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Where Profits Are Owned: The Cross-Country Incidence of the Global Minimum Tax

Paolo M. Panteghini*

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Abstract

The global minimum tax raises the tax rate of havens. It takes income from the shareholders of multinationals and gives revenue to the governments of the countries where profits are produced. Since shareholders do not always live where profits are produced, countries need not share the gains. I study this incidence with two non-havens whose tax rates are endogenous and whose residents own profits produced abroad. One sufficient statistic governs the direct welfare effect: the foreign exposure of resident ownership, that is, the ratio between the shifted profit that residents own and the part of it produced at home. I derive its critical value in closed form. Countries whose multinationals operate mainly abroad tend to lose, and countries that host foreign subsidiaries tend to gain. When the other non-haven changes its rate, a first-order ownership externality arises, and it can reverse the direct effect. A floor high enough to stop shifting need not restore the Samuelson condition or raise welfare, because foreign ownership still leads governments to export taxes. In a calibrated example, cross-border portfolio ownership reduces the redistribution. Real activity is held fixed: the analysis isolates the ownership incidence of an effective floor and is not a full assessment of Pillar Two.

Keywords: Global minimum tax, Pillar Two, Cross-border ownership, Tax exporting, Profit shifting, Tax competition.
JEL: H25, H73, F23.

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1 Introduction

The global minimum tax raises the tax rate of havens. This has two effects on a non-haven. Its shareholders pay more tax on the profit their firms shift to havens, and its government recovers revenue on the profit that is no longer shifted. The first effect follows ownership: it falls on whoever owns the shifted profit, wherever that profit is produced. The second follows production: it accrues to the government of the country where the profit is produced, whoever owns it. When ownership and production coincide, the two effects net out within the country and the welfare effect depends on how much shifting responds to the floor. When they do not, the same reform can make one non-haven better off and another worse off. This paper asks what decides which is which.

This paper studies the welfare effects of the global minimum tax when ownership and production do not coincide. My starting point is Johannesen (2022), where a marginal increase in the floor raises welfare in a non-haven if and only if the semi-elasticity of shifting exceeds a threshold that depends on the tax rate and on the social value of owners' consumption. That analysis covers a special case: each multinational is wholly owned by the residents of its headquarters country, and the profit produced in a country accrues to the firm of that country. I depart from it by letting residents own profit produced abroad and foreigners own part of the domestic base, while keeping the rest of the framework, in particular fixed real activity.

My main result is that, once ownership and production are separated, the same condition should be read as a statement about ownership, not about elasticities. I work with two non-havens whose tax rates are set in equilibrium and several havens. Multinationals may produce in both non-havens, and residents may own shares in the multinational headquartered abroad. The direct effect of the floor on a country then depends on the ownership and activity structure through one number only: the foreign exposure of resident ownership, which is the ratio between the shifted profit that its residents own and the part of it produced at home. It equals one when residents own no profit produced abroad. The direct effect is positive if and only if this exposure is below a critical value that I derive in closed form. This critical value is finite at every interior optimum. The reason is that the semi-elasticity cannot be raised independently to meet the benchmark condition: at an interior optimum it is tied to the shifted fraction and bounded above. Hence, in every admissible equilibrium, there is a level of exposure beyond which the direct effect is negative. The floor tends to move welfare from headquarters countries with large foreign operations to countries that host foreign subsidiaries.

Three further results qualify this one. First, the direct effect is not the whole effect. The envelope theorem removes the welfare consequence of a country's own rate adjustment, but not that of the other non-haven's rate, which changes the income residents earn on profit produced there. This ownership externality is first order, proportional to residents' foreign holdings, and present even when reaction functions are flat; it is negative whenever the other non-haven raises its rate in response to the floor, which it does under a closed-form condition that holds throughout the calibration. In the calibration the externality is large enough to reverse a positive direct effect. Second, a floor high enough to stop shifting does not solve the ownership problem. Concealment costs and haven rents disappear, but foreign ownership still leads governments to export taxes: at an interior optimum the marginal rate of substitution between public and private consumption equals the resident share of the domestic base, not one, and at the kink it can lie on either side of one. Such a floor therefore need not restore the Samuelson condition or raise welfare,

as it does under domestic ownership. Third, cross-border portfolio ownership can reduce the redistribution. In the calibration, a portfolio share just below thirty-eight per cent held by host-country residents in the headquarters-country multinational turns the loss of the headquarters country into a gain; the direction of this effect depends on the activity matrix and is not a general result.

The same income channel that generates the externality also gives the non-haven reaction functions a slope. Under domestic ownership the reported bases of the non-havens do not interact and their reaction functions are flat. Here they slope, and in either direction: rates are strategic substitutes when the public good is normal and strategic complements when it is inferior. The slopes are small in the calibration, and the result is reported mainly for its sign.

Section 2 reviews the literature. Section 3 presents the model, characterises the equilibrium and derives the welfare effects of the floor, both marginal and large. Section 4 gives the numerical results and Section 5 concludes. Proofs are in Appendix A, and Appendix B contains additional results.

2 Related literature

This paper builds on the tax-competition literature (Bucovetsky, 1991; Keen and Konrad, 2013; Zodrow, 2003). This literature shows that the rules for taxing foreign income matter and that reforms must be evaluated in equilibrium (Bond and Samuelson, 1989). A minimum tax can even lower unconstrained equilibrium rates (Konrad, 2009). Related work studies how coordination is reached (Konrad and Thum, 2021) and surveys policy choice across jurisdictions (Agrawal et al., 2022).

