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

Thomas A. Gresik,† Dirk Schindler,‡ and Guttorm Schjelderup§

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Abstract

We study the link between a country's institutional quality in tax collection and its optimal corporate tax policies in a model of heterogeneous multinationals that can shift income using both debt and transfer prices in order to explain the variation in policy choices across countries. Countries with weak institutional quality, i.e., mainly developing countries, can be made worse off adopting policies that attract FDI as the benefits from higher wages and production are more than offset by tax base erosion. Countries with moderate institutional quality can gain from under-utilizing their ability to collect taxes, since the benefit of attracting more FDI outstrips the benefit of increased tax revenue. Countries with very strong institutions benefit from FDI and should utilize their full ability to collect taxes.

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

JEL Classifications: F23, H26, H32, F68

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†University of Notre Dame, Norwegian Center for Taxation, and CESifo, tgresik@nd.edu

‡Erasmus School of Economics, Norwegian Center for Taxation, Tinbergen Institute, and CESifo, schindler@ese.eur.nl

§Norwegian School of Economics, Norwegian Center for Taxation, and CESifo, guttorm.schjelderup@nhh.no

1 Introduction

Foreign direct investment (henceforth FDI) and with it the emergence of multinational companies has long been a dominant force in the global economy. The rising importance of multinationals has resulted in significant welfare gains[1] for both developed and developing countries but also the loss of billions of dollars in 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: (1) substantial variation in 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, e.g., Bilicka (2019). We will show that these empirical regularities can be understood as part of a broader picture that arises 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.

Despite tax competition and an apparent race to the bottom, the substantial differences in 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)). Data from the OECD's Corporate Tax Statistics database (OECD (2022)) show that corporate tax (CIT) revenues are particularly important in developing countries.[3] Yet, statutory tax rates are, on average, highest in developing countries despite the fact that the corporate tax base in developing countries often consists of large multinational companies (IMF, OECD, UN and World Bank (2016) and OECD (2022)) and despite the fact that the corporate tax rate is reported to be one of the main drivers to attract FDI in developing countries (Mooij and Ederveen (2008)). However, the value to a country of attracting FDI may be eroded by income shifting suggesting that countries may trade-off the value of FDI against tax base erosion.[4] Given

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

[2] Tørsløv, Wier, and Zucman (2022) estimate that about 36% of multinational profits are shifted to tax havens each year. The amount of tax avoidance can be extreme. De Simone, Klassen, and Seidman (2017), Dharmapala and Hebous (2017), Bilicka (2019), and Johannesen, Tørsløv, and Wier (2020) provide evidence of a significant percentage of affiliates in both developed and developing host countries that report zero (or negative) taxable income.

[3] In 2018, CIT revenue as a share of total tax revenues (unweighted average) was 19.2% in Africa, 15.6% in Latin-America, and only 10% in OECD countries.

[4] According to Crivelli, de Mooij, and Keen (2016), tax revenue losses from base erosion amount to 1% of GDP in

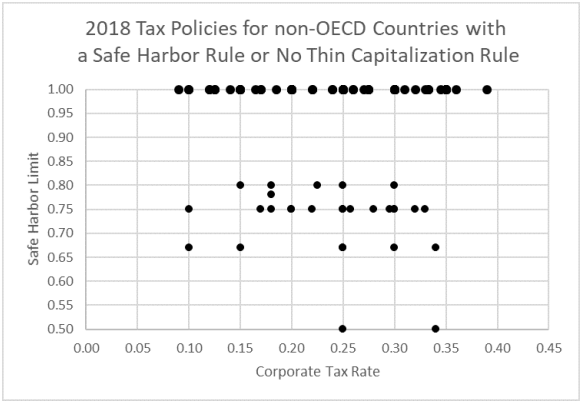

Figure 1: Safe Harbor Limits and Tax Rates
Data collected from EY (2018). The figure includes data from all non-OECD countries with safe harbor rules or no thin capitalization rule except for tax haven countries. Tax haven countries are defined as countries with a zero corporate tax rate and no thin capitalization limit: Bahamas, Bahrain, Bermuda, Bonaire, BVI, Cayman Is., Guernsey, Isle of Man, Jersey, Maldives, and UAE.

these trade-offs, should we think of FDI in combination with income shifting as a boon, resulting in better economic development, or as a bane as FDI and multinationals take out more than the benefit they create in these countries? Our analysis provides an answer to this question.

Jurisdictions also differ widely in their approach to curb income shifting by multinationals (EY (2018)). Some countries use the OECD (2013, 2015) toolbox to the fullest extent to limit such shifting, whereas others have in place lenient rules that give multinationals substantial leeway. In 2018, 42 countries used a safe harbor thin capitalization rule to impose a ceiling on debt to equity (or asset) 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.[5] 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 notable feature of the data is the 20 percentage-point gap or bifurcation between countries that have no thin capitalization limit (or a limit of 1) and those that have lower safe harbor limits starting at 0.8.[6]

developed countries and 1.5% of GDP in developing countries. For developing countries, World Bank Group (2018) estimates fiscal losses from tax avoidance as high as 5.9% of GDP.

[5]In addition, 23 predominately OECD countries used an earnings stripping rule that imposed a maximum limit on interest payments to earnings, with limits ranging from 10% to 60%. Five countries used a combination of safe harbor and earnings stripping rules and four countries used some other type of rule. Data was collected from EY (2018) and is available from the authors on request.

[6]For example, despite many economic similarities Colombia's thin capitalization limit is 0.75 while Bolivia's is 1.

We will show that this bifurcation is connected to the incidence of full income shifting out of a host country. It arises because of a natural non-convexity in equilibrium country welfare due to the change in the tax benefits of income shifting that occur when affiliates have zero taxable income. As a result, a host country that benefits from attracting FDI must choose between two distinct policies that are each locally optimal: one that generates taxable income from the FDI and one that does not. It is with this second option that one observes zero taxable income from affiliates and high tax rates, as the corporate tax rates only raise revenue from relatively inelastic domestic investment.[7] Our paper is the first to provide an economic explanation for this bifurcation pattern by showing that the first option is globally optimal for countries with higher institutional capacity in tax administration and the second option is globally optimal for countries with lower institutional capacity, typically developing countries.[8] We will also show that this is only part of the explanation. Consistent with empirical data, our analysis shows that some countries with a moderately high capacity in tax administration will under-utilize their capacity to curb profit shifting and adopt the same policies as lower-capacity countries.

To identify an explanation for the empirical differences among host country tax policies in the presence of FDI and income-shifting multinationals, we set up a model of national welfare maximization for a single host country that can choose its corporate tax rate, a thin capitalization rule to limit income shifting via internal debt, and the intensity with which it can audit transfer prices (up to its institutional capacity). By focusing on the optimal tax policy of a single host country, we are able to show that the observed behavior exists even in the absence of tax competition.

Our analysis is novel in four main ways. First, we consider the welfare effects of a host country's corporate tax policies in the presence of both debt financing and transfer pricing. Most previous studies of the welfare effects of income shifting have only considered 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)).[9] Both channels are essential for addressing the variation in thin capital-

[7]Depending on the database, 20-50% of affiliates report non-positive tax bases. In our one-period model, there are no tax benefits from generating negative taxable income by an affiliate but there can be in a multi-period setting. See also footnote 23.

[8]Recent development economics work, such as by Basri et al. (2021), Gadenne (2017), and Brockmeyer et al. (2021), identifies the importance of institutional capacity, but does not consider broader welfare effects.

[9]Gresik and Nelson (1994) derive optimal transfer price regulations but do not focus on the role of FDI or tax havens. Gresik, Schindler, and Schjelderup (2017) examined the interplay between debt financing and transfer pricing in a model with a representative multinational. That paper focused on the optimal design of thin capitalization rules holding the host country tax rate constant.

ization rules and the incidence of full income shifting when economic rents are present.[10] 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.[11] 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. 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 to change, and an endogenous quality decision regarding how much of its ability to utilize in deterring tax avoidance.

Three key discoveries follow from our analysis. The first pertains to how transfer pricing and debt financing combine to affect a host country's welfare from inbound FDI and the domestic economy. Permissive thin capitalization rules move the corporate income tax closer to a cash flow tax and encourage an increase in FDI because more host income can be shifted to tax haven affiliates. In effect, host governments can discriminate more between investment sources, subjecting relatively immobile domestic investment to higher tax rates than the highly mobile international investment.[12] However, permissive thin capitalization limits can also facilitate more aggressive transfer pricing on the interest rate paid by the host subsidiary. With both instruments at their disposal, multinationals are better able to shift supernormal profits. In fact, our analysis 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]

[10] Heckemeyer and Overesch (2017) find that both channels are important with the effect of transfer pricing on the semi-elasticity of profits with respect to international tax differentials being four times higher than the one of debt shifting.

[11] In models with a representative multinational, this rule can also imply that no pure-strategy market equilibrium exists.

[12] This view has been advocated by 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."

[13] Corporate tax revenue makes up more than 25% of total tax revenue in developing countries, but typically less than 10% in developed countries (Avi-Yonah (2016)). A significant informal sector (e.g., see Dharmapala, Slemrod, and Wilson (2011)) and weak institutional quality make it difficult for these countries to rely on personal income tax revenues instead of relying heavily on domestic firms. For example, Fjeldstad and Moore (2008) report that 286 domestic companies contribute about 70 per cent of domestic tax revenue in Tanzania.

Our finding that pursuing FDI can reduce a country's welfare if its institutional quality is weak is in line with concerns voiced by non-governmental organizations over the possibility that FDI may be a burden to a country if multinationals can strip out most of the benefits of FDI and that developing countries may be 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 support our findings. They 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.

