policy that attracts no FDI is globally optimal

Figure 4 illustrates an example in which it is globally optimal for the host country to adopt a tax policy that attracts no FDI. For this example, $F(l_m, k) = 1.3k^{0.3}l_m^{0.4}$, $G(l_d) = l_d^{0.88}$, $r = 0.08$, $\alpha = 3$, $C(R - r) = (R - r)^2$, $\phi \in [0.1, 10]$, $\beta_\pi = 0$, and $\beta_w = 0.8$. The values of λ, γ, δ and A are suggestive of a developing country as they imply low domestic rents, high subsidiary rent consistent with Karabarbounis and Nieman (2014), and a foreign sector that is larger than the domestic sector. The left graph plots $\Omega(b, t)$. The right graph plots $\Omega(b, T^*(b))$. Both graphs reveal non-convexities in the host welfare function identified in the above welfare analysis.

[40] In some economies, (b_{++}, t_{++}) and/or $(b_{+0}, T^*(b_{+0}))$ may not exist.

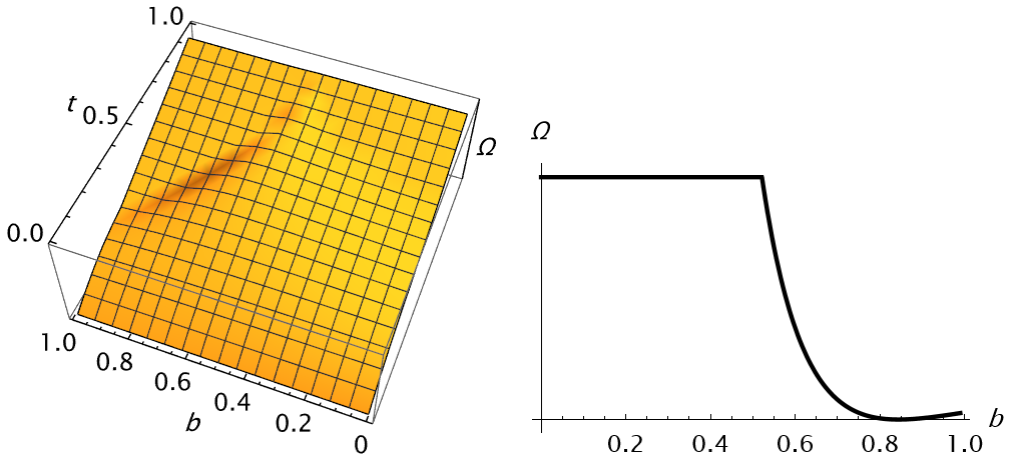

Figure 4: Host welfare as a function of b and t. No FDI is optimal when $F(l_m, k) = 1.3k^{0.3}l_m^{0.4}$, $G(l_d) = l_d^{0.88}$, $r = 0.08$, $\alpha = 3$, $C(R - r) = (R - r)^2$, $\phi \in [0.1, 10]$, $\beta_\pi = 0$, and $\beta_w = 0.8$. $t = T^*(b)$ for all b in the right panel.

Together the graphs show that host welfare is maximized at $(b, T^*(b))$ for $0 \leq b \leq b_0 \approx 0.52$. All of these policies attract zero FDI. For each b above b_0, the policy $(b, T^*(b))$ attracts FDI but the subsidiaries report no taxable income. For b just above b_0, the welfare gain from a higher wage in (22) is initially smaller than the welfare loss from lower domestic firm tax revenues in (22). For $b > 0.85$, the wage effect dominates the tax revenue effect, but not by enough for a policy that attracts FDI and generates no subsidiary tax revenue to be preferred to a no-FDI policy. The left graph shows that an optimal no-FDI policy also dominates all policies that attract FDI and subsidiary tax revenues.

An optimal policy that attracts no FDI might appear pathological as it requires a sufficiently low welfare weight on private income (i.e., private consumption). However, our example uses a welfare weight on wage income of 0.8 (some higher values would yield the same result), which implies the host country values public spending only 14% more than worker consumption.

The welfare weights used in Figure 4 are also consistent with the challenge facing some developing countries. They must rely on corporate taxation of domestic firms to fund even limited public infrastructure investment (Avi-Yonah,

2016) because of weak institutional capacity to audit multinational firms and to enforce personal income tax collection (Dharmapala et al., 2011). In extreme cases like Tanzania, less than 300 domestic firms provide about 70 per cent of total tax revenue (Fjelstad and Moore, 2008). Our analysis shows that such countries can be made worse off trying to attract multinational activity. When FDI crowds out domestic tax revenue via lower domestic firm profit and multinationals shift their tax bases abroad, the reduction in government spending capacity can outweigh welfare gains from higher private (labor) income. This discussion is not meant to imply that increased wage income does not benefit developing countries. It does, and our example captures and values those benefits, such as poverty reduction, by setting β_w fairly high.