Within this literature, Johannesen (2022) is the model closest to mine: havens raise their rates to the floor and the welfare effect on non-havens is ambiguous. In its main analysis all profit produced in a country accrues to its domestic firm, which in my notation is $\Omega_i = 1$, and households own only the multinational headquartered in their country. Its online appendix allows firms to produce abroad and notes that the floor then redistributes from non-havens with positive net foreign direct investment to those with negative net positions, but ownership remains domestic. I depart from this setting in two ways. I separate the activity matrix from the ownership matrix, so that residents may hold shares in a foreign multinational: this is my σ_{ij} for $i \neq j$, and it gives the portfolio result of Table 3. I then solve for the response of the other non-haven's rate, sign the resulting term and reduce the ownership and activity structure to one statistic with a closed-form threshold (Section 3.5). The separation also changes the result on a high floor: a floor that stops shifting is beneficial when $\Omega_i = 1$, and Section 3.6 shows that this may fail otherwise.

The closest equilibrium model is Janeba and Schjelderup (2023), where two non-havens compete for both real investment and reported profit. Firms have absentee owners, so private owner income does not enter welfare, and the cross-country externality works through the relocation of real activity. The model is symmetric, so there is no net foreign-investment position. I instead combine endogenous non-haven rates with resident ownership of profits. This allows welfare effects to differ across non-havens even when real activity is fixed. In the terms of Schjelderup and Stähler (2024), this adds a third channel to the domestic and relocation effects: an ownership externality, through which one country's rate affects another country via the profits its residents own there.

Other models keep owners' private income but not cross-border ownership. Hebous

and Keen (2023), who generalise Kanbur and Keen (1993), characterise efficient and Pareto-improving minimum rates when governments value both private income and public spending. Their extension to three endogenous rates keeps ownership domestic. Haufler and Kato (2024) also keep after-tax owner income, but study one non-haven, so redistribution among non-havens cannot arise. They show instead that partial coverage can lead to separate rates for firms inside and outside the minimum-tax regime. The floor in this paper should therefore be read as applying to profits within scope.

The slope of the non-haven reaction functions is another point on which cross-border ownership matters, since with domestic ownership the reaction functions are flat. The literature has not settled the sign of tax reaction functions. Mintz and Tulkens (1986) show that rates may be strategic substitutes when private consumption and the public good are complements. Levaggi and Panteghini (2021) show that expenditure spillovers can make a jurisdiction respond positively to the rate of one neighbour and negatively to that of another, and Miniaci et al. (2022) find both signs in the data. In my model real activity is fixed and the rates interact only through the income that residents earn on profit produced abroad. The ownership matrix determines which reaction functions slope, and the normality of the public good determines the sign (Lemma 3).

Models with revenue-maximising governments shut down the ownership channel. Haufler et al. (2025) obtain asymmetric effects between developed and developing hosts, but through the relocation of real investment once the floor removes an avoidance advantage. Chen and Sun (2025) show that, as the floor rises, the substance-based income exclusion may lead countries to set rates below the floor, attract real investment and collect the top-up themselves. This margin is absent here, because havens host no real activity and the top-up raises no revenue in equilibrium. Quantitative and institutional complements include Ferrari et al. (2024) on multinational activity, Devereux (2023) on implementation incentives and Devereux and Vella (2023) on the mechanics of top-up taxes.

The model treats shifting as a single margin, whereas in practice profit leaves a jurisdiction through the pricing of intra-group transactions and through the location of intra-group debt, with unequal weight (Heckemeyer and Overesch, 2017). On the debt channel, Panteghini (2009) lets a multinational shift a fraction of the coupon paid by its foreign subsidiary, at a quadratic concealment cost, and shows that two governments competing for this income set higher rates when shifting or default becomes more costly. The evidence indicates that the response of subsidiary leverage to the subsidiary rate is concentrated in the lower deciles of the leverage distribution (Miniaci and Panteghini, 2026), and that the parent rate also matters once effective marginal rates are used (Miniaci et al., 2014). Schindler and Schjelderup (2012) show that the shifting margin depends on ownership as well: a multinational shifts less debt into affiliates with minority owners, because the tax saving accrues in proportion to equity shares whereas the offsetting tax liability arises in the wholly owned financial centre. These findings qualify Lemma 1, where the fraction shifted out of a country is the same for all producers in it and depends only on the rate of that country. With heterogeneous shifting, the exposure ratio can still be defined on firm-specific shifted profit, but the sufficient-statistic result does not carry over automatically. The mechanical loss weights the shifted fractions by resident ownership, while the revenue response weights them by domestic production. A one-dimensional sign condition then requires either that the covariance between the two be zero or additional moments of the joint distribution of ownership and shifting. Finally, the externality identified by Schindler and Schjelderup (2012) runs between the majority and the minority owners of one firm, in a model without governments, whereas the externality of Section 3.5 runs

between countries.

Last, my results link the minimum tax to tax exporting and ownership. Huizinga and Nielsen (1997) show that foreign ownership raises the optimal source-based rate, because part of the burden falls on non-residents. Huizinga and Nicodème (2006) document this effect. Here Ω_i determines the equilibrium rate, the shifted share and the semi-elasticity, but it cancels out of the direct sign condition, which depends instead on foreign exposure. Ω_i enters directly once shifting stops. This is in line with Desai and Hines (2003, 2004), who argue that ownership patterns are central to the evaluation of international tax rules. Buettner and Poehnlein (2024) show that jurisdictions constrained by a German local minimum rate raise their rates, as Lemma 4 predicts under the condition that holds in the calibration.

3 The model

There are two non-havens, indexed by $i, j \in \{1, 2\}$, and $H \geq 2$ havens. Each non-haven is the headquarters of one multinational enterprise. Havens host no real activity. Their only potential tax base is the profit that foreign firms report there.