The second discovery identifies how a host country's ability to curb income shifting affects its optimal tax policy. We refer to this tax administration ability as a host country's institutional quality. It is a function of a country's tax administration capacity and its utilization of that capacity. Institutional quality in tax revenue administration differs across countries. Developing countries typically have lower capacity than developed countries. This turns out to be a crucial difference in our model because a lower-quality country will collect fewer (if not zero) tax revenues from foreign-owned affiliates, without which FDI-induced welfare losses in its domestic sector are harder to offset. Consistent with the empirical results in Fuest, Hebous, and Riedel (2011) on debt financing and in Johannesen, Tørsløv, and Wier (2020) on tax revenues, we will show that with less tax administration quality, a host country will adopt permissive tax policies in order to attract more FDI in order to earn larger non-revenue benefits while a country with higher quality will adopt less permissive policies that attract FDI and raise tax revenues.[15] We will also show that the optimal policies that attract FDI without affiliate tax revenues differ significantly from the optimal policies that attract FDI with affiliate tax revenues. Thus, small differences in a country's administrative quality can result in large changes in its optimal policy, changes that are consistent

[14] See Alfaro and Chauvin (2018) for a survey of how financial markets matter for the benefits of FDI.

[15] Investment tax credits (ITCs) exacerbate this income shifting problem, even if the credits are non-refundable, because they reduce an affiliate's host tax liability. ITCs effectively shift income out of the host country equal to the pre-tax value of the credits before a multinational engages in any income shifting via debt financing and transfer prices. With an ITC, a multinational has less host tax to avoid. Thus, it will avoid at least as much host tax liability by coupling income shifting with an ITC than it would without an ITC. In effect, 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 regarding the extensive margin and intensive margin effects of tax policies intended to reduce the amount of income shifting.

with tax policy differences documented in Figure 1.

Developed countries tend to have advanced tax administrations to curb aggressive transfer pricing while attracting welfare-enhancing FDI. The optimal policy for these countries is a combination of moderate thin capitalization limits and moderate tax rates as reflected in the data. In equilibrium, these countries attract FDI that generates strictly positive taxable income. At the other end of the institutional capacity spectrum, developing countries tend to have weak tax administrations. Conditional on attracting FDI, the optimal tax policy for these countries encourages aggressive income shifting by setting a high thin capitalization limit and a high tax rate, whose burden falls only on domestic firms (consistent with Hines (2010)). Such a policy attracts FDI but generates no taxable subsidiary income. Emerging countries tend to have intermediate levels of institutional capacity. Some of these countries will be close to indifferent between the moderate policies used by developed countries and the aggressive income shifting policies of developing countries. As a result, two similar countries can have very different optimal policies.

The third discovery is that some countries with intermediate levels of institutional capacity may choose to under-utilize this capacity and adopt the same policies as lower-capacity countries. Under-utilization comes at a cost of reduced subsidiary tax revenues, but if the optimal policies consistent with full utilization yield little tax revenue, the boost in FDI from under-utilization would more than offset the welfare losses from the lost revenue.[16] Austria, Ireland, Israel, and Sweden are examples of countries with good institutional capacity whose policies our theory would associate with low capacity countries. We will show that the ability of a host country to choose strategically the level of institutional capacity it utilizes reconciles the policies of the above countries with our model's predictions. We believe this result that countries with intermediate levels of institutional capacity can benefit from under-utilization is new to the FDI literature.

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 the global optimum. The relevant equilibria include one without FDI and one(s) in which a country would choose to under-utilize its institutional capacity. We

[16] Stronger countries will not choose to under-utilize their institutional quality because they would lose too much subsidiary tax revenue.

extend our analysis to consider earnings stripping rules in section 8, and offer concluding remarks in section 9.

2 Literature review

Our study is related to the literature on the welfare effects of FDI. There is a large literature that spans several topics and it is outside the scope of this paper to review this literature. We shall therefore concentrate our review on those papers that are most closely related to our study.

Our paper is part of the literature that studies how corporate income tax policies affect welfare when multinationals can shift income to tax havens. Most of this literature suggests that tax havens lower welfare. For instance, Slemrod and Wilson (2009) prove that the presence of tax havens in a setting with multinational firms lowers host country welfare when the country can charge domestic investors and foreign investors different tax rates, and workers can avoid wage taxes. In their model, tax havens limit the power of a host country to tax the normal return on investment and reduce its ability to indirectly tax workers. Positive welfare effects from tax havens are found in Desai, Foley and Hines (2006) who argue that while tax havens may allow multinationals to reduce income taxes paid in high-tax jurisdictions, they may have offsetting effects on real investment that are attractive to the same governments. This argument is based on the insight that when capital is perfectly mobile, a source tax on capital falls on immobile factors of production (Gordon, 1986). The reason is that capital outflows following a tax increase lower worker productivity and thus wages. From a policy point of view, it is therefore better to tax workers directly. Tax havens may help firms avoid the tax on mobile capital partly or wholly, and reduce the adverse effects of inefficient policies. Wang (2020) estimates the welfare effects of corporate taxes in the presence of non-specific income shifting but treats income shifting as orthogonal to the output decisions of subsidiaries and assumes away full income shifting. Spencer (2020) models the effect of repatriation taxes, but allows for no income shifting.

Hong and Smart (2010) use a general equilibrium model to show 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. In their model, an affiliate of a multinational can be financed partially with debt issued at the market (normal) interest rate from a related affiliate in a tax haven. In their model,

there is no role for transfer pricing, no firm heterogeneity, and no accounting for negative taxable income. Since interest expenses under the thin capitalization limit are tax deductible, internal debt reduces the 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. Hong and Smart (2010) show that the optimal policy of any host government is to allow the affiliate to be financed entirely by debt by setting a thin capitalization limit of one unless there are agency costs associated with internal borrowing. This prediction is inconsistent with the many countries in Figure 1 that set lower limits. When they introduce agency costs from internal borrowing, the optimal policy is for all host countries to set a limit strictly less than one. This prediction is also inconsistent with the variation in Figure 1. In contrast, by introducing differences in the ability of countries to deter income shifting, our model is able to generate the range of thin capitalization limits observed in the data

Besides Hong and Smart (2010), there is scarce theoretical literature on the optimal design of thin capitalization rules.[17] Haufler and Runkel (2012) study tax competition equilibria when countries compete in tax rates and thin capitalization levels and countries can differ in population. This paper does not include transfer pricing effects. Gresik, Schindler, and Schjelderup (2017) and Mardan (2017) study the optimal choice of safe harbor vs. earnings stripping rules for a given corporate income tax rate, with Mardan (2017) focusing on the role of capital market imperfections. Kalamov (2020a) studies the choice of safe harbor vs. earnings stripping rules when host countries compete for FDI. Kalamov (2020b) analyzes the Hong and Smart (2010) and the Gresik, Schindler, and Schjelderup (2017) models when 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 (2020) is the closest paper to ours in the sense that it includes country variation and it considers a country's choice of the level of tax administration. Country variation is in the level of economic development. Countries face the same cost of tax administration but firms operating

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

in less developed countries have higher capital costs. In contrast, in our model country variation takes the form of differences in the capacity to audit income shifting. In Mardan's model, firms shift income in a non-specific manner rather than considering transfer pricing and debt financing as separate but inter-connected channels. It also includes no labor, no firm heterogeneity, no entry costs, and no negative income provisions. These last features are important because once one accounts for the loss of tax benefits from income shifting when affiliate income is negative, an equilibrium wage rate will not exist without entry costs and firm heterogeneity. Mongrain, Oh, and van Ypersele (2020) also 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 country does not want to completely shut down income shifting. Their paper also differs from ours in that profit shifting is generic and has no effect on gross subsidiary profit, they do not address the issue of firms shifting more than 100% of gross profit, their model only considers an extensive margin, and host countries seek only to maximize tax revenue.

Finally, our paper informs a recent literature in development economics that estimates the importance of improving tax administration quality. Basri et al. (2021) exploit a natural experiment in Indonesia and find that improving tax administration dramatically increased tax revenues. Most of the effect is driven by turning previously unrecognized revenues into taxable income. Relatedly, Gadenne (2017) finds that a program to improve tax capacity in Brazilian municipalities robustly improved tax revenue in these municipalities. Providing Brazilian municipalities with (unconditional) grants did not have the same effect. In contrast, Brockmeyer et al. (2021) show that increasing the rate of the property tax dominates better tax enforcement (i.e., better quality of tax administration) for the case of Mexico. Whereas better enforcement leads to welfare losses as non-compliant property taxpayers lose more than the government gains in revenue, a tax hike triggers a net welfare gain. This (mainly) empirical literature, however, 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 A model of income shifting via debt and transfer prices

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 domestic firm employs L_d units of labor at a wage rate w to produce $G(L_d)$ units of output that are sold in a competitive market. The production function $G(\cdot)$ is strictly increasing and strictly concave in L_d. The pre-tax income of the domestic firm is

$$\pi = G(L_d) - wL_d. \tag{1}$$

The host country levies a corporate income tax rate of t so the domestic firm has a post-tax profit of $(1-t)\pi$.

There exist 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 can choose to 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). 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, strictly concave, and is homogeneous of degree $\eta \in (0,1)$ in capital and labor. This last assumption implies that F exhibits decreasing returns to scale. 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. Denote the multinational's economic cost of capital by r. 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 capital takes the form of equity, E, and/or internal debt, B, so that $k = E + B$. Following most corporate tax codes worldwide, we assume that interest expenses are tax deductible, but costs of equity are not. For simplicity we do not allow any subsidiary to take on external debt, although one of the determinants of the parent's cost of capital may be the amount it borrows from

international markets.[18] We assume that each multinational's economic cost of capital reflects, in part, a country-firm-specific risk of the investment so that r need not simply equal a worldwide interest rate.[19] 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 to distinguish pre-tax income from after-tax profit, equals

$$\Pi_T = F(l_m, k) - wl_m - RB. \tag{2}$$

That is, R is the transfer price of internal debt. Most transfer price models study transfer prices on intermediate inputs other than debt. However, allowing multinationals to use their transfer prices on debt to shift income out of the host country is a simple and direct way to see the linkages between debt shifting and transfer pricing. Moreover, disputes between tax authorities and multinationals over interest rates charged between affiliates are commonplace in many countries.