Our result has a further implication. Standard policies to compel countries that suffer from insufficient public funds and weak public institutions to attract FDI can lead to a vicious circle. FDI can crowd out more public spending. This leads to further reductions in public spending, which can cause struggling states to become failed states over time. Of course, there are other gains from FDI that are not part of our model, such as from technological spillovers. Our results suggest that these other gains could need to be substantial to compensate for the welfare losses our work identifies.

7.2 Small changes in institutional quality can have large policy effects

Figure 5 illustrates an example in which it is optimal for the host country to adopt a tax policy that attracts FDI. It shares the same parameter values used in Figure 4 except that $F(l_m, k) = 1.5k^{0.3}l_m^{0.4}$, $\alpha = 1.935$, $\beta_\pi = 0.25$, and $\beta_w = 0.85$. We chose these specific parameter values to create an example in which the host country is close to indifferent between the locally optimal policy that attracts FDI and generates subsidiary tax revenue and the locally optimal policy that attracts FDI and generates no subsidiary tax revenue. Such indifference is necessary for a small change in α to generate the gap in safe harbor limits between very similar countries seen in Figure 1.

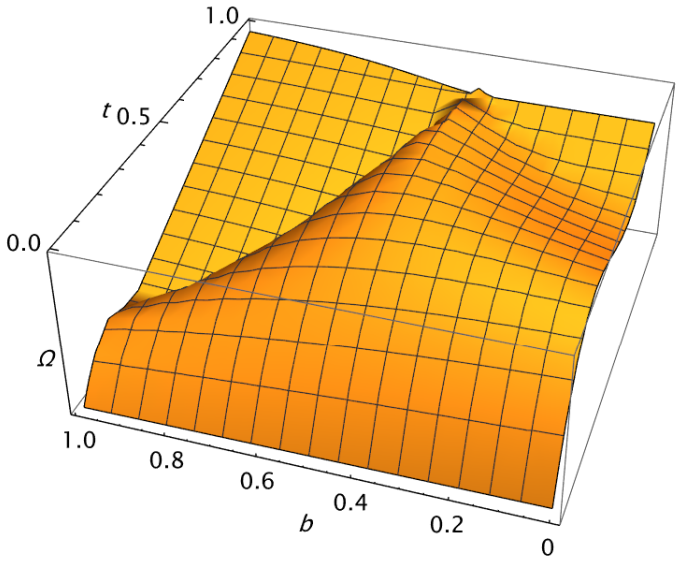

Figure 5: Host country welfare as a function of host tax policies (b, t) when $F(l_m, k) = 1.5k^{0.3}l_m^{0.4}$, $G(l_d) = l_d^{0.9}$, $r = 0.08$, $\alpha = 1.935$, $C(R - r) = (R - r)^2$, $\phi \in [0.1, 10]$, $\beta_\pi = 0.25$, and $\beta_w = 0.85$.

The globally optimal tax policy at $\alpha = 1.93$ is $(b, t) = (1, T^*(1))$. It attracts FDI with no subsidiary tax revenue. At $\alpha = 1.94$, the globally optimal tax policy is $(b, t) = (0.44, 0.61)$. It attracts FDI and subsidiary taxable revenues. Both policies dominate any no-FDI policy. The small increase in α reduces welfare from the locally optimal policy that attracts FDI but yields no subsidiary tax revenue because stronger transfer price enforcement lowers FDI and wages by enough to offset the welfare gains from increased domestic tax revenue collection. The same change in α increases welfare from the locally optimal policy that attracts FDI and yields subsidiary tax revenue by increasing tax revenues enough to offset the welfare losses from reduced FDI and wages. With marginally better institutional quality a host country now strictly prefers the latter policy.

We now prove that the results of this example apply in general by deriving the comparative statics for changes in host welfare with respect to a change in α. Our analysis proceeds in two steps.

First, we consider the effect of a change in α on host welfare when $\beta_w < 1$

from policies of the form $(b, T^*(b))$ that attract FDI but generate no subsidiary taxable income. Following (22) for policies in $\mathcal{M}_{+0}$,

$$\begin{aligned} & \frac{d\Omega(b, T^*(b;\alpha);\alpha)}{\partial\alpha} \\ = \; & [\beta_w - L_d + L_d(1-\beta_\pi)(1-T^*(b))]w_\alpha + (G - wL_d)(1-\beta_\pi)\frac{\partial T^*(b)}{\partial\alpha} \end{aligned} \tag{23}$$

where $L_d < 1$, $b > b_0$, and w_α is the rate of change of the equilibrium wage from a change in α. Because totally differentiating (17) implies that $\partial T^*/\partial\alpha = (T^* - 2\xi\pi)L_d w_\alpha/\pi$, (23) simplifies to

$$\frac{d\Omega(b, T^*(b;\alpha);\alpha)}{d\alpha} = [\beta_w - L_d(\beta_\pi(1-2\xi\pi) + 2\xi\pi)]w_\alpha. \tag{24}$$

The effect of a change in α depends on the signs of w_α and of the bracketed term in (24). For b close to b_0, $w_\alpha < 0$ because M is not too large. For simplicity, we will assume that $w_\alpha < 0$ for all $b > b_0$ so that the locally optimal policy is $(1, T^*(1))$. If for b close to one, w_α is positive, the locally optimal policy could be $(b, T^*(b))$ for some $b < 1$. However, since (24) applies for all $b > b_0$, our results continue to hold. This assumption is satisfied by all our simulations.