3.1 Activity and ownership

Let $\pi_{ij} \geq 0$ be the true profit produced in country j by the multinational headquartered in country i, with $\pi_{ii} > 0$. Real activity is fixed, so the matrix $\{\pi_{ij}\}$ is exogenous. Two aggregates are used throughout. The first is the profit produced in country j,

$$B_j \equiv \sum_i \pi_{ij}, \tag{1}$$

which is the potential tax base of government j. The second is the worldwide profit of the multinational headquartered in i, $\sum_j \pi_{ij}$, which is the pre-tax income of its shareholders.

Ownership is described by a matrix $\{\sigma_{ij}\}$. Here $\sigma_{ij} \geq 0$ is the share of the multinational headquartered in j owned by residents of country i, with $\sum_i \sigma_{ij} \leq 1$. The rest is held outside the two non-havens. With $\sigma_{ii} = 1$ and $\sigma_{ij} = 0$ for $i \neq j$, each multinational is wholly owned at home. The key object is the profit produced in country k that accrues to residents of country i,

$$D_{ik} \equiv \sum_j \sigma_{ij}\, \pi_{jk}. \tag{2}$$

The diagonal term D_{ii} is the part of the domestic base owned by residents. The off-diagonal term D_{ij} is the profit produced abroad that they own.

A uniform stake across the operations of a firm is a simplification. If residents of i own a share $\sigma_{ijk} \geq 0$ of the operations of firm j in country k, define $D_{ik} \equiv \sum_j \sigma_{ijk}\pi_{jk}$, which reduces to (2) when $\sigma_{ijk} = \sigma_{ij}$ for every k. Provided the profit shifted out of an operation accrues to the owners of that operation, every result below depends on ownership only through D_{ik}, and so it also holds under this definition. This covers the affiliate-level joint ventures of Schindler and Schjelderup (2012). The uniform stake is used only in the expression for Ω_i below, in the comparative static (13) and in Table 3.

3.2 Firms and havens

As in most of the theoretical literature, I assume that concealment costs are proportional to the scale of the activity that generates the profit and convex in the fraction concealed. I use the quadratic form.

Assumption 1. *A firm that produces a profit p in a non-haven and reports there only the fraction $1-m$ of it bears a concealment cost $p\,s(m)$, where*

$$s(m) = \frac{\gamma m^2}{2}, \qquad \gamma > 0. \tag{3}$$

Over-reporting is costless and never profitable.

This literature writes the concealment cost as a generic function s with $s(0) = s'(0) = 0$, $s' > 0$ and $s'' > 0$, and uses the quadratic only when a magnitude has to be computed. I impose the quadratic from the start. This is a real restriction, because the equilibrium shifted fractions need not be small and the identity $s'(m) = m\,s''(m)$ holds for the quadratic but not in general. Appendix B lists the results that survive with a generic cost.[1]

Let τ_j be the tax rate of non-haven j, τ_H the common rate of the havens and $\tau_M \geq 0$ the global minimum rate. If profit is reported where the rate is below τ_M, the difference is collected as a top-up tax. The lowest effective rate on shifted profit is therefore

$$\widetilde{\tau} \equiv \max\left(\tau_H, \tau_M\right). \tag{4}$$

The net profit of the multinational headquartered in i is

$$\Pi_i = \sum_j \pi_{ij}\,\varphi_j, \qquad \varphi_j \equiv 1 - \tau_j\left(1 - m_j\right) - \widetilde{\tau}\,m_j - \frac{\gamma m_j^2}{2}, \tag{5}$$

where m_j is the fraction shifted out of country j and φ_j is the share of a unit of profit produced in j that is left after taxes and concealment costs. The rules exclude a substance-based return from the base of the top-up tax. Hence the statutory floor of fifteen per cent does not imply an effective rate of fifteen per cent on subsidiaries with real activity (Schjelderup and Stähler, 2024). Since havens host no real activity in this model, the exclusion is zero there, and τ_M should be read as the effective floor on shifted profit. Maximising (5) gives the following result.

Lemma 1. *The fraction shifted out of country j is $m_j = 0$ if $\tau_j \leq \widetilde{\tau}$ and otherwise solves $\gamma m_j = \tau_j - \widetilde{\tau}$, so that*

$$m_j = \min\left\{\max\left\{\frac{\tau_j - \widetilde{\tau}}{\gamma},\, 0\right\},\, 1\right\}, \tag{6}$$

and is therefore the same for every multinational producing in j. The reported base of country j is $B_j(1-m_j)$ and

$$\frac{\partial \varphi_j}{\partial \tau_j} = -\left(1 - m_j\right). \tag{7}$$

[1] The cost $p\,s(m)$ is borne where the profit is produced. The cost and the benefit of shifting out of j therefore accrue in the same proportions to the same shareholders. This rules out the externality of Schindler and Schjelderup (2012), where the cost of the strategy falls on a wholly owned affiliate while the benefit is spread over affiliates that are not wholly owned.

If in addition $\widetilde{\tau} = \tau_M$ on a neighbourhood of the point considered, then

$$\frac{\partial \varphi_j}{\partial \tau_M} = -m_j. \tag{8}$$

Proof: See Appendix A. □

The shifted fraction depends only on the rate of the country out of which profit is moved. Foreign subsidiaries in j therefore shift the same fraction as the domestic firm, and this is why the reported base is $B_j(1-m_j)$. The two derivatives are envelope results: the firm's response has no first-order effect on its net profit. The condition attached to (8) is needed because $\widetilde{\tau} = \max(\tau_H, \tau_M)$ is not differentiable at $\tau_H = \tau_M$. Lemma 2 shows that havens set $\tau_H = \tau_M$. The relevant comparative static is therefore taken along the path on which the two rates move together, and (8) applies throughout.