Each multinational incurs income shifting costs of $\alpha C(R-r)B$ to reflect any tax administration auditing the host country may conduct. These income shifting costs consist of three components. First, 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.[20] Second, the multinational's transfer price costs are proportional to the amount of debt, as the total shifted income out of the host country will equal $(R - r)B$. The transfer price costs are linear in B to coincide with the standard practice in most countries of using a "comparable price" rule for ensuring that 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.[21] Third, $\alpha > 0$

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

[19] While the norm in the tax competition literature is to assume all multinationals can finance investments at a worldwide interest rate, our assumption is consistent with corporate finance textbooks that make clear that a firm's economic cost of capital varies with its CAPM β. In addition, the opportunity cost of investing in a host country will also depend on country-specific factors related to the multinational's available projects in the host country and the strength of the host country's legal system.

[20] 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 such as Cristea and Nguyen (2016), Davies et al. (2018), and Flaaen (2017).

[21] Under the most common and preferred method among host countries, the comparable price auditing method, a revenue authority collects comparable price data from firms engaged in independent or arm's-length transactions. An audited firm's transfer price is typically deemed to be non-compliant if it falls outside the inter-quartile range of the comparable data. Thus, 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.

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 a 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 the quality of its court system or the level of corruption. These are characteristics that are not easily or quickly changed. Lower values of α correspond to a country that faces higher marginal administrative costs or has less capacity to audit transfer prices and impose non-compliance penalties. We then endogenize the host country decision to under-utilize its institutional capacity and show that for some host countries the choice of institutional quality is driven more by strategic factors than the direct marginal costs of building quality.

A key reason for financing a subsidiary with debt instead of equity is that interest payments on debt are tax deductible while equity payments are not. With the same tax rate applied to a subsidiary's host country income as is applied to the income of the domestic firm, a multinational's global after-tax profit equals

$$\Pi = \begin{cases} (1-t)\Pi_T + RB - rk - \alpha CB - \phi & \text{if } \Pi_T \geq 0 \\ F - wl_m - rk - \alpha CB - \phi & \text{if } \Pi_T < 0. \end{cases} \tag{3}$$

The first line of (3) is the sum of a multinational's after-tax operating profit plus the profit realized in the tax haven affiliate net of income shifting costs and capital costs, $RB - rk - \alpha CB$, minus its fixed entry cost. The second line of (3) 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 the multinational. It just does not create any benefit once taxable subsidiary income is non-positive. Regardless of the value of Π_T, the fixed entry costs are never tax deductible.[22]

No multinational will want to shift so much income that $\Pi_T < 0$ because income shifting is costly.[23] Notice at fixed values of l_m and k for which $F - wl_m - rk \geq 0$, $\Pi_T < 0$ implies that Π is

[22] Allowing ϕ to be tax deductible would not affect any of a multinational's intensive margins and would only eliminate extensive margin effects at $t = 1$.

[23] In most countries, losses can be carried forward to offset taxable income in future years or they can 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. Even in a dynamic model, the value to a firm of creating negative taxable subsidiary income is less than 100%. This is what our model captures.

strictly decreasing in R for $R > r$. This means that at an optimum a multinational will always set its transfer price so that $\Pi_T \geq 0$. In addition, we show in the Appendix that each multinational has the incentive to finance its subsidiary entirely with debt, i.e., $B = k$. 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.[24]

To discourage multinationals from financing foreign operations entirely with debt, the host country can adopt a thin capitalization rule. 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 a full tax deduction for the interest payments it makes to its parent as long as its debt as a proportion of its total capital 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 $b/(1 - b)$.[25,26]

The multinational's problem then is to choose l_m, k, and R to maximize

$$\Pi = (1 - t)\Pi_T + (Rb - r - \alpha Cb)k - \phi \text{ subject to } \Pi_T = F - wl_m - Rbk \geq 0. \tag{4}$$

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 $M =$

In addition, allowing for loss offsets increases the welfare costs of income shifting and makes it more likely that our subsequent analysis would imply that a country should not attract FDI.

[24] Including a cost of income shifting associated with a firm's debt-equity ratio encourages even more reliance on transfer pricing to shift income.

[25] Adding a cost term to the firm's profit function to reflect costs associated with the amount of debt a subsidiary takes on would alter the way in which firms use their transfer price and the amount of debt to shift income without altering the main economic trade-offs the host country faces because the cost function αCB already captures some regulatory cost that are proportional to B.

[26] After presenting our main results, we will discuss the implications of adopting an earnings stripping rule in Section 8.

$(\hat{\phi}-\underline{\phi})/(\bar{\phi}-\underline{\phi})$ and let $L_m(b,t)$ and $K(b,t)$ denote the quantities of labor and capital that maximize (4), conditional on entry.[27] These quantities will be independent of ϕ so aggregate multinational labor demand equals ML_m, aggregate FDI equals MK, and the host country's tax base is $\pi+M\Pi_T$. Let $R(b,t)$ denote a multinational's optimal transfer price and let $\Pi^*(b,t,\phi)$ denote the indirect profit of a firm with entry cost ϕ prior to its entry decision. The dependence on α is suppressed in the notation.

Host country welfare is the weighted sum of labor income, after-tax domestic firm profit, and tax revenues.[28] Let $\beta_w \geq 0$ denote the welfare weight on domestic labor income and let $0 \leq \beta_\pi \leq 1$ denote the welfare weight on after-tax domestic firm profit. We normalize the welfare weight on tax revenue to one. By assuming that $\beta_\pi \leq 1$, we eliminate the desirability of subsidizing firms with tax revenues. Thus, host country welfare is defined as

$$\Omega = \beta_w w + \beta_\pi(1-t)\pi + t\pi + t(F - wL_m - RbK)M. \tag{5}$$

The host country will choose its thin capitalization parameter b and its tax rate t to maximize its welfare. If $\beta_w < 1$ and $\beta_\pi < 1$ for a host country, then that country prefers a dollar of tax revenue over a dollar of wage gains or after-tax domestic profit (see footnote 13). Our formulation allows us to consider optimal tax policy for countries with a wide range of welfare functions including national income maximization when $\beta_w = \beta_\pi = 1$ and tax revenue maximization when $\beta_w = \beta_\pi = 0$. Importantly, the welfare weights β_w and β_π effectively measure the relative importance of private income (or so to speak 'private consumption') relative to the spending capacity of the government (so to speak 'public consumption').[29]

4 A motivating example

Before presenting our analysis of this model, we use an example to highlight several aspects of the economic trade-offs in the model that generate two properties of host policies seen in Figure 1: The

[27] 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] This is in contrast to studies such as World Bank Group (2020) that focus only on jobs benefits.

[29] In that sense, our 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 would use endogenous weights, our welfare weights would decrease with a decrease in tax revenue, i.e., the spending capacity of the government. As it will turn out later, such an effect would rather reinforce our results to come.

mass of 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 as a function of the thin capitalization parameter, b, for two slightly different host countries. For this example, we assume $F(l_m, k) = k^{0.3} l_m^{0.5}$ and $G(L_d) = L_d^{0.85}$, so that the multinational and domestic sectors generate rents. We also assume $r = 0.08$, $t = 0.45$, $C(R-r) = (R-r)^2$, $\phi \in [0.1, 10]$, $\beta_\pi = 0.3$, and $\beta_w = 1$. In the graph on the left, $\alpha = 2.75$. In the graph on the right, $\alpha = 3.5$, so that the host country in the left panel has less institutional capacity. These values are not meant to reflect calibrated values but only to illustrate the range of possible welfare effects from different thin capitalization rules.

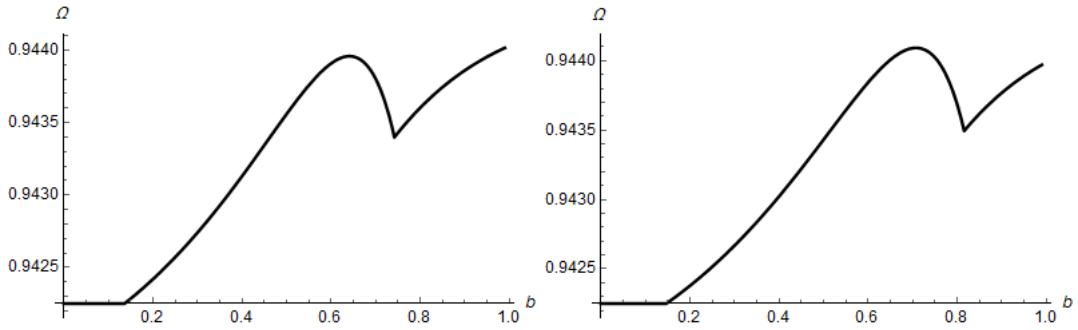

Figure 2: Host country welfare as a function of the thin capitalization parameter, b, when $F(l_m, k) = k^{0.3} l_m^{0.5}$, $r = 0.08$, $t = 0.45$, $G(L_d) = L_d^{0.85}$, $C(R-r) = (R-r)^2$, $\phi \in [0.1, 10]$, $\beta_\pi = 0.3$, and $\beta_w = 1$. In the left graph, $\alpha = 2.75$. In the right graph, $\alpha = 3.5$.

In both graphs, the observed welfare patterns from changes in the thin capitalization limit are due to three different 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. As we will show later, this region only exists for a sufficiently high tax rate. 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. 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 welfare losses from lower domestic sector profits and lower domestic and multinational 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, the strictly increasing region at high values b corresponds to tax policy at which the host country attracts FDI but none of the subsidiaries report taxable 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 last region as the gains from higher wages dominate the truncated tax revenue losses from income shifting.[31] While both graphs illustrate how a tax loss rule affects the trade-offs from more permissive thin capitalization rules between the welfare gains from greater wage income versus welfare losses from fewer domestic profits and reduced tax revenues, the graph on the right shows that adopting no thin capitalization limit can be optimal.