Regarding the bracketed term in (24), recall that $2\xi\pi < 1$ is necessary for the domestic firm's net profit to be strictly concave when it operates in the informal market. If $\beta_w = 1$, the bracketed term is always positive and host welfare is decreasing in α. For $\beta_w < 1$, the bracketed term will also be positive at higher values of b if FDI crowds out enough employment by the domestic firm. For values of b close to b_0, the bracketed term can be negative because domestic employment is close to one.

As long as b near one attracts enough FDI, L_d will be less than β_w. In this case, more effective transfer price regulation attracts less FDI due to lower net income shifting profit. Less FDI results in a lower wage and higher domestic tax revenues, but the marginal welfare loss from a lower wage dominates and host welfare falls as seen in Figure 6 below.

Second, we calculate how a change in α changes welfare from the locally optimal policy that attracts FDI and generates taxable subsidiary income. On

M_{++}, the Envelope Theorem and the firm's first-order conditions (8) - (11) imply that

$$\begin{aligned}\frac{d\Omega_{++}(b_{++},t_{++})}{d\alpha} &= (\beta_w - t - (1-t)\beta_\pi L_d)w_\alpha + t\Pi_T M_\alpha \\ &- \frac{t(Rb - r - \alpha Cb)}{1-t}K_\alpha - \frac{tMbK(1-\alpha C')}{1-t}R_\alpha. \quad (25)\end{aligned}$$

Direct calculations show that the comparative statics K_α, R_α, M_α, and w_α are all negative. That is, an increase in α reduces capital investment per firm, the transfer price, the measure of multinational firms, and the host wage.

If b_{++} is strictly between 0 and 1, then $\partial\Omega_{++}/\partial b = 0$ at (b_{++}, t_{++}) and (25) reduces down to

$$\frac{d\Omega_{++}(b_{++},t_{++})}{d\alpha} = tMbK\left(\frac{C'}{\alpha C''} - \frac{RC}{\alpha(C - RC')}\right) > 0. \quad (26)$$

Thus, an increase in α increases host welfare from the locally optimal tax policy that attracts FDI and raises strictly positive subsidiary taxable income, as is also seen in Figure 6 below. The primary reason is that better institutional quality in the tax authority encourages multinationals to shift less income out of the host country.

Combining comparative statics (24) and (26), if one begins with a host country whose value of α implies indifference between the locally optimal policies that attract FDI with and without taxable subsidiary income, a small increase in α reduces welfare from the locally optimal policy that attracts FDI but yields no subsidiary tax revenue and increases welfare from the locally optimal policy that attracts FDI and yields subsidiary tax revenue. With a marginally better institutional quality, a host country now strictly prefers a policy that attracts FDI with taxable income, and its optimal policy exhibits a discrete jump in the optimal thin capitalization limit consistent with the stark bifurcation in real-world thin capitalization rules observed in Figure 1.

7.3 Strategic under-utilization of institutional quality

The analysis in the previous subsections assumed that a host country will always want to fully utilize its institutional capacity. We now relax this assumption. The next proposition describes how a host country's optimal tax policy varies with its institutional capacity when it can under-utilize that capacity. The proof follows directly from comparative statics (24) and (26).

Proposition 4 *Assume for all* $\alpha > 0$ *that* $b_{++} \in (0,1)$, $L_d(b_{+0}, T^*(b_{+0}) < \beta_w$, $w_\alpha(b_{+0}, T^*(b_{+0})) < 0$ *for all* α, *and a host country with no institutional capacity prefers attracting FDI that generates no multinational tax revenue to attracting no FDI. Then, there exists* $\alpha^* > 0$ *such that (i) for all* $\alpha > \alpha^*$, *the optimal host-tax policy involves full utilization of the country's institutional capacity and it attracts FDI that generates positive multinational tax revenue, and (ii) for all* $\alpha < \alpha^*$, *the optimal tax policy involves complete under-utilization of the country's institutional capacity and it attracts FDI that generates no multinational tax revenue.*[41]

Figure 6 illustrates the intuition of Proposition 4 when a host country can choose strategically to audit in a way that does not fully utilize its institutional capacity and to change its tax policy so it is optimal given the lower level of institutional quality.[42] Figure 6 plots welfare at the two local optima that attract positive FDI using the same parameter values used for Figure 5.