The rate τ_M is a minimum effective rate on shifted profit. It is not a full description of Pillar Two, and three features of the rules are left out. First, only groups above a revenue threshold are covered (Haufler and Kato, 2024). Second, the substance-based income exclusion makes the floor bind on residual profit, not on total profit (Chen and Sun, 2025; Schjelderup and Stähler, 2024). Third, the order in which the qualified domestic top-up tax, the income inclusion rule and the undertaxed profits rule apply decides which government collects. In the model, the haven collects at the floor, which is the same as a universal domestic top-up collected at source. The first two features would change the size of the effects derived below, and the third would change how they are shared among governments. In all three cases the exposure statistic keeps its form, with profit in scope in place of total shifted profit. The same holds for the Side-by-Side package agreed by the Inclusive Framework (OECD, 2026), which I discuss in the conclusion.

I now turn to havens. Two rules govern where shifted profit is reported. First, shifted profit can be reported only in havens. Concealment needs legal and secrecy infrastructure that havens supply and non-havens do not. A non-haven that sets its rate at the floor therefore does not attract profit shifted out of the other non-haven.[2] Second, when several havens offer the same lowest effective rate, shifted profit is split equally among them.

Lemma 2. *In every equilibrium in which some profit is shifted, every haven sets $\tau_H = \tau_M$, the top-up tax collects no revenue, and $\widetilde{\tau} = \tau_M$. The profile in which every haven sets τ_M is an equilibrium. When no profit is shifted, haven rates do not affect any payoff and the same profile is selected.*

Proof: See Appendix A. □

Havens have no domestic base and compete for the same mobile profit. A rate below τ_M attracts no extra profit, because the firm's tax saving is capped by the top-up tax, and it loses revenue. A rate above τ_M loses the whole base to the other havens. Ownership plays no role in this argument, so Lemma 2 holds whether or not ownership crosses borders. From now on, $\widetilde{\tau} = \tau_M$.

[2] Johannesen (2022) notes that, for intermediate values of the floor, a non-haven may prefer to set its rate at τ_M and receive part of the profit shifted out of the other non-havens. The first rule rules out this deviation. Without it, a non-haven j setting $\tau_j = \tau_M$ would, under the second rule, collect $\tau_M \sum_{k \neq j} B_k m_k/(H+1)$, at the cost of moving its own rate away from its optimum. The revenue goes to zero as H grows, while the cost does not depend on H. The deviation is therefore unprofitable for H large enough. The required number of havens need not be small, however. In the calibration of Section 4, the headquarters country would deviate at $\tau_M = 0.20$ unless $H \geq 19$. A government already at the kink of Section 3.6 would gain from the deviation for any finite H.

3.3 Governments and equilibrium

The representative resident of country i consumes a private good and a public good, with preferences $U(C_i, G_i)$ satisfying $U_C, U_G > 0$. The private and public budget constraints are

$$C_i = \sum_k D_{ik}\,\varphi_k + y_i, \qquad G_i = \tau_i B_i\,(1 - m_i)\,, \tag{9}$$

where y_i is exogenous income. By Lemma 2, the public budget contains no top-up revenue. Let

$$MRS_i \equiv \frac{U_G(C_i, G_i)}{U_C(C_i, G_i)} \tag{10}$$

be the marginal rate of substitution between public and private consumption. It is the price at which the government of i is willing to turn its residents' private consumption into the public good. Governments choose their rates simultaneously. They take τ_M as given and anticipate the response of firms. I look for the Nash equilibrium of the game between the two non-haven governments.

Besides the marginal rate of substitution (10), four objects appear repeatedly below. The first two describe who owns the domestic base and how the base responds to the domestic rate:

$$\Omega_i \equiv \frac{D_{ii}}{B_i} \leq 1, \qquad \varepsilon_i \equiv \frac{\partial\,[B_i(1 - m_i)]}{\partial \tau_i}\frac{\tau_i}{B_i(1 - m_i)} = -\frac{\tau_i}{\gamma\,(1 - m_i)} < 0, \tag{11}$$

where the second equality follows from Lemma 1. With uniform stakes, (2) gives $\Omega_i = \sum_j \sigma_{ij}\pi_{ji} / \sum_j \pi_{ji}$. This is the average share held by residents in the firms that produce in the country, weighted by what these firms produce there. The gap between Ω_i and one measures the part of the domestic tax that is paid by foreigners. Since Ω_i is an average, a foreign subsidiary in the country lowers it only if residents own less of that subsidiary than of the rest of the domestic base. What drives tax exporting is ownership, not the location of the headquarters.

The other two objects describe how shifting responds to the tax saving and where the profit owned by residents is produced:

$$\eta_i \equiv \frac{1}{\gamma\, m_i}, \qquad a_i \equiv \frac{\sum_k D_{ik}\, m_k}{D_{ii}\, m_i} \geq 1. \tag{12}$$

By (6), $\partial m_i / \partial(\tau_i - \tau_M) = 1/\gamma$. Hence η_i is the semi-elasticity of shifted profit with respect to the marginal tax saving. I call a_i the foreign exposure of resident ownership. It is the ratio between the shifted profit owned by residents of i and the part of that profit produced at home. It equals one when residents own no profit produced abroad, and it rises with the foreign activity of the domestic multinational. It does not rise with every increase in resident holdings abroad. With two non-havens, $a_i = 1 + D_{ij}m_j/(D_{ii}m_i)$. Raising σ_{ij} increases D_{ij} by π_{jj} and D_{ii} by π_{ji}, so that, at given shifted fractions,

$$\operatorname{sign} \frac{\partial a_i}{\partial \sigma_{ij}} = \operatorname{sign}\left[\pi_{jj} D_{ii} - \pi_{ji} D_{ij}\right]. \tag{13}$$

Buying shares in a foreign multinational raises the exposure of i if that multinational produces mostly abroad, and lowers it if it produces mostly in i. In equilibrium, a change in σ_{ij} also moves the rates and, through them, m_i and m_j, and these responses have no

definite sign. Both η_i and a_i are evaluated at the shifted fractions of Lemma 1. They are therefore equilibrium objects, not primitives.