The graphs also show how the formal modelling of a tax loss rule can result in multiple locally optimal values of b. For the graph on the left, the global optimum occurs at $b = 1$ while, for the graph on the right, the global optimum occurs at $b = 0.71$. In both graphs, the host country's preferences are non-convex in b.[32] Both an increase and a decrease in b near the kink increases host welfare. The non-convexity arises because of the limitation on receiving a tax benefit from subsidiary losses and not because of some technical assumption. At $\alpha \approx 3.04$, the optimal value of b jumps from 1 down to 0.67. Taken together, the graphs show how a small change in host country institutional quality 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 an optimal labor, capital, and transfer price choice by each multinational that chooses to enter, the set of entering firms defined by $\hat{\phi}$, an optimal labor choice for the domestic firm, and a market-clearing wage rate. We denote these equilibrium values by $L_m(b,t)$, $K(b,t)$, $R(b,t)$, $\hat{\phi}(b,t)$, $L_d(b,t)$, and $w(b,t)$. Since $M = (\hat{\phi} - \underline{\phi})/(\bar{\phi} - \underline{\phi})$

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

[31] At very high tax rates, one can observe no FDI for low values of b and positive FDI with no taxable income for high values of b. In this latter situation, welfare can be U-shaped.

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

is the measure of multinational firms that enter, we will show for each (b,t), that the resulting equilibrium 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 sets of values of (b,t) associated with each of these cases by $\mathcal{M}_{++}$, $\mathcal{M}_{+0}$, and $\mathcal{M}_0$. For example, $\mathcal{M}_0 = \{(b,t)|M = 0\}$. In cases 1 and 2, the amount of FDI is positive because some multinational firms enter. In case 1, the subsidiary pays a positive host tax. In case 2, all taxable income is shifted out of the host country so the subsidiary pays no host tax. 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 multinational's problem, (4), can be solved by choosing L_m, K, R, and $\hat{\phi}$ to maximize aggregate multinational profit.[33] With μ denoting the multiplier on the constraint, $\Pi_T \geq 0$, the associated Lagrangian is

$$\Lambda = M(\hat{\phi})\left[(1-t)\Pi_T + (Rb - r - \alpha Cb)K\right] - \int_{\phi=\underline{\phi}}^{\hat{\phi}} \phi dM(\phi) + \mu M(\hat{\phi})\Pi_T. \tag{6}$$

The analysis of the multinational's problem differs if $t < 1$ and if $t = 1$. If $t < 1$, the firm's first-order conditions associated with (6) in any positive-FDI equilibrium imply

$$F_L(L_m, K) = w, \tag{7}$$

$$F_K(L_m, K) = \frac{(\mu - t)Rb + r + \alpha Cb}{1 - t + \mu}, \tag{8}$$

$$t - \alpha C' = \mu, \tag{9}$$

$$\hat{\phi} = (1-t)\Pi_T + (Rb - r - \alpha Cb)K + \mu\Pi_T, \tag{10}$$

and

$$\mu\Pi_T = 0 \tag{11}$$

where $\mu \geq 0$, F_K denotes the marginal product of capital, and F_L denotes the marginal product of labor. By (7) and (8), each multinational will equate its marginal product of labor with the pre-tax

[33] 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.

wage rate, and it will equate its marginal product of capital with its after-tax cost of capital. With positive taxable income, (9) 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 gain from income shifting per dollar of debt, net of income shifting costs, $R - \alpha C$, is always positive. This net gain is equal to r when $R = r$ and is increasing in R as long as the marginal cost of transfer pricing, $\alpha c'$, is less than one. By (10), the marginal multinational to enter will earn zero after-tax global profit. Eq. (11) is the complementary slackness condition.

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 $R^*(1)$. In order for a multinational to be willing 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.[34] 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, a multinational that enters would choose values of K, L_m, and R that imply $\Pi_T = 0$, $F_L = w$, and $\mu = 1 - \alpha C' > 0$.

For a host country with $\alpha = 0$ close to zero, $R^*(1)$ goes to ∞ 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 $t = 1$.

For all t, the remaining equilibrium conditions imply that the domestic firm employs labor until the marginal product of labor equals the wage rate,

$$G_L(L_d) = w, \tag{12}$$

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

and that the labor market clears[35],

$$L_d + M(\hat{\phi})L_m = 1. \tag{13}$$

Thus, a positive-FDI equilibrium with $t < 1$ is defined by the solution to (7) - (13). 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:

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

$$\text{(A2) } (R(1,1) - r - \alpha C(R(1,1) - r))K(1,1) > \underline{\phi}.^{36}$$

Assumption (A1) requires that some multinationals enter when $b = t = 0$ and is sufficient for the existence of tax policies in which Case 1 equilibria arise. It will be satisfied if $\underline{\phi}$ is small or if output is sufficiently large. Assumption (A2) requires that some multinationals enter when $b = t = 1$. Because $\hat{b} < 1$, subsidiary taxable income will be zero. Assumption (A2) is sufficient for the existence of tax policies in which Case 2 equilibria arise as it ensures for b close to 1 that net income shifting profit is large enough to cover the fixed entry costs for firms with ϕ close to $\underline{\phi}$. It defines an upper bound on α because, as α goes to ∞, transfer price profit goes to 0 when $b = 1$. Thus, there exists $\bar{\alpha} < \infty$ such that for all $\alpha \geq \bar{\alpha}$, $\mathcal{M}_{+0}$ is empty. Assumptions (A1) and (A2) also reduce the set of tax policies that result in zero FDI, and they make it less likely that the optimal tax policies induce no FDI. Nevertheless, we will show that there always exist tax policies in which Case 3 equilibria arise. 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 in order to explain the elements of Figure 3.

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

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

[36] This assumption is equivalent to $F(L_m(1,1), K(1,1)) - w(1,1)L_m(1,1) - (r + \alpha C(R(1,1) - r))K(1,1) \geq \underline{\phi}$ because $\Pi_T = 0$.

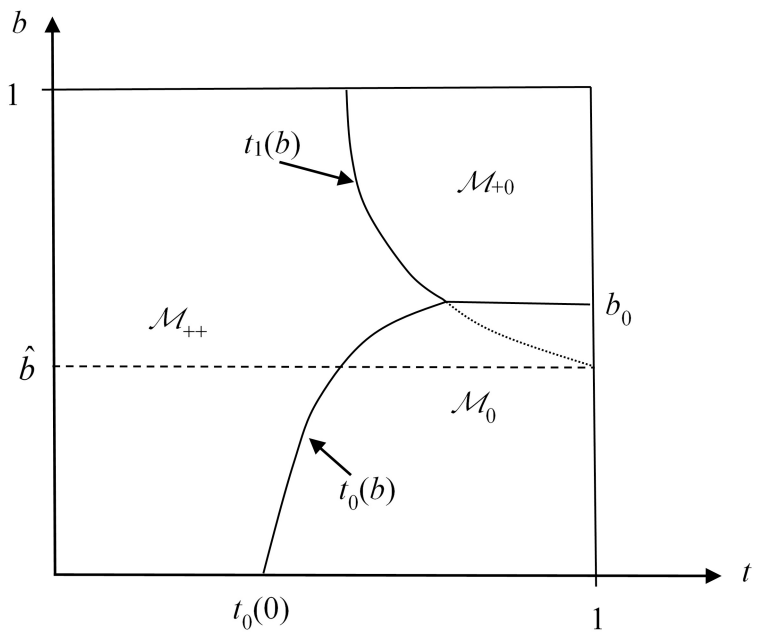

Figure 3: Equilibrium Regions

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. Because $\Pi_T > 0$ for all equilibria in this case, $\mu = 0$ and eq. (8), the first-order condition with respect to K, simplifies to

$$(1-t)(F_K - Rb) = r - Rb + \alpha Cb. \tag{14}$$

The left-hand side of the equation is marginal after-tax subsidiary income from FDI and the right-hand side is the unit cost of capital reduced by transfer pricing. In addition, decreasing returns to scale of the subsidiary production function implies that

$$\Pi_T > F_K K + F_L L_m - wL_m - RbK = (F_K - Rb)K. \tag{15}$$

If $F_K - Rb \geq 0$ in an equilibrium, then (15) implies that Π_T must be strictly positive. Conversely, if $\Pi_T = 0$ (or sufficiently close to zero), then $F_K - Rb$ must be strictly negative. 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 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. We refer to the boundary between $\mathcal{M}_{++}$ and $\mathcal{M}_0$ as $t_0(b)$. 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 $\hat{b}$. We refer to the boundary between $\mathcal{M}_{++}$ and $\mathcal{M}_{+0}$ as $t_1(b)$. 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. The proof is 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 (b is larger) reduces the net cost of capital by inducing more income shifting, attracts more capital and more multinationals (consistent with the estimates in Merlo et al. (2019)), and raises 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 more transfer pricing and debt financing.

The ambiguous effect on capital arises through (14) 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,[37] the firm's marginal tax haven profit is negative ($r - Rb + \alpha C b > 0$), so 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. The multinational responds by investing more capital in order to lower its marginal taxable subsidiary income. Thus, different values of b can influence affiliate capitalization in opposite directions.

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

[37] When Π_T is close to zero, the general equilibrium effects associated with income shifting will not dominate multinational capital choices.

(10) 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 Π_T is close to zero, the equilibrium wage and equilibrium global after-tax profit will change in opposite directions, as indicated by parts (iii) and (iv) of Proposition 1. 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 Π_T is close to zero. When b is large, larger income shifting incentives increase K and w. As long as Π_T is close to zero, 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 focus in Proposition 1 on equilibria with Π_T close to zero is helpful because Π_T will be close to zero near $t_1(b)$, 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 $t \geq t_1(b)$. Moreover, $t_1(b) \to 1$ as $b \to \hat{b}$. For $b < \hat{b}$, $t_1(b)$ is not defined because Π_T is positive for all t. For tax rates just below $t_1(b)$, Π_T must be positive but close to zero. Thus, we can use the results in Proposition 1 to show that $t_1(b)$ 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 close to 1. 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 creates the incentive for multinationals to shift more 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 two 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. In this subsection, we will identify tax policies that attract no FDI in a market equilibrium, i.e., $\hat{\phi} = \underline{\phi}$ and $M = 0$. The set $\mathcal{M}_0$ is non-empty because at $b = 0$ and $t = 1$, $\Pi^* = -rK - \phi < 0$ so no firm will enter. In fact, there is a non-trivial set of tax policies near $b = 0$ and $t = 1$ that 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 the boundary, $t_0(b)$.