Consistent with (24), the thin solid line plots welfare from the locally optimal policy that attracts FDI but yields no taxable subsidiary income, $(b,t) = (1, T^*(1))$. It is decreasing in α as the quantity demanded of labor by multinationals is greater than β_w. The dashed line in Figure 6 denotes host welfare at $(1, T^*(1))$ with $\alpha = 0$. Host welfare at $(1, T^*(1))$ is maximized when $\alpha = 0$ because no transfer price auditing attracts the most FDI and taxable subsidiary income is still zero. Consistent with (26), the heavy solid line plots

[41] Requiring that $w_\alpha(b_{++}, T^*(b_{++})) < 0$ for all α is a sufficient but not necessary condition. If $w_\alpha(b_{++}, T^*(b_{++})) > 0$ at low values of α, partial under-utilization instead of complete under-utilization could be optimal.

[42] Introducing a marginal cost associated with changing α only adds a second reason for a host country to under-utilize its institutional capacity.

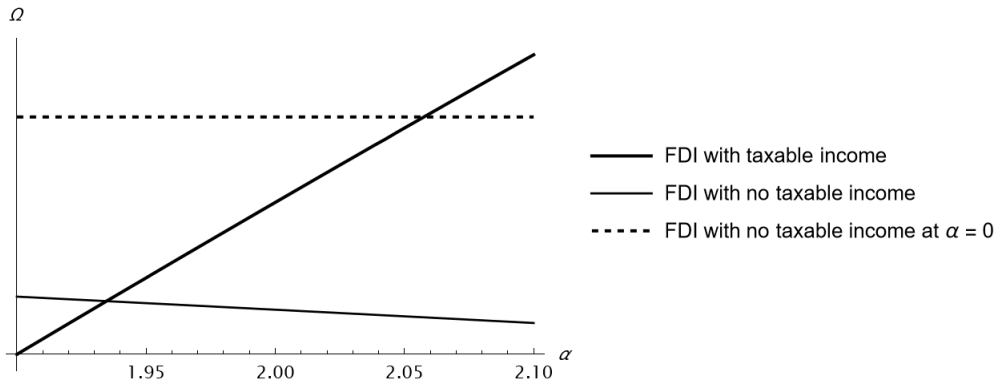

Figure 6: Host welfare as a function of α.

welfare from the locally optimal policy that attracts FDI with taxable income. It is increasing in α. For $\alpha < 1.935$, the optimal policy when the host country fully utilizes its institutional capacity attracts FDI with no taxable subsidiary income, but if it chooses to operate as though its value of α is zero, its welfare increases by attracting more FDI. For $\alpha > 1.935$, the optimal policy when the host country fully utilizes its institutional capacity attracts FDI that yields taxable income. However, a country with institutional capacity between 1.935 and 2.06 can improve its welfare by under-utilizing its capacity by operating as though $\alpha = 0$ and adopting $(b, t) = (1, T^*(1))$. While under-utilization has a welfare cost in terms of lost subsidiary tax revenues, the welfare gain from increased FDI dominates. This strategic choice of auditing intensity is consistent with high-capacity countries, such as Austria, Ireland, Israel, and Sweden, exhibiting lower levels of institutional quality in order to attract FDI that pays no taxes.

7.4 Discussion and extensions

Our analysis has shown how a number of empirical regularities of FDI can be understood in relation to optimal corporate tax policy by accounting for differing levels of institutional quality among countries. Our modeling of institutional capacity and its use also provides a bridge between papers in the "tax havens are harmful" literature and the "tax havens are good" literature.

Both literatures attest to the use of tax havens by multinationals as a way to pay a lower effective tax rate than domestic firms pay despite facing the same statutory rate. The question is whether the use of tax havens to lower a foreign firm's effective tax rate while keeping the statutory rate unchanged enhances FDI enough to improve host country welfare. We prove that the answer to this question depends critically on the interaction of both income-shifting mechanisms, a country's institutional capacity to curb income shifting, and a country's social welfare preferences.

In contrast to Hong and Smart (2010), our findings imply that in countries with sufficient institutional quality, the presence of decreasing returns to scale and transfer pricing leads to a different optimal policy. Specifically, the globally optimal tax policy attracts FDI, permits a limited degree of debt shifting, and imposes a positive tax on the normal rate of return - even in the absence of additional administrative costs associated with debt shifting. By focusing on FDI, as opposed to passive capital investment, our analysis further contradicts Gordon (1986), in which the optimal tax rate on capital income is zero. If profits cannot be perfectly taxed, even a small open economy will adopt a positive corporate income tax rate and restrict debt shifting to avoid pure cash-flow taxation.

Countries with low institutional quality face a different marginal welfare trade-off. Under the globally optimal policy that attracts FDI, they will not earn tax revenue from multinationals and must assess whether the welfare benefits of increased FDI and higher wages outweigh the tax revenue losses from domestic firms, which earn less taxable income due to the wage increase. If the benefits from FDI dominate, the globally optimal policy is to set a high statutory tax rate but allow for full debt shifting. If the tax revenue losses dominate, the globally optimal policy attracts no FDI. This trade-off eventually depends on the welfare weights put on private labor income relative to (corporate) tax revenues. Furthermore, countries with medium institutional quality may strategically under-utilize their institutional capacity to curb profit shifting, as allowing profit shifting to tax havens generates more FDI and efficiency gains that exceed the welfare loss from lower corporate tax revenue.