The marginal analysis of Sections 3.3 to 3.5 is carried out on the domain

$$\tau_M < \tau_i < \tau_M + \gamma, \qquad D_{ii} > 0, \qquad i = 1, 2, \tag{14}$$

where $m_i \in (0, 1)$ and each government's problem has a solution inside the shifting region that satisfies the second-order condition. This excludes three cases. If $\tau_i \leq \tau_M$, then $m_i = 0$ and the statistics η_i and a_i of (12) are not defined. A marginal increase in the floor then leaves both shifting and revenue unchanged, so that $\partial G_i/\partial \tau_M = 0$ rather than $\tau_i B_i/\gamma$. If $\tau_i = \tau_M$, the government is at a kink and the first-order condition (15) is replaced by one-sided inequalities. This case is studied explicitly in Section 3.6. If $D_{ii} = 0$, which the ownership matrix allows, residents own none of the domestic base, $\Omega_i = 0$ and a_i is not defined. The welfare derivative (21) must then be read in its unnormalised form (20), which remains valid. At any interior optimum with $D_{ii} > 0$, Proposition 1 below and $MRS_i > 0$ imply $1 + \varepsilon_i > 0$. By (11), this is equivalent to $\gamma(1 - m_i) > \tau_i$. Condition (14) is assumed, without further mention, in every result on a marginal change in the floor.

Each government chooses its rate to maximise the utility of its representative resident, taking as given the floor and the rate of the other non-haven. The first-order condition can be written with the two statistics of (11).

Proposition 1. *The best response of government i satisfies*

$$MRS_i = \frac{\Omega_i}{1 + \varepsilon_i}. \tag{15}$$

Proof: See Appendix A. □

Condition (15) says that the marginal value of the public good equals the resident share of the domestic base, inflated by the elasticity of the reported base. With $\Omega_i = 1$ it is the first-order condition of the domestic-ownership case. The gap between Ω_i and one is the part of the domestic tax paid by foreigners. As in Huizinga and Nielsen (1997), it pushes the country towards a higher rate. Profit produced abroad does not appear in (15): it is not part of the domestic base and, by Lemma 1, the tax paid on it does not depend on τ_i.

The rate of the other non-haven enters the problem of country i only through C_i, and therefore only through the marginal rate of substitution. The interaction among non-havens is thus different from that in Janeba and Schjelderup (2023), where it works through the relocation of real activity. Here it works through an income effect, and it has two consequences that the next two subsections take in turn: it gives the reaction functions a slope, and it makes the response of τ_j to the floor a first-order term in the welfare of country i, which the envelope theorem does not remove.

3.4 Reaction functions and the response to the floor

Both governments choose at the same time, so a change in the floor moves both rates. The response of each rate is an equilibrium object. I first characterise it for any preferences, and then compute it in closed form.

Let $F_i \equiv \partial U(C_i, G_i)/\partial \tau_i$ be the first-order condition of government i, $R_i' \equiv -F_{i\tau_j}/F_{i\tau_i}$ the slope of its reaction function, and $\widehat{d}_i \equiv -F_{i\tau_M}/F_{i\tau_i}$ the response it would make if the other rate were held fixed.

Lemma 3. *At an interior Nash equilibrium at which the second-order conditions hold and* $R_1' R_2' < 1$,

$$R_i' = \frac{D_{ij}\,(1-m_j)\,U_C\,g_i}{F_{i\tau_i}}\,\frac{\partial MRS_i}{\partial C_i}, \qquad \frac{d\tau_i}{d\tau_M} = \frac{\widehat{d}_i + R_i'\,\widehat{d}_j}{1 - R_i' R_j'}, \tag{16}$$

where $g_i \equiv \partial G_i/\partial \tau_i > 0$. *If* $D_{ij} > 0$, *the reaction function of* i *slopes down,* $R_i' < 0$, *if and only if* $\partial MRS_i/\partial C_i > 0$, *and slopes up,* $R_i' > 0$, *if and only if* $\partial MRS_i/\partial C_i < 0$. *If* $D_{ij} = 0$ *or* $\partial MRS_i/\partial C_i = 0$, *then* $R_i' = 0$. *In particular,* $U_{CC} \leq 0$ *and* $U_{CG} \geq 0$, *not both zero, imply* $R_i' < 0$ *whenever* $D_{ij} > 0$, *and under preferences quasi-linear in private consumption both slopes are zero and* $d\tau_i/d\tau_M = \widehat{d}_i$.

Proof: See Appendix A. □

I call the public good normal at a point where $\partial MRS_i/\partial C_i > 0$ and inferior where this derivative is negative. With quasi-concave preferences, this is the sign of the income effect on the demand for the public good at a given price. The rates of the two non-havens are therefore strategic substitutes when the public good is normal and strategic complements when it is inferior. The strength of the link is proportional to D_{ij}. The same element of the ownership matrix creates both the externality and the strategic interaction, and for the same reason. A higher foreign rate lowers the income of residents who own profit abroad. This lowers their demand for the public good if it is normal, and raises it if it is inferior. Quasi-linearity is the special case in which this income effect is absent. It is the only case in which the response of each rate to the floor is a single-country comparative static for both countries at once. Appendix B gives an explicit specification in which both signs arise.