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 is the boundary between the policies that result in positive FDI and positive multinational tax revenue and the policies that attract no FDI. The second part is the boundary between the policies that result in positive FDI and zero multinational tax revenues and policies 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 $t \geq t_0(b)$. From the proof of Proposition 1, when M is close to zero, an increase in b increases entry ($\hat{\phi}_b > 0$) while an increase in t decreases entry ($\hat{\phi}_t < 0$). Thus, $t_0(b)$ must be strictly increasing for all $b < \hat{b}$. By continuity, this trade-off must continue as b rises just above $\hat{b}$. Thus, 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 $(b_0, t_1(b_0))$. Moreover, 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.

A special case arises when transfer pricing is costless because $\alpha = 0$. This is the case for which the host country's institutions are so weak that it cannot detect or chooses not to detect any transfer price deviation. With $\alpha = 0$, $\mathcal{M}_0 = \{(0,t)|t \geq t_0\}$ and $\mathcal{M}_{++} = \{(b,0)|0 \leq b \leq 1\} \cup \{(0,t)|t < t_0\}$. $\mathcal{M}_{+0}$ thus consists of all policies with $b > 0$ and $t > 0$. With no institutional capacity to limit transfer price deviations, the host country will attract strictly positive FDI with any strictly positive thin capitalization limit and any strictly positive tax rate but multinationals will shift all taxable income out of the host country.

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). However, in order to identify the optimal policy we must identify a host country's optimal tax policy for each region in Figure 3 separately. By doing so, we can then compare host welfare at each of the local optima to find the global optimum in the following section.[38] First of all, special attention will be paid to the changes in welfare near the boundaries of the three regions because the local incentives will help identify non-convexities in equilibrium host welfare that can lead to the bifurcation in thin capitalization limits observed in Figure 1.

For all three types of equilibria, totally differentiating (5) yields

$$\begin{aligned} d\Omega &= t\Pi_T dM - tMbKdR + tM(F_K - Rb)dK - ((t + (1-t)\beta_\pi)L_d - \beta_w + tML_m)dw \\ &- tMRKdb + ((1-\beta_\pi)\pi + \Pi_T M)dt. \end{aligned} \tag{16}$$

Eq. (16) 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** $\Pi_T > 0$

[38] It is not possible to rule out any of the three types of equilibria without ignoring the phenomenon of full income shifting or the variety of thin capitalization rules observed in practice.

First, we focus on the 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 as the host country's incentives may be to move out of this region. 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 between $\mathcal{M}_{++}$ and $\mathcal{M}_0$, the measure of entrants is close to zero so (16) simplifies to

$$d\Omega = t\Pi_T dM + (\beta_w - (t + (1-t)\beta_\pi))dw + (1-\beta_\pi)\pi dt \tag{17}$$

and Proposition 1 implies that $M_t < 0$ and $w_t < 0$ to the left of the boundary and $M_b > 0$ and $w_b > 0$ above the boundary. If the host country seeks to maximize national income ($\beta_w = \beta_\pi = 1$), then $\Omega_b > 0$ and $\Omega_t < 0$ in (17). Decreasing t (or increasing b) near the boundary with $\mathcal{M}_0$ increases host welfare by attracting FDI. However, an increase in t also increases host welfare because $\Omega_t > 0$ on $\mathcal{M}_0$. As a result, the host country faces local incentives to increase and decrease its tax rate, a conflict that arises when preferences are non-convex.

Near the boundary between $\mathcal{M}_{++}$ and $\mathcal{M}_{+0}$, Π_T is close to zero. By collecting together terms that affect Π_T, (16) simplifies to

$$d\Omega = tMd\Pi_T + (\beta_w - (t + (1-t)\beta_\pi)L_d)dw + (1-\beta_\pi)\pi dt, \tag{18}$$

and Proposition 1 implies that $d\Pi_t/db < 0$, $w_b > 0$, $d\Pi_T/dt < 0$, and $w_t > 0$. Near the boundary with $\mathcal{M}_{+0}$, the signs of Ω_b and Ω_t in (18) are now ambiguous due to opposing effects on w and Π_T. As a result, 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 will 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 will 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 with Case 1, an optimal policy on $\mathcal{M}_{+0}$ may not exist if welfare can be improved by attracting no FDI.

Because the equilibrium wage and all equilibrium firm choices are independent of t, an increase in t will increase tax revenues from the domestic sector, and by (16), $\Omega_t = (1 - \beta_\pi)\pi > 0$ for all $\beta_\pi < 1$. Thus,

Proposition 3 *For each $b > b_0$, host welfare on $\mathcal{M}_{+0}$, where equilibrium subsidiary taxable income is equal to 0, is maximized at $t = 1$.*

In light of Proposition 3, the optimal policy on $\mathcal{M}_{+0}$ must take the form $(b, 1)$ for some $b > b_0$.[39] Intuitively, with the multinational's subsidiary generating no host tax revenue, the host tax rate should be set to maximize tax revenues from the domestic firm.

With $t_{+0} = 1$, for any $b > b_0$,

$$\Omega_{+0}(b) \equiv \Omega(b, 1) = G(L_d) + (\beta_w - L_d)G_L(L_d) \tag{19}$$

and

$$\Omega_b = (\beta_w - L_d)w_b. \tag{20}$$

Eq. (20) highlights a welfare trade-off between wage income and tax revenues generated by the domestic sector. A small increase in the thin capitalization limit above b_0 attracts a small amount of FDI and increases the equilibrium wage, which in turn reduces domestic taxable income and hence also tax revenues collected from domestic firms. According to Proposition 2, $w_b > 0$ when M is close to zero. For b just above b_0, M is close to zero and $\Omega_b = (\beta_w - 1)w_b > 0$ for all $\beta_w > 1$. In this case, since the host country values a dollar of wage income more than a dollar of tax revenue, the local incentives on $\mathcal{M}_{+0}$ near the boundary with the zero FDI region $\mathcal{M}_0$ imply that a locally

[39] Note, however, that the policy $(b_0, 1)$ attracts no FDI and is thus not an element of $\mathcal{M}_{+0}$.

optimal policy on $\mathcal{M}_{+0}$ exists. However, if $\beta_w < 1$ so that the host country values a dollar of wage income less than a dollar of tax revenue,[40] then the incentives near the boundary with $\mathcal{M}_0$ mean attracting no FDI is a better outcome than attracting a small amount of FDI. It can still be the case that attracting a large amount of FDI is preferred to attracting no FDI, even with $\beta_w < 1$. As long as w_b remains positive, which is the case in all our simulations, beyond some value of b, multinational employment in the host country can exceed β_w. In this situation, host welfare is a convex function of b and there can exist a policy $(b', 1)$ for some $b' > b_0$ that is locally optimal on $\mathcal{M}_{+0}$ (but not necessarily globally optimal on $\mathcal{M}_{+0}$.) The right panel of Figure 4 illustrates this possibility with $b' = 1$.

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 are independent of b and t. Welfare is also independent of b. However, by increasing t, the host country can increase tax revenues from the domestic firm and increase its welfare. Thus,

Proposition 4 *The set of optimal host policies that attract no FDI consists of the policies* $(b, 1)$ *for* $0 \leq b \leq b_0$.

Therefore, maximal host welfare on $\mathcal{M}_0$ is $\Omega_0 \equiv \Omega(b_0, 1) = G(1) + (\beta_w - 1)G_L(1) > 0$.

7 Identifying the globally optimal policy

The above welfare analysis identifies three distinct host tax policies that can be globally optimal for the host country: (b_{++}, t_{++}), $(b_{+0}, 1)$, and $(b_0, 1)$.[41] In this subsection, we proceed (i) by showing with an example that attracting no FDI can be globally optimal for a host country, (ii) by proving how small cross-country differences in α can generate discrete cross-country differences in tax policies, and (iii) by proving how endogenizing the host country's institutional quality parameter, α, affects the globally optimal host policy.

[40] For example, 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.

[41] Remember that in some economies, (b_{++}, t_{++}) and/or $(b_{+0}, 1)$ may not exist.

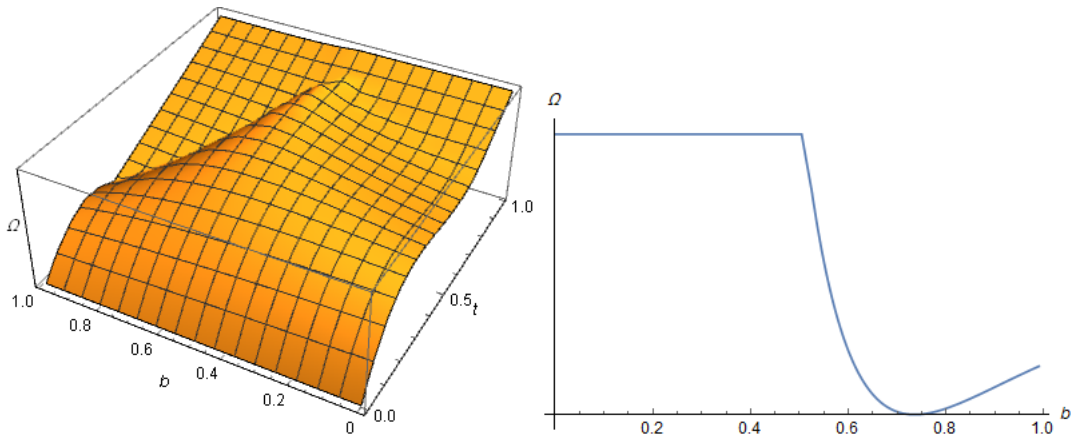

Figure 4: Host welfare as a function of b and t. No FDI is optimal when $F(l_m, k) = 1.5k^{0.3}l_m^{0.4}$, $G(L_d) = L_d^{0.9}$, $r = 0.08$, $\alpha = 3$, $C(R - r) = (R - r)^2$, $\phi \in [0.1, 10]$, $\beta_\pi = 0$, and $\beta_w = 0.8$. $t = 1$ in the right panel.