Our results also relate to the hypotheses in Gordon and Li (2009, Section 2.4.3), where the authors speculate about the taxation of multinationals when their model is applied to an international setting with FDI and profit shifting. They expect some positive, but low, tax revenue from multinationals and suggest that diverting away labor from domestic firms will reduce domestic tax revenue all else equal. As noted above in section 2, their model and intuition is not able to explain all the empirical regularities we highlighted in our introduction, most notably the variation in thin capitalization rules. Moreover, because their model does not account for profit shifting and differences in institutional qualities, Gordon and Li (2009) cannot capture a country's strategic use of its institutional capacity. Our model allows for such an analysis and shows that some countries will be better off in voluntarily letting multinationals shift all their tax base.

Our analysis raises another question: Is it possible that the optimal tax policy could be implemented by charging multinational firms a lower tax rate than the domestic firm? We do not model this case explicitly, as it would complicate (and overburden) our already complex analysis. However, we do offer two observations regarding this question. First, separate tax rates applied to income from FDI and to income from the domestic firm, will not eliminate the incentives for multinationals to shift income to a tax haven unless the host country eliminates the tax benefit of debt financing by setting $b = 0$. As long as the thin capitalization limit, b, and the tax rate levied on multinational firms are strictly positive, each multinational will still have the incentive to shift income using transfer pricing and debt financing.

Second, the reason that a host country that levies a separate multinational rate might want to permit income shifting arises because tax policy affects both intensive and extensive margin decisions related to FDI and employment. The host country would need to impose at least two tax rates on FDI income: one that taxes the normal return on capital and one that taxes economic rents. Host tax policy needs to target both an effective tax rate to influence each multinational's extensive margin decision and a marginal effective tax rate to influence the intensive margin decisions. Thus, the host country is faced

with a "number of targets vs. number of instruments" problem for which a positive thin capitalization limit serves as a second tax instrument to solve this welfare problem. We believe that the reason we observe countries using thin capitalization rules instead of a second multinational tax rate is because it can more easily accommodate firm heterogeneity.

Finally, we can extend our model to consider earnings stripping rules, which serve as an alternative to safe harbor rules. They limit the tax deduction for interest payments that exceed a specified fraction of pre-tax earnings.[43] In our model, an earnings stripping rule corresponds to a constraint of the form $RB \leq b(F - wL_m)$ for $0 \leq b \leq 1$. For any $b < 1$, subsidiary taxable income will always be strictly positive. Only policies from $(1, t_1(1))$ to $(1, T^*(1))$ can attract FDI and yield no taxable income. The optimal policy on this segment is $(1, T^*(1))$. When the host country only uses an earnings stripping rule, Gresik, Schindler, and Schjelderup (2017) show that the optimal transfer price, R, equals r when there are no costs associated with debt financing, and subsidiary production exhibits constant returns to scale. Adding in financing costs to the current paper would not change the results in sections 5 and 6 but, with decreasing returns to scale, would imply $R > r$ for the case of earnings stripping. With no financing costs, attracting FDI is always optimal. With financing costs, a no-FDI policy can be optimal, and a discrete change in optimal tax policies from a small change in institutional quality still arises.

8 Conclusion

In this paper, we study the optimal design of corporate income tax rules in the presence of income shifting via transfer pricing and debt financing and tax loss rules that discourage creating income losses. Our analysis shows the optimal tax policy can change discontinuously with a host country's institutional ability to curb income shifting. This discontinuity generates a bifurcation in

[43] A number of major economies including the United States and the EU now use earnings stripping rules instead of safe harbor rules. Earnings stripping rules are also directed by the EU Anti Tax Avoidance Directive (EU-ATAD) in 2019 that builds on OECD Action Plan 4 (OECD 2015).

safe harbor limits among developing and developed countries consistent with observed choices. We also identify a strategic motive for countries with intermediate institutional capacity to under-utilize their capacity and operate as low capacity countries. Our results are robust to the addition of variable cost heterogeneity among multinationals, introducing costs of enforcing thin capitalization rules, and allowing domestic capital investment to be elastic.

We do not attempt to model tax competition effects for two reasons. First, in order to solve tax competition models, it is generally necessary to include only the most basic elements of corporate tax policies. However, we have shown that the basic elements do not generate firm or country behavior observed in the data. Second, and more importantly, we show that the optimal tax policies for developing countries attract FDI through permissive thin capitalization limits and not low tax rates. Countries for whom the optimal policy generates no tax revenues from foreign affiliates, set their tax rates to target their domestic sector. For developed countries for whom the optimal policy generates tax revenues from foreign affiliates, tax competition effects can be expected to influence the quantitative properties of the equilibrium policies but not the qualitative properties. If anything, competition over thin capitalization limits and tax rates would give more developed countries the incentive to under-utilize their institutional capacity for tax administration.