There is, however, a case in which the response of a rate to the floor is a single-country comparative static whatever the preferences. If $D_{ji} = 0$, so that the residents of j own no profit produced in i, then $R_j' = 0$ by (16) and $d\tau_j/d\tau_M = \widehat{d}_j$. This covers the case of Proposition 4 below and of the calibration, where the host country owns nothing abroad. It does not give the sign of $\widehat{d}_j$, which equals $\operatorname{sign} F_{j\tau_M}$ because $F_{j\tau_j} < 0$. Differentiating F_j and grouping terms gives

$$F_{j\tau_M} = \underbrace{\left[U_C \frac{\partial c_j}{\partial \tau_M} + U_G \frac{\partial g_j}{\partial \tau_M}\right]}_{\text{elasticity}} + \underbrace{\frac{\partial C_j}{\partial \tau_M}\left[U_{CC} c_j + U_{CG} g_j\right]}_{\text{private income}} + \underbrace{\frac{\partial G_j}{\partial \tau_M}\left[U_{CG} c_j + U_{GG} g_j\right]}_{\text{public good}}, \tag{17}$$

with $c_j \equiv \partial C_j/\partial \tau_j$ and $g_j \equiv \partial G_j/\partial \tau_j$. Under (3), $\partial c_j/\partial \tau_M = -D_{jj}/\gamma$ and $\partial g_j/\partial \tau_M = B_j/\gamma$, so the first group equals $U_C B_j (MRS_j - \Omega_j)/\gamma$. It is positive at an interior optimum, because $MRS_j = \Omega_j/(1+\varepsilon_j) > \Omega_j$. Intuitively, a higher floor makes the reported base less elastic, and this calls for a higher rate. The second group is the term added by curvature in private consumption. It is zero when $U_{CC} = U_{CG} = 0$, and non-positive whenever $U_{CC} \leq 0$ and $U_{CG} \geq 0$, since $c_j < 0$, $g_j > 0$ and $\partial C_j/\partial \tau_M < 0$. The third group is negative whenever $U_{CG} c_j + U_{GG} g_j < 0$. This holds when $U_{CG} \geq 0$ and $U_{GG} < 0$, and the group is present under quasi-linearity as well.

The sign of $\widehat{d}_j$ therefore depends on preferences, and I do not sign it in general. With additively separable preferences, $U_{CG} = 0$ and $U_{CC} \leq 0$, concavity in private consumption

leaves the first and third groups as they are under quasi-linearity and only adds the second group, which is non-positive. It can therefore work against a positive rate response, but not in its favour. If $U_{CG} > 0$, the third group also becomes more negative. Appendix B shows that, at the equilibrium of the calibration, the second group is small relative to the first.

To compute $\widehat{d}_i$, and not only to sign it, and to calibrate the model, I now specialise preferences.

Assumption 2. *Preferences are* $U(C,G) = C + bG - cG^2$ *with* $b, c > 0$. *Write* $\widehat{G} \equiv b/(2c)$ *for the level of the public good at which* $U_G = 0$.

Quadratic utility is used only here and in the numerical illustration. Under Assumption 2, $MRS_i = b - 2cG_i$ and preferences are quasi-linear. Hence $R_1' = R_2' = 0$ by Lemma 3 and $d\tau_i/d\tau_M = \widehat{d}_i$.

Lemma 4. *Under Assumption 2, at an interior optimum,*

$$\frac{d\tau_i}{d\tau_M} = \frac{\tau_i \left[b - 2c\gamma B_i \left(1 - m_i\right)^2 \right]}{2cB_i \left(1 - m_i\right) \left[\gamma \left(1 - m_i\right) - \tau_i\right]^2 + MRS_i \left[\gamma \left(1 - m_i\right) + \tau_i\right]}. \tag{18}$$

The denominator is positive whenever the second-order condition for the choice of τ_i *holds, so that*

$$\operatorname{sign} \frac{d\tau_i}{d\tau_M} = \operatorname{sign} \left[\widehat{G} - \gamma B_i \left(1 - m_i\right)^2 \right]. \tag{19}$$

National rates and the floor are therefore strategic complements if and only if $\gamma B_i (1-m_i)^2$ *falls short of the satiation level of the public good.*

Proof: See Appendix A. □

Condition (19) is the closed form of the contest between the first and the third group in (17). It compares $\gamma B_i (1 - m_i)^2$ with the satiation level of the public good, not with actual provision. Since $G_i = \tau_i B_i (1 - m_i)$ and $\gamma(1 - m_i)/\tau_i = -1/\varepsilon_i$, the condition can be written as $G_i < |\varepsilon_i| \, \widehat{G}$. Since $|\varepsilon_i| < 1$ at an interior optimum, it can fail even when provision is still far below satiation. For the range of floors considered in Section 4, the two sides of (19) differ by a factor of at least two.

Two things follow for the welfare analysis of the next subsection. First, when (19) holds for country j, a higher floor raises τ_j and lowers the income of the residents of i who own profit produced in j. Second, this does not require the reaction functions to slope. By Lemma 3 they are flat here, and yet (18) is strictly positive.

3.5 The welfare effect of a marginal increase in the floor

This subsection contains the main results. I first decompose the marginal welfare effect of the floor into a direct trade-off and an ownership externality, then show that the sign of the direct trade-off depends on the ownership and activity structure through one statistic.

Consider a marginal increase in τ_M. Since τ_i is chosen optimally, the envelope theorem implies that the induced change in τ_i has no first-order effect on the welfare of country i. The change in τ_j does have one, because τ_j enters C_i through φ_j. Using Lemmas 1 and 2,

$$\frac{\partial C_i}{\partial \tau_M} = -\sum_k D_{ik} \, m_k < 0, \qquad \frac{\partial G_i}{\partial \tau_M} = \frac{\tau_i B_i}{\gamma} > 0, \qquad \frac{\partial C_i}{\partial \tau_j} = -D_{ij} \left(1 - m_j\right). \tag{20}$$

The mechanical loss is proportional to the profit that residents of i own and that is shifted anywhere in the world. This is the numerator of the exposure statistic a_i in (12). The revenue gain is proportional to the profit produced in the country, whoever owns it, and its size depends on the semi-elasticity η_i defined in the same equation.