7.1 When '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, $F(l_m, k) = 1.5k^{0.3}l_m^{0.4}$, $G(L_d) = L_d^{0.9}$, $r = 0.08$, $\alpha = 3$, $C(R - r) = (R - r)^2$, $\phi \in [0.1, 10]$, $\beta_\pi = 0$, and $\beta_w = 0.8$. The values of λ, γ, δ and A are selected to be suggestive of a developing country as these values are indicative of low domestic rents, high subsidiary rent consistent with Karabarbounis and Nieman (2014), and a foreign sector that is larger than the domestic sector. The remaining parameter values define a baseline example in which it is optimal for the host country to attract no FDI. The left graph plots $\Omega(b, t)$. The right graph plots $\Omega(b, 1)$. Both graphs reveal non-convexities in the host welfare function identified in the above welfare analysis. The right graph, in particular, shows that an increase in b just above $b_0 \approx 0.55$ attracts FDI but the welfare gain from a higher wage is smaller than the welfare loss from lower domestic firm tax revenues. Thus, the globally optimal host policy attracts no FDI in equilibrium.

At first glance, 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). We note, however, that our example uses a fairly high welfare weight on wage income of 0.8 (even higher values would yield the same result), which implies the host country values public spending only 25% more than private consumption.

The welfare weights used in Figure 4 are also consistent with the challenge some developing

countries face: They need to 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 by reducing profits in domestic firms, and multinationals shift their tax bases abroad, the reduction in government spending capacity can easily 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 provocative implication. Standard policies to force countries that suffer from insufficient public funds and weak public institutions to attract FDI can lead to a vicious circle. FDI crowds 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 would need to be substantial to compensate for the new welfare losses our work identifies.

7.2 Institutional quality and discontinuities: Small changes 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 does attract FDI. It is generated using the same parameter values used in Figure 4 except that $\alpha = 2.19$, $\beta_\pi = 0.3$, and $\beta_w = 0.86$. The main change is the reduction in α. We chose these specific parameter values to create an example in which the host country is close to indifferent between all three local optima. We focus on this 3-way indifference case as it allows us to show how a change in α can cause a host country's optimal tax policy to shift between the three possible equilibrium cases and generate the discontinuous jump in safe harbor limits we observe in Figure 1. Before discussing Figure 5 in more detail, as it is presented solely for illustration purposes, we first compute and sign two comparative statics with respect to changes in α that will help us establish

general results about how a small change in α can lead to a discrete change in tax policy. Our analysis proceeds in two steps.

First, we compare the locally optimal policy that attracts no FDI with the one that attracts FDI but generates no subsidiary taxable income. For policies that generate equilibria on $\mathcal{M}_{+0}$,

$$\frac{d\Omega_{+0}(b,1)}{d\alpha} = (\beta_w - L_d)w_\alpha \tag{21}$$

where L_d is the equilibrium level of labor at $t = 1$ and $b > b_0$. Eq. (21) allows us to understand how changes in a host country's institutional quality affect the welfare differences between attracting FDI that generates no taxable income and attracting no FDI. Recall that for b just above b_0, M is close to zero so L_d is close to one, and $w_\alpha < 0$. This means for most $\beta_w < 1$, there are values of b above b_0 for which an increase in α increases host welfare. More effective transfer price regulation, reflected by an increase in α, attracts fewer multinationals because each multinational earns less net income shifting profit. The multinationals that enter when $t = 1$ are only profiting from income shifting, so any change in the host country that reduces the net profit from income shifting will attract less FDI, and result in a lower wage. A lower wage increases the taxable income of domestic firms and results in larger taxes collected from domestic firms. With $\beta_w < 1$, the welfare gain from higher tax revenues more than offsets the welfare loss from a lower wage.

For b close to one, host welfare on $\mathcal{M}_{+0}$ can either increase or decrease depending on the sign of $\beta_w - L_d$. If setting $b = 1$ attracts enough FDI, then L_d will be less than β_w. Now the marginal tax loss from domestic firms is low enough that the marginal welfare gain from a higher wage dominates. This reversal in the sign of $\beta_w - L_d$ between the locally optimal no-FDI policy at $(b_0, 1)$ and a policy near (1,1) that attracts FDI but generates no tax revenues from the FDI can be observed in the change in the slope of the welfare function in the right panel of Figure 4. If $\beta_w > L_d$ at (1,1), an increase in α will decrease welfare from the policy (1,1).

In order to appreciate the broader implication of welfare decreasing with α near (1,1), suppose there is a host country whose top two local optima generate identical welfare at (1,1) and at $(b_0, 1)$. With a marginally higher institutional quality, the country will now prefer to attract no FDI, while with a marginally lower institutional quality, the country will prefer to attract FDI and allow maximal income shifting with the policy (1,1). Thus, a small change in institutional quality can

generate a discrete change in the better thin capitalization policy.

Second, we determine 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 (7) - (10) imply that

$$\frac{d\Omega_{++}(b_{++},t_{++})}{d\alpha} = (\beta_w - t - (1-t)\beta_\pi L_d)w_\alpha + t\Pi_T M_\alpha - \frac{t(Rb - r - \alpha Cb)}{1-t}K_\alpha - \frac{tMbK(1-\alpha C')}{1-t}R_\alpha. \tag{22}$$

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_{++} satisfies $\partial\Omega_{++}/\partial b = 0$, (22) reduces down to

$$\frac{d\Omega_{++}(b_{++},t_{++})}{d\alpha} = tMbK\left(\frac{C'}{\alpha C''} - \frac{RC}{\alpha(C - RC')}\right) > 0. \tag{23}$$

Thus, an increase in α increases host welfare from the locally optimal tax policy that attracts FDI and results in strictly positive taxable income. The primary reason is that better institutional quality in the tax authority encourages multinationals to shift less income out of the host country. Together comparative statics (21) and (23) allow us to determine how a small change in α changes the globally optimal tax policy.

In order for a small difference in the institutional qualities of two otherwise similar host countries to lead to a discrete difference in their optimal tax policies, as seen in Figure 1, it must be that their welfare from at least two of their locally optimal policies is similar. Thus, consider the situation in Figure 5 in which three distinct local optima exist (one of them at (1,1)) and yield identical host welfare. β_w must be less than one for this three-way tie scenario to exist. Welfare values are reported in Table 1. The globally optimal tax policy at $\alpha = 2.19$ attracts FDI but no tax revenues with $(b,t) = (1,1)$. If α increases to 2.20, the globally optimal tax policy attracts FDI and generates taxable income by setting $b = 0.48$ and $t = 0.56$.

According to comparative statics (21) and (23), if one begins with a host country whose value of α implies it is indifferent among three distinct local policy optima, a small increase in α reduces welfare from the locally optimal policy that attracts FDI but generates no taxable income and

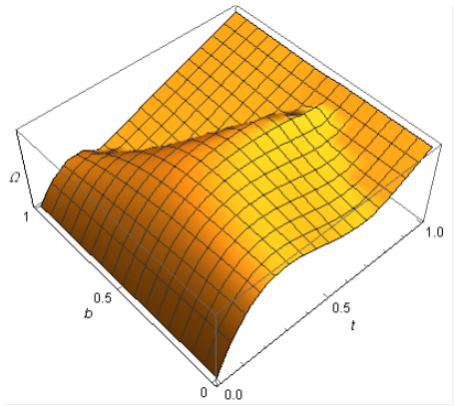

Figure 5: Comparable welfare from the optimal no-FDI policy, the optimal positive-FDI-with-positive-taxable-income policy, and the optimal positive-FDI-with-zero-taxable-income policy.

	$\alpha = 2.19$	$\alpha = 2.20$
FDI $= 0$	0.874	0.874
FDI > 0 and $\Pi_T > 0$	0.874228	0.874253
FDI > 0 and $\Pi_T = 0$ $b = 1$	0.874237	0.874236

Table 1: Host welfare at each local optima as a function of α.

increases welfare from the locally optimal policy that attracts FDI and generates taxable income. Consistent with (21), the last row of Table 1 confirms that, with large enough multinational employment generated by setting $b = 1$, better transfer price enforcement reduces welfare through lower FDI and wages enough to more than offset the welfare gains from increased domestic tax revenue. Consistent with (23), the second row of Table 1 confirms that an increase in α increases multinational tax revenues collected under the locally optimal policy that attracts FDI with taxable income and results in more welfare. Combining the above two changes implies that with marginally better institutional quality a host country now strictly prefers a policy that attracts FDI with taxable income. As a result, a discrete jump in the optimal thin capitalization rule can occur that would explain the stark bifurcation in real-world thin capitalization rules observed in Figure 1.

7.3 Strategic under-utilization of institutional quality

The conclusions in the previous subsections implicitly assume 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 (21) and (23).

Proposition 5 *Assume for all $\alpha > 0$ that $b_{++} \in (0,1)$, $L_d(b_{+0},1) < \beta_w$, 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*

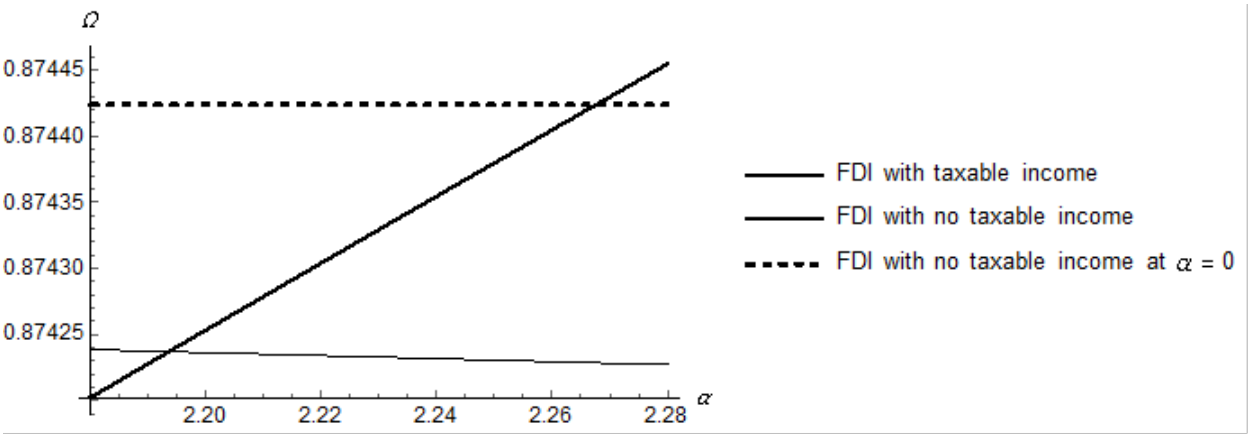

Figure 6: Host welfare as a function of α.