Finally, our analysis identifies conditions under which it is harmful for a country to attract FDI. Countries that value tax revenue highly, but have a low ability to curb income shifting (i.e., low institutional quality), may suffer a loss in welfare from attracting FDI if the welfare loss from lost domestic tax revenue dominates the welfare gain from higher domestic wages. There has long been a presumption that attracting FDI is good for developing countries (Williamson, 1989). Recent studies, like the World Bank study by Andersen, Kett, and von Uexkull (2018), which focus on policies in developing countries for attracting FDI, overlook the possibility that attracting FDI may harm host country welfare. These studies also fail to account for a common tax incentive, a permissive thin capitalization rule with interest rate transfer pricing.

A policy implication of our findings is that what works well for developed

economies need not work the same way nor be appropriate for developing economies. We have shown that for developing countries that rely heavily on corporate tax revenues and have weak tax administration capabilities, offering tax incentives such as tax holidays and investment tax credits only exacerbates the problem. Even for developing countries that do benefit from attracting FDI, our analysis shows how their optimal corporate tax policies differ from those of developed countries. Thus, in the context of corporate tax reform, our paper formalizes the idea in Bhagwati (2004) of "appropriate governance," and shows how a host country's level of actual governance affects how it should think about attracting FDI.

The BEPS Inclusive Framework initiative recognizes this challenge by providing capacity building support for developing countries.[44] Our paper, however, offers a cautionary note that the improved capacity will not necessarily be reflected in revised tax policies when the strategic concerns we identify lead the countries to decide to under-utilize their improved capacity.

Appendix: Proofs

Proof of 100% Debt Financing Without a Thin Capitalization Rule. Consider the Lagrangian $\Lambda = \Pi + \mu\Pi_T - \lambda(B - k)$ where μ is the multiplier on the constraint, $\Pi_T \geq 0$, and λ is the multiplier on the constraint, $B \leq k$. $\lambda = 0$ if, and only if, $R = r$, which implies the contradiction of $\mu > 0$ and $\Pi_T > 0$. For $R > r$, the strict convexity of $C(\cdot)$ implies that $(R-r)C' - C > 0$ so $RC' - C > rC' > 0$, $\lambda > 0$, and $B = k$.

Proof of Proposition 1. (i) This case requires $t < 1$. Totally differentiating

[44] See https://www.oecd.org/tax/beps/about/

(8) - (11) and (13) - (14) with $\mu = 0$ yields

$$\begin{pmatrix} (1-t)F_{KK} & (1-t)F_{KL} & 0 & 0 & 0 & 0 \\ F_{KL} & F_{LL} & 0 & 0 & 0 & -1 \\ 0 & 0 & -\alpha C'' & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 & 0 & -(1-t)L_m \\ 0 & 0 & 0 & 0 & G_{LL} & -1 \\ 0 & M & 0 & mL_m & 1 & 0 \end{pmatrix} \cdot \begin{pmatrix} dK \\ dL_m \\ dR \\ d\hat{\phi} \\ dL_d \\ dw \end{pmatrix} = \begin{pmatrix} a_1 \\ 0 \\ -dt \\ a_2 \\ 0 \\ 0 \end{pmatrix} \quad (27)$$

where $m = 1/(\bar{\phi} - \underline{\phi})$, $a_1 \equiv \alpha(C - RC')db + (F_K - Rb)dt$ and $a_2 \equiv \alpha(C - RC')Kdb + \Pi_T dt$. Denote the 6x6 matrice in (27) by Z. Direct calculation shows that $|Z| = \alpha C''[G_{LL}M(1-t)F_{KK} - G_{LL}(1-t)^2 mL_m^2 \nabla^2 F + (1-t)\nabla^2 F] > 0$. By the convexity of $C(\cdot)$, $C - RC' \leq 0$. The homogeneity assumption on F implies that $KF_{KK} + L_m F_{KL} < 0$ and $L_m F_{LL} + KF_{KL} < 0$.

Additional direct calculations then show that
$K_b = \alpha^2(C-RC')C''[MG_{LL}+F_{LL}-G_{LL}(1-t)mL_m(L_mF_{LL}+KF_{KL})]/|Z| > 0$,
$\hat{\phi}_b = -\alpha^2(C-RC')C''[G_{LL}M(1-t)(F_{KL}L_m+KF_{KK})+(1-t)K\nabla^2 F)]/|Z| > 0$,
$w_b = \alpha^2(C - RC')C''G_{LL}(MF_{KL} + KmL_m(1-t)\nabla^2 F)/|Z| > 0$,
$K_t = \alpha C''[(F_K - Rb)(MG_{LL} - G_{LL}(1-t)mL_m^2 F_{LL} + F_{LL}) - G_{LL}mL_m(1-t)F_{KL}\Pi_T]/|Z|$,
$\hat{\phi}_t = -\alpha C''[(F_K - Rb)G_{LL}MF_{KL}(1-t)L_m + \Pi_T(G_{LL}M(1-t)F_{KK} + (1-t)\nabla^2 F)]/|Z|$, and
$w_t = \alpha C''G_{LL}[(F_K - Rb)MF_{KL} + \Pi_T mL_m(1-t)\nabla^2 F]/|Z|$.