The exposure statistic is sufficient only in a limited sense. It summarises how the sign of the bracket in (21) depends on the ownership and activity structure, at an interior optimum and given the equilibrium values of τ_i, m_i and η_i. It does not summarise the total welfare effect, which also depends on D_{ij} and on the response of the other non-haven, nor the size of the bracket, which still depends on Ω_i. It is also not directly observable. Measuring it would require the activity matrix, the ownership matrix and the shifting margin of each jurisdiction, and country-by-country reports do not provide the distribution of ultimate ownership.

Proposition 2. *A marginal increase in the global minimum rate changes welfare in country i by*

$$\frac{dW_i}{d\tau_M} = U_C \left\{ B_i m_i \left[MRS_i \, \tau_i \eta_i - \Omega_i a_i \right] - D_{ij} \left(1 - m_j\right) \frac{d\tau_j}{d\tau_M} \right\}. \tag{21}$$

Proof: See Appendix A. □

The term in square brackets is the direct trade-off between the revenue gain and the mechanical loss. Under domestic ownership the mechanical loss has weight one; here it has weight $\Omega_i a_i$. The last term is the ownership externality. It works through the rate of the other non-haven, not through the location of real activity. It is zero when residents of i own no profit produced abroad, and it is negative whenever national rates and the floor are strategic complements. It should not be confused with the spillback of Hebous and Keen (2023). That effect works through the slope of the best response of the unconstrained country and disappears when this slope is zero. What matters here is the response of τ_j to the floor. By Lemma 3, this response is present even when the best responses of the two non-havens do not depend on each other.

Leave the externality aside for a moment and use Proposition 1 to eliminate MRS_i. This gives a condition that depends on the ownership and activity structure only through a_i.

Proposition 3. *Assume $1 + \varepsilon_i > 0$. The term in square brackets in (21) is positive if and only if*

$$\eta_i > T(a_i) \equiv \frac{a_i \left(1 - m_i\right)}{\tau_i \left[\left(1 - m_i\right) + a_i m_i\right]}. \tag{22}$$

The threshold T is strictly increasing in a_i, equals $(1 - m_i)/\tau_i$ at $a_i = 1$, and converges to the finite limit $(1 - m_i)/(\tau_i m_i)$ as $a_i \to \infty$. Neither Ω_i nor the composition of ownership enters (22) separately.

Proof: See Appendix A. □

Two features of this result are worth noting. The first is invariance. The share of the domestic multinational owned by foreigners and the presence of foreign subsidiaries in the country both affect the equilibrium rate, and through it m_i and η_i. Neither, however, enters the sign condition directly. The second feature is that the threshold has an upper bound, $T(\infty) = (1 - m_i)/(\tau_i m_i)$. Since $\varepsilon_i = -\tau_i \eta_i m_i/(1 - m_i)$, the assumption $1 + \varepsilon_i > 0$, which holds at every interior optimum, is equivalent to $\eta_i < T(\infty)$. The semi-elasticity

and the shifted fraction are not independent: both depend on the concealment technology and on the equilibrium rate. Once this link is taken into account, the condition becomes a restriction on a_i alone.

Corollary 1. *Since $\eta_i = 1/(\gamma m_i)$ by (12), the term in square brackets in (21) is positive if and only if*

$$a_i < a_i^* \equiv \frac{\tau_i (1 - m_i)}{m_i [\gamma (1 - m_i) - \tau_i]}, \tag{23}$$

provided $\gamma(1 - m_i) > \tau_i$, which is equivalent to $1 + \varepsilon_i > 0$ and therefore holds at every interior optimum. At every such optimum the critical value is finite, so a country whose residents own enough profit abroad faces a negative direct trade-off. The critical value depends on γ, m_i and τ_i and diverges as $\gamma(1 - m_i)$ falls to τ_i.

Proof: See Appendix A. □

Corollary 1 is the main result of the paper. Under domestic ownership the condition is read as a requirement on the semi-elasticity of shifting: a country that fails it is one where shifting responds too little to the tax differential. Here the condition is read as a requirement on the ownership structure. The semi-elasticity cannot be raised independently to meet it, because at an interior optimum it is tied to the shifted fraction and bounded by $T(\infty)$. Hence, in any given equilibrium, there is a level of exposure that makes the direct trade-off negative. The result does not give a single exposure threshold valid for all admissible elasticities, because a_i^* changes with the equilibrium.

Consider two non-havens with the same equilibrium rate, the same shifted fraction and the same concealment technology, so that $\eta_1 = \eta_2$ and $T(\cdot)$ is the same function for both, but with $a_1 > a_2$.

Proposition 4. *Under the above conditions the direct trade-off is positive in country 2 and negative in country 1 for every semi-elasticity in the interval $(T(a_2), T(a_1))$, which is non-empty because T is strictly increasing. If in addition $a_2 = 1$, so that the residents of country 2 own no shifted profit produced abroad, and $d\tau_2/d\tau_M \geq 0$, then the ownership externality is zero for country 2 and non-positive for country 1, and the total welfare effects carry the same signs. The global minimum tax then redistributes from non-havens whose residents own profit produced abroad to non-havens that host the production of foreign-owned multinationals.*

Proof: See Appendix A. □

The result is deliberately weak, because it keeps tax rates and shifted fractions equal in the two countries. The assumptions of the second part are those under which the externality cannot reverse the ranking of the direct effects: it is zero for the country with lower exposure and adds to the loss of the country with higher exposure. Section 4 shows that the split survives when rates and shifted fractions are set in equilibrium and differ across countries.