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.

Figure 6 illustrates the intuition of Proposition 5 when a host country can choose strategically to audit in a way that does not fully utilize its institutional capacity and change its tax policy so it is optimal given the lower level of institutional quality.[42] Because small changes in α can cause a country's optimal tax policy to change discontinuously, we use (21) and (23) to determine how α affects welfare at each of the local optima separately. Figure 6 plots welfare at the two local optima that attract positive FDI using the same parameter values used for Figure 5.

Consistent with comparative static (21), the thin solid line shows that welfare from the locally optimal policy that attracts FDI but yields no taxable income, $(b, t) = (1, 1)$, is decreasing in α as the quantity demanded of labor by multinationals at (1,1) is greater than β_w. Host welfare at (1,1) is maximized when $\alpha = 0$ because no transfer price auditing attracts the most FDI and does not sacrifice any taxable income. The value of host welfare at (1,1) with $\alpha = 0$ corresponds to the dashed line in Figure 6. Consistent with comparative static (23), the heavy solid line shows that welfare from the locally optimal policy that attracts FDI with taxable income is increasing in α. For $\alpha < 2.195$, the optimal policy when the host country fully utilizes its institutional capacity attracts FDI that yields no taxable income, but if it chooses to operate as though its value of α is zero, its

[42]Introducing a marginal cost associated with changing α would not alter our conclusions. It would only add a second reason for a host country to under-utilize its institutional capacity.

welfare increases by attracting more FDI. For $\alpha > 2.195$, 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 2.195 and 2.27 can improve its welfare by under-utilizing its capacity by operating as though $\alpha = 0$ and adopting $(b, t) = (1, 1)$. While under-utilization has a welfare cost in terms of lost affiliate tax revenues, the welfare gain from increased FDI dominates.[43] Thus, the strategic choice of auditing intensity results in some countries with strong institutional capacity, such as Austria, Ireland, Israel, and Sweden in our 2018 data, exhibiting lower levels of institutional quality in order to attract FDI with zero taxable income.

8 Earnings stripping rules

The main alternative to a safe harbor rule is an earnings stripping rule. Earnings stripping rules limit the tax deduction for interest payments to interest payments that do not exceed a specified fraction of pre-tax earnings (either EBIT or EBITDA). In our model, an earnings stripping rule corresponds to a constraint of the form $RB \leq b(F - wL_m)$ for $0 \leq b \leq 1$. A number of major economies including the United States and several EU countries now use earnings stripping rules instead of safe harbor rules. In the EU, the change from safe harbor to earnings stripping rules was prompted in 2008 by attempts in Germany and Denmark to foster the equity base in firms and prevent international income shifting. These attempts were reinforced in 2019 by the EU Anti Tax Avoidance Directive (EU-ATAD) that builds on the OECD Action Plan 4 (OECD (2015)).

For any $b < 1$, subsidiary taxable income will always be strictly positive. Thus, the set of policies that attract FDI and yield no taxable income is a line segment from $(1, t_1(1))$ to $(1, 1)$. The optimal policy on this segment is (1,1). Gresik, Schindler, and Schjelderup (2017) show that the optimal transfer price, R, equals r when there are no costs associated with debt financing, as in the current paper. Adding in financing costs to the current paper would not change the results in sections 5 and 6 but would imply $R > r$ for the case of earnings stripping. Thus, the case of no financing costs is the most extreme case that could arise with earnings stripping rules.

With no financing costs, the adoption of an earnings stripping rule eliminates country characteristics for which no FDI is an optimal outcome. With financing costs, both the potential optimality

[43] Because auditing costs are incurred outside the host country, the incentive to under-utilize institutional capacity is not driven by the presence of social concealment costs.

of a no FDI policy and the discrete jump to optimal tax policies from small changes in a country's institutional quality can arise.

9 Conclusion

In this paper, we study the optimal design of corporate income tax rules in the presence of income shifting. We show that tax laws that eliminate marginal tax benefits from reporting income losses not only cap the amount of income a multinational firm will want to shift out of a host country, they also affect a country's optimal corporate income tax rate and thin capitalization limit. Our analysis shows the optimal tax policy can change discontinuously with a host country's institutional ability to curb income shifting. This discontinuity property is shown to generate a bifurcation in thin capitalization limits among developing, developed, and emerging countries that is consistent with the pattern observed in practice. We also identify a strategic motive for developed countries of 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 not beneficial for a country to attract FDI. For example, 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 because the welfare losses from lost tax revenue dominate the welfare gains from higher domestic wages.

Going back at least to the era of the Washington Consensus (Williamson (1989)), there has been a presumption that attracting FDI is good for developing countries. Consistent with this view, economists have documented the ability of lower effective average and marginal tax rates in attracting FDI[44] and the link between lower tax rates and wages.[45] Recent policy studies that focus on developing country policies that can attract FDI, such as the World Bank study by Andersen, Bett, and von Uexkull (2018), also fail to acknowledge that attracting FDI may not be welfare-enhancing for a developing country nor do they take account of perhaps the most widespread 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, attracting FDI can make the country worse off. Offering other tax incentives such as tax holidays and investment tax credits only exacerbates the problem. Even for developing countries who can and 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.[46] 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. For any $t \in [0,1]$, the Lagrangian for a multinational's profit-maximization problem is $\Lambda = \Pi + \mu\Pi_T - \lambda(B-k)$ where

[44] For example, de Mooij and Ederveen (2008) report in a meta-analysis significant semi-elasticities of FDI with respect to both effective average and marginal tax rates in the range of -4 to -5.

[45] For example, see Fuest, Peichl, and Siegloch (2018).

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

μ is the multiplier on the constraint, $\Pi_T \geq 0$, and λ is the multiplier on the constraint, $B \leq k$. The necessary first-order conditions imply $\mu = t - \alpha C' \geq 0$, $\lambda = \alpha RC' - \alpha C \geq 0$, $(1-t+\mu)F_k + \lambda - r = 0$, and $F_l = w$. At $R = r$, $\mu = t$, $\lambda = 0$, $F_k = r$, and $F_l = w$ but $\Pi_T = F - l_m F_l - BF_k > 0$ for all $0 \leq B \leq k$ because the production function is homogeneous of degree $\eta < 1$. Thus, the optimal value of R is not equal to r. $R < r$ is also not optimal as it implies $\lambda < 0$. 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. This case requires $t < 1$. When $t = 1$, either $\mathcal{M} = 0$ or $\Pi_T = 0$. Totally differentiating (7) - (10) and (12) - (13) with $\mu = 0$ yields

$$\begin{pmatrix} (1-t)F_{KK} & (1-t)F_{KL} & 0 & 0 & 0 & 0 \\ F_{KL} & F_{LL} & 0 & 0 & 0 & -1 \\ 0 & 0 & -\alpha C'' & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 & 0 & -(1-t)L_m \\ 0 & 0 & 0 & 0 & G_{LL} & -1 \\ 0 & M & 0 & mL_m & 1 & 0 \end{pmatrix} \cdot \begin{pmatrix} dK \\ dL_m \\ dR \\ d\hat{\phi} \\ dL_d \\ dw \end{pmatrix} = \begin{pmatrix} a_1 \\ 0 \\ -dt \\ a_2 \\ 0 \\ 0 \end{pmatrix} \quad (24)$$

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 (24) 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

$K_b = \alpha^2(C - RC')C''[MG_{LL} + F_{LL} - G_{LL}(1-t)mL_m(L_m F_{LL} + KF_{KL})]/|Z| > 0$,

$\hat{\phi}_b = -\alpha^2(C - RC')C''[G_{LL}M(1-t)(F_{KL}L_m + KF_{KK}) + (1-t)K\nabla^2 F)]/|Z| > 0$,

$w_b = \alpha^2(C - RC')C''G_{LL}(MF_{KL} + KmL_m(1-t)\nabla^2 F)/|Z| > 0$,

$K_t = \alpha C''[(F_K - Rb)(MG_{LL} - G_{LL}(1-t)mL_m^2 F_{LL} + F_{LL}) - G_{LL}mL_m(1-t)F_{KL}\Pi_T]/|Z|$,

$\hat{\phi}_t = -\alpha C''[(F_K - Rb)G_{LL}MF_{KL}(1-t)L_m + \Pi_T(G_{LL}M(1-t)F_{KK} + (1-t)\nabla^2 F)]/|Z|$, and

$w_t = \alpha C''G_{LL}[(F_K - Rb)MF_{KL} + \Pi_T mL_m(1-t)\nabla^2 F]/|Z|$.

While the comparative statics with respect to b are unambiguously signed, the comparative statics with respect to t for K, $\hat{\phi}$, and w have potentially countervailing terms that depend on the magnitude of M, the sign of $F_K - Rb$, and/or the magnitude of $(1-t)\Pi_T$.

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

When $\mu = 0$, (8) implies that $(1-t)(F_K - Rb) = -(Rb - r - \alpha Cb)$. For $b \leq \hat{b}$, $Rb - r - \alpha Cb < 0$ for all $t < 1$ because (9) implies that $R^*(\hat{b}, t) < R^*(1)$, which means tax haven profit is negative. In order for a multinational to be willing to enter the host market, its after-tax subsidiary profit must be positive, which it will be because $F_K - Rb > 0$ 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.

For each $b > \hat{b}$, there exists a value of t, denoted by $t_2(b)$, at which $r - Rb + \alpha Cb = 0$. If $t = 0$, $R = r$ and $r - Rb + \alpha Cb = r(1-b) \geq 0$. If t is close to one, then $r - Rb + \alpha Cb < 0$. Thus, $t_2(b)$ is well-defined. Eq. (8) then implies that $F_K - Rb > 0$ for $t < t_2(b)$ and $F_K - Rb < 0$ for $t > t_2(b)$. However, we know from (15) that $\Pi_T = 0$ must imply $F_K - Rb < 0$. For t just below $t_1(b)$, $(1-t)\Pi_T$ is close to zero. Thus, $K_t > 0$, $w_t > 0$, and $\hat{\phi}_t < 0$.