(ii) If $M \approx 0$, then $w_t < 0$ and $\hat{\phi}_t < 0$ but K_t can be positive or negative.

(iii) For $b \leq \hat{b}$, $Rb - r - \alpha Cb < 0$ for all $t < 1$ so entry implies $F_K - Rb > 0$ at the optimal capital, labor, and transfer price choices. Thus, for $b \leq \hat{b}$, $w_t < 0$ while $K_t < 0$ and $\hat{\phi}_t > 0$ if $(1-t)\Pi_T$ is sufficiently close to zero.

(iv) For each $b > \hat{b}$ and t just below $t_1(b)$, $\Pi_T \approx 0$ so a firm must earn positive net income shifting profit to justify entry. By (15), $F_K - Rb < 0$ which implies $K_t > 0$, $w_t > 0$, and $\hat{\phi}_t < 0$. In the limit as $\alpha \to \infty$, $\alpha(C - RC') = -rt$ and $\alpha C'' = -1$, which implies $K_t > 0$ and $\hat{\phi}_t < 0$.

Proof of Lemma 1. First, on $\mathcal{M}_{++}$, $d\Pi_T/db = (F_K - Rb)K_b - RK - L_m w_b$, because $F_L = w$ and $R_b = 0$. By (15), $F_K - Rb < 0$ when $\Pi_T \approx 0$ while $w_b > 0$ and $K_b > 0$ by Proposition 1(i). Thus, $d\Pi_T/db < 0$ for Π_T close to zero.

Second, $d\Pi_T/dt = (F_K - Rb)K_t - L_m w_t - bKR_t$ where by Proposition 1(i) $R_t > 0$ and by Proposition 1(iv) $w_t > 0$ and $K_t > 0$ when $\Pi_T \approx 0$. Thus,

$d\Pi_T/dt < 0$ when $\Pi_T \approx 0$ and $dt_1(b)/db = -d\Pi_T/db/d\Pi_T/dt < 0$.

Proof of Proposition 2. We derive the comparative statics with respect to b when $t = 1$. The comparative statics for any $t < 1$ on $\mathcal{M}_{+0}$ can be generated by substituting $1 - t + \mu$ for μ in the expressions below. The signs of the comparative statics remain unchanged.

Totally differentiating (8) - (14) with $\mu > 0$ yields

$$\begin{pmatrix} 0 & F_K - Rb & 0 & -bK & 0 & 0 & -L_m \\ F_K - Rb & \mu F_{KK} & \mu F_{KL} & 0 & 0 & 0 & 0 \\ 0 & F_{KL} & F_{LL} & 0 & 0 & 0 & -1 \\ -1 & 0 & 0 & -\alpha C'' & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -1 & 0 & -\mu L_m \\ 0 & 0 & 0 & 0 & 0 & G_{LL} & -1 \\ 0 & 0 & M & 0 & mL_m & 1 & 0 \end{pmatrix} \cdot \begin{pmatrix} d\mu \\ dK \\ dL_m \\ dR \\ d\hat{\phi} \\ dL_d \\ dw \end{pmatrix} = \begin{pmatrix} RKdb \\ \alpha(C - RC')db \\ 0 \\ 0 \\ \alpha(C - RC')Kdb \\ 0 \\ 0 \end{pmatrix} \tag{28}$$

where BH is the upper 5x5 matrice. $|BH| > 0$. Denote the 7x7 matrice in (28) by X. Direct calculation yields

$$\begin{aligned} |X| &= ML_m G_{LL}(F_K - Rb)\alpha C'' - MG_{LL}(-\mu F_{KK} bK + \alpha C''(F_K - Rb)^2) \\ &- m\mu^2 L_m^2 G_{LL} bK\nabla^2 F + \mu F_{KL}^2 + m\mu L_m^2 G_{LL}\alpha C'' F_{LL}(F_K - Rb)^2 + |BH| > 0 \end{aligned} \tag{29}$$

$$\begin{aligned} K_b &= [-\mu M F_{KL} RKG_{LL} + \alpha(C - RC')bK(MG_{LL} + F_{LL} - \mu m L_m^2 F_{LL} G_{LL}) \\ &- \alpha C'' F_{LL} RK(F_K - Rb)mL_m - \mu m L_m \alpha(C - RC')bK^2 F_{KL} G_{LL} \\ &- mL_m^2 \alpha^2 C''(C - RC')(F_K - Rb)F_{LL} G_{LL} K]/|X|, \end{aligned} \tag{30}$$

$$\begin{aligned} R_b &= [-MG_{LL}(\alpha(C - RC')(L_m F_{KL} - (F_K - Rb)) + \mu F_{KK} RK) \\ &+ \mu m L_m G_{LL} \cdot \alpha(C - RC')K(F_{KL}(F_K - Rb) + L_m \nabla^2 F) \\ &+ \mu m L_m^2 G_{LL}(\mu RK\nabla^2 F - \alpha(C - RC')F_{LL}(F_K - Rb)) \\ &- (\mu RK\nabla^2 F - \alpha(C - RC')F_{LL}(F_K - Rb))]/|X|, \end{aligned} \tag{31}$$