Note: The comparative statics for the case in which there is no transfer pricing ($\alpha = \infty$) can be generated mechanically by setting $\alpha(C - RC') = -rt$ and $\alpha C'' = -1$. In this case, $K_t > 0$ and $\hat{\phi}_t < 0$. The sign of w_t remains ambiguous.

Proof of Lemma 1. First, we can show that $d\Pi_T/db < 0$ on $\mathcal{M}_{++}$ when $\Pi_T \approx 0$. The multinational first order conditions imply

$$\frac{\partial \Pi_T}{\partial K} K_b + \frac{\partial \Pi_T}{\partial L_m}(L_m)_b + \frac{\partial \Pi_T}{\partial R} R_b = -(Rb - r - \alpha Cb)K_b/(1-t) - bK(1 - \alpha C')R_b. \tag{25}$$

Note that

$$\frac{d\Pi_T}{db} = \frac{\partial \Pi_T}{\partial K} K_b + \frac{\partial \Pi_T}{\partial L_m}(L_m)_b + \frac{\partial \Pi_T}{\partial R} R_b + \frac{\partial \Pi_T}{\partial b}, \tag{26}$$

where $R_b = 0$ and $\partial \Pi_T/\partial b = -RK - L_m w_b$. With $w_b > 0$ and $K_b > 0$, $d\Pi_T/db < 0$ because $Rb - r - \alpha Cb > 0$ for Π_T close to zero.

Second, we can show that $d\Pi_T/dt < 0$ when $\Pi_T \approx 0$. Now the multinational first order conditions imply

$$\frac{\partial \Pi_T}{\partial K} K_t + \frac{\partial \Pi_T}{\partial L_m}(L_m)_t + \frac{\partial \Pi_T}{\partial R} R_t = -(Rb - r - \alpha Cb)K_t/(1-t) - bKR_t, \tag{27}$$

where $R_t > 0$. Then,

$$\frac{d\Pi_T}{dt} = -K_t(Rb - r - \alpha Cb)/(1-t) - bKR_t - L_m w_t. \tag{28}$$

When $\mu = 0$, (8) implies that $(1-t)(F_K - Rb) = -(Rb - r - \alpha Cb)$. For $b < \hat{b}$, the right-hand side is positive so Π_T must be strictly positive in order for the host country to attract FDI. In order for $(b,t) \in \mathcal{M}_{++}$, as opposed to $\mathcal{M}_0$, Π_T must be bounded away from zero. Thus, this lemma does not apply when $b < \hat{b}$. For $b > \hat{b}$, the equilibrium marginal return on capital investment in the subsidiary is negative when $\Pi_T \approx 0$. From Proposition 1, an increase in the host tax rate encourages each multinational to invest more capital in the host country, set a larger transfer price, and the wage rate increases when Π_T is close to zero. Thus, $d\Pi_T/dt < 0$.

Finally, $dt_1(b)/db = -d\Pi_T/db/d\Pi_T/dt < 0$.

Proof of Proposition 2. We derive the comparative statics with respect to b when $t = 1$ as this will be the relevant tax rate to consider for the welfare analysis on $\mathcal{M}_{+0}$. 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 (7) - (13) with $\mu > 0$ yields

$$\begin{pmatrix} & & & & & 0 & -L_m \\ & & & & & 0 & 0 \\ & & BH & & & 0 & -1 \\ & & & & & 0 & 0 \\ & & & & & 0 & -\mu L_m \\ 0 & 0 & 0 & 0 & 0 & G_{LL} & -1 \\ 0 & 0 & M & 0 & mL_m & 1 & 0 \end{pmatrix} \cdot \begin{pmatrix} d\mu \\ dK \\ dL_m \\ dR \\ d\hat{\phi} \\ dL_d \\ dw \end{pmatrix} = \begin{pmatrix} RKdb \\ \alpha(C - RC')db \\ 0 \\ 0 \\ \alpha(C - RC')Kdb \\ 0 \\ 0 \end{pmatrix} \tag{29}$$

where BH, the bordered Hessian for (6) is

$$\begin{pmatrix} 0 & F_K - Rb & 0 & -bK & 0 \\ F_K - Rb & \mu F_{KK} & \mu F_{KL} & 0 & 0 \\ 0 & F_{KL} & F_{LL} & 0 & 0 \\ -1 & 0 & 0 & -\alpha C'' & 0 \\ 0 & 0 & 0 & 0 & -1 \end{pmatrix} \tag{30}$$

and $|BH| > 0$. Denote the 7x7 matrice in (29) by X. Direct calculation shows that

$$\begin{aligned} |X| &= ML_m G_{LL}(F_K - Rb)\alpha C'' - MG_{LL}(-\mu F_{KK} bK + \alpha C''(F_K - Rb)^2) \\ &- m\mu^2 L_m^2 G_{LL} bK\nabla^2 F + \mu F_{KL}^2 + m\mu L_m^2 G_{LL}\alpha C'' F_{LL}(F_K - Rb)^2 + |BH| > 0. \end{aligned} \tag{31}$$

Solving (29) then yields

$$\begin{aligned} K_b &= [-\mu M F_{KL} RK G_{LL} + \alpha(C - RC')bK(MG_{LL} + F_{LL} - \mu m L_m^2 F_{LL} G_{LL}) \\ &- \alpha C'' F_{LL} RK(F_K - Rb)mL_m - \mu m L_m \alpha(C - RC')bK^2 F_{KL} G_{LL} \\ &- mL_m^2 \alpha^2 C''(C - RC')(F_K - Rb)F_{LL} G_{LL} K]/|X|, \end{aligned} \tag{32}$$

$$\begin{aligned} R_b &= [-MG_{LL}(\alpha(C - RC')(L_m F_{KL} - (F_K - Rb)) + \mu F_{KK} RK) \\ &+ \mu m L_m G_{LL}\alpha(C - RC')K(F_{KL}(F_K - Rb) + L_m\nabla^2 F) \\ &+ \mu m L_m^2 G_{LL}(\mu RK\nabla^2 F - \alpha(C - RC')F_{LL}(F_K - Rb)) \\ &- (\mu RK\nabla^2 F - \alpha(C - RC')F_{LL}(F_K - Rb))]/|X|, \end{aligned} \tag{33}$$

$$\begin{aligned} w_b &= [-\alpha^2 c''(C - RC')(F_K - Rb)^2 G_{LL} F_{LL} m L_m K - \alpha C'' MR(F_K - Rb)G_{LL} F_{KL} K \\ &+ \alpha(C - RC')MbG_{LL} F_{KL} K + \alpha(C - RC')\mu\nabla^2 F m b L_m G_{LL} K^2]/|X|, \end{aligned} \tag{34}$$

and

$$\begin{aligned}\hat{\phi}_b &= [-\alpha(C-RC')MbG_{LL}(KF_{KK}+L_mF_{KL})K+\alpha(C-RC')K|BH|_4 \qquad (35)\\ &+ \alpha C''MG_{LL}(F_K-Rb)K(\alpha(C-Rc')(F_K-Rb)-\alpha(C-RC')L_mF_{KL}+\mu L_mRF_{KL}]/|X|\\ &> 0.\end{aligned}$$

By the convexity of $C(\cdot)$ and noting that $F_K - Rb < 0$ on $\mathcal{M}_{+0}$, the first line of (32) is positive while the remaining terms in the numerator are negative. Thus, the sign of K_b is ambiguous. For R_b, the first, third, and fourth terms in the numerator of (33) are negative while the second term is ambiguous in sign. Similarly, the second term in the numerator of (34) is negative while the other three terms are positive. For $M = 0^+$, the second term goes to zero and $w_b > 0$.

Finally, $\hat{\phi}_b > 0$ because $|BH|_4$, the determinant of the upper 4x4 principal minor of $|BH|$, is non-positive, $c(\cdot)$ is convex, and the homogeneity of F implies that $KF_{KK} + L_mF_{KL} < 0$.

Proof of Lemma 2. (i) By Proposition 2, Π^* is increasing in b when $t = 1$. By (A2), entry must occur at $b = t = 1$. Moreover, at $b = \hat{b}$ and $t = 1$, $\Pi^* < 0$. Thus, because there is no entry at $b = \hat{b}$ and $t = 1$, there must exist $b \in (\hat{b}, 1)$ such that a postive measure of multinationals enter for all $b > b_0$.

(ii) For $b \leq \hat{b}$, $\hat{\phi}_b > 0$ and $\hat{\phi}_t < 0$ by Proposition 1. Also, if there is no FDI at (b,t), there should also be no FDI for all (b',t) with $b' < b$. Suppose that this result was not true. That is, for some $b' < b$, assume 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 $G_L(1)$ as otherwise the labor market would exhibit excess demand. Formally then

$$\begin{aligned}\underline{\phi} \geq \Pi^*(b,t) &\geq \Pi(L_m(b',t),K(b',t),R(b',t),w(b,t),b,t)\\ &> \Pi(L_m(b',t),K(b',t),R(b',t),w(b',t),b,t) > \Pi(b',t). \qquad (36)\end{aligned}$$

The second weak inequality in (36) follows from profit maximization. The first strict inequality in (36) arises because by assumption the reduction in b increases the equilibrium wage by attracting FDI and 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 chain of inequalities in (36) implies there will be no FDI at (b', t), which contradicts our initial assumption. A similar argument also applies to increases in t. Thus, $t_0(b)$ represents the boundary between $\mathcal{M}_{++}$ and $\mathcal{M}_0$.

(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 addition, 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 occur at some $t < 1$ and it must 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 also does not vary with t. As a result, 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 $b > b_0$.

Proof of Proposition 4. By (16), $\Omega_t = (1 - \beta_\pi)\pi > 0$ for all $\beta_\pi < 1$ when $(b, t) \in \mathcal{M}_0$. If $\beta_\pi = 1$, then host welfare is independent of t on $\mathcal{M}_0$. Thus, $t = 1$ is still optimal.

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