$$
\begin{aligned}
w_b = [\quad & - \quad \alpha^2 c''(C - RC')(F_K - Rb)^2 G_{LL} F_{LL} m L_m K \\
& - \quad \alpha C'' M R (F_K - Rb) G_{LL} \cdot F_{KL} K + \alpha (C - RC') M b G_{LL} F_{KL} K \\
& + \quad \alpha (C - RC') \mu \nabla^2 F m b L_m G_{LL} K^2] / |X|,
\end{aligned} \tag{32}
$$

and

$$
\begin{aligned}
\hat{\phi}_b = & [-\alpha (C - RC') M b G_{LL} (K F_{KK} + L_m F_{KL}) K + \alpha (C - RC') K |BH|_4 \\
& + \alpha C'' M G_{LL} (F_K - Rb) K (\alpha (C - Rc')(F_K - Rb) - \alpha (C - RC') L_m F_{KL} \\
& + \mu L_m R F_{KL}] / |X| > 0.
\end{aligned} \tag{33}
$$

The first line of (30) is positive and the remaining terms in the numerator are negative by the convexity of $C(\cdot)$ because $F_K - Rb < 0$ on $\mathcal{M}_{+0}$. Thus, the sign of K_b is ambiguous. For R_b, the first, third, and fourth terms in the numerator of (31) are negative while the second term is ambiguous in sign. The second term in the numerator of (32) is negative while the other three terms are positive. For $M = 0^+$, $w_b > 0$. $\hat{\phi}_b > 0$ because the determinant of the upper 4x4 principal minor of BH, is non-positive, $c(\cdot)$ is convex, and the homogeneity of F implies that $K F_{KK} + L_m F_{KL} < 0$.

Proof of Lemma 2. (i) By Proposition 2, Π^* is increasing in b when $t = 1$. By (A2), entry must occur at $b = t = 1$. At $b = \hat{b}$ and $t = 1$, $\Pi^* < 0$. Thus, there exists $b_0 \in (\hat{b}, 1)$ such that a positive measure of firms enter for all $b > b_0$. (ii) For $b \leq \hat{b}$, $\hat{\phi}_b > 0$ and $\hat{\phi}_t < 0$ by Proposition 1. If there is no FDI at (b, t), there will be no FDI for all (b', t) with $b' < b$. Suppose to the contrary that for some $b' < b$, FDI is strictly positive. At (b, t), the lack of FDI means that $w(b, t) = G_L(1)$. With strictly positive FDI at (b', t), the equilibrium wage, $w(b', t)$ must exceed $G_L(1)$. Formally then

$$
\begin{aligned}
\underline{\phi} \geq \Pi^*(b, t) \quad & \geq \quad \Pi(L_m(b', t), K(b', t), R(b', t), w(b, t), b, t) \\
& > \quad \Pi(L_m(b', t), K(b', t), R(b', t), w(b', t), b, t) > \Pi(b', t).
\end{aligned} \tag{34}
$$

Profit maximization yields the second weak inequality in (34). The first strict inequality in (34) arises because by assumption the reduction in b increases

the equilibrium wage. The second strict inequality arises because a reduction in b, holding the host wage and all multinational choices fixed, reduces multinational profit by allowing a smaller tax deduction for interest payments. Together the inequalities in (34) imply there will be no FDI at (b', t), which contradicts our initial supposition. A similar argument also applies to increases in t. Thus, $t_0(b)$ is the boundary between $\mathcal{M}_{++}$ and $\mathcal{M}_0$ and is increasing in b.

(iii) At $b = \hat{b}$ and for all $t < 1$, $\Pi_T > 0$, so in the limit as b converges to $\hat{b}$ from above, $t_1(\hat{b})$ converges to one. In the limit as t approaches one with $b = \hat{b}$, transfer price profits go to zero and after-tax subsidiary profit goes to zero. These two results imply that for t close to one, multinational profit will not be sufficient to cover the fixed cost of entry. Thus, the boundary between $\mathcal{M}_{++}$ and $\mathcal{M}_0$ at $\hat{b}$ must begin at some $t < 1$ and continue into the region for which $b > \hat{b}$.

Finally, because $t_1(b)$ is decreasing by Lemma 1, there exists $b_0 > \hat{b}$ for which no FDI arises at $(b_0, t_1(b_0))$. For $t > t_1(b_0)$, the host economy moves into $\mathcal{M}_{+0}$, and the equilibrium firm choices and the equilibrium wage become independent of t. With $\Pi_T = 0$, equilibrium multinational profit does not vary with t, and the boundary of $\mathcal{M}_0$ will extend into the region where $\Pi_T = 0$ and will be horizontal. By Proposition 2, M must be positive for $b > b_0$.

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