Finally, the main claims of the paper do not need the quadratic cost (3): the sufficient statistic and its threshold, the first-order nature of the ownership externality, and the condition $MRS_i = \Omega_i$ at an interior optimum without shifting hold for any convex concealment cost. Appendix B lists the results that survive with a generic cost and those that do not.

3.6 A floor high enough to stop shifting

Suppose the floor is high enough that $m_1 = m_2 = 0$ by Lemma 1. The government's problem is then no longer smooth at $\tau_i = \tau_M$, and two cases must be distinguished.

In the interior case, the government chooses a rate strictly below the floor. The elasticity in (11) is zero, and (15) holds with equality and becomes

$$MRS_i = \Omega_i. \tag{24}$$

Let τ_i^0 be the rate that solves (24) at $m_i = 0$. With real activity fixed and no shifting, the profit tax is a lump-sum tax. The only reason why the government does not raise it further is that the marginal value of the public good has fallen to Ω_i, the fraction of the marginal tax that residents pay themselves. The rate is not bounded by satiation of the public good: at τ_i^0, U_G is still strictly positive, and τ_i^0 would be the satiation rate only if Ω_i were zero.

In the kink case, the government of i sets $\tau_i = \tau_M$. The left derivative of welfare at the floor, where no profit is shifted, is $U_C B_i(MRS_i - \Omega_i)$. The right derivative, where shifting starts again with $m_i = 0$ and $\partial m_i/\partial \tau_i = 1/\gamma$, is $U_C B_i[MRS_i(1 - \tau_M/\gamma) - \Omega_i]$. The kink therefore requires

$$\Omega_i \leq MRS_i \qquad \text{and} \qquad MRS_i \left(1 - \frac{\tau_M}{\gamma}\right) \leq \Omega_i, \tag{25}$$

with MRS_i evaluated at $G_i = \tau_M B_i$. The first inequality says that the government does not gain by lowering its rate below the floor. The second says that it does not gain by raising its rate and letting shifting start again. The second inequality holds automatically when $\tau_M \geq \gamma$. The two conditions are necessary, and they are also sufficient when welfare is concave on each side of the floor. The first fails for $\tau_M > \tau_i^0$, where the interior case applies. The second fails at low floors, where the government sets a rate above the floor and shifting continues. In the kink case, the floor still determines the allocation even though shifting has stopped.

The two cases differ in the direction of the remaining distortion. Take as the benchmark the Samuelson condition $MRS_i = 1$. Under this condition the domestic split between private and public consumption is undistorted, given the international distribution of income. It is not the optimum of a world planner, who would also have to weigh the two non-havens against each other and against the owners outside them. In the interior case, $MRS_i = \Omega_i < 1$ whenever some profit produced at home accrues to foreigners, and the public good is over-provided relative to the benchmark. In the kink case, $MRS_i \geq \Omega_i$ by (25), and MRS_i may be below, equal to or above one. In the last case, the public good is under-provided. Under Assumption 2, $MRS_i = b - 2c\tau_M B_i$ at the kink, which equals one for a single value of the floor. Hence, at an interior optimum, a floor that stops shifting gives $MRS_i = 1$ only if $\Omega_i = 1$. At the kink, it does so only if the floor happens to be at the benchmark value.

Two further points matter for the welfare effect of such a floor. First, in both cases world resources are no longer wasted: nothing is spent on concealment and nothing goes to the havens. This is a statement about the world, not about any single country. For one country, $C_i + G_i = \sum_k D_{ik}(1 - \tau_k) + y_i + \tau_i B_i$ when there is no shifting. This sum increases with τ_i at rate $B_i(1 - \Omega_i)$ and decreases with τ_j at rate D_{ij}, so it depends on both rates.

Second, both rates change. Holding them at their pre-reform values, the changes in private and public consumption are

$$\Delta C_i = -\sum_k D_{ik}\left[\tau_k m_k - \frac{\gamma m_k^2}{2}\right], \qquad \Delta G_i = \tau_i B_i m_i. \tag{26}$$

The reform is a discrete change, so the marginal rate of substitution cannot be treated as constant. Let MRS_i^+ be the marginal rate of substitution after the reform, at the level $G_i + \Delta G_i$ of the public good. With quasi-linear preferences $U(C, G) = C + v(G)$ and v concave, the difference $v(G_i + \Delta G_i) - v(G_i)$ lies between $MRS_i^+ \Delta G_i$ and $MRS_i \Delta G_i$. This gives a sufficient condition for a gain and a sufficient condition for a loss, both at fixed national rates.

Proposition 5. *Let $U(C, G) = C + v(G)$ with $v' > 0$ and $v'' < 0$ and let the pre-reform floor be zero, so that $m_k = \tau_k/\gamma$ by (6). Hold the tax rates of both non-havens fixed at their pre-reform values and define*

$$R_i \equiv \frac{\sum_k D_{ik}\,\tau_k m_k}{2\,\tau_i B_i m_i}, \tag{27}$$

which reduces to $\Omega_i a_i/2$ when the two non-havens set the same rate. At these fixed rates, a floor high enough to stop shifting raises welfare in country i if $MRS_i^+ > R_i$ and lowers it if $MRS_i < R_i$. If country i re-optimises its own rate while τ_j is held fixed, the first condition remains sufficient for a gain. If the other non-haven re-optimises and shifting has stopped there, the exact additional term

$$-D_{ij}\,\Delta\tau_j \tag{28}$$

must be added to ΔC_i, and it is negative when the reform raises τ_j.

Proof: See Appendix A. □

Three comments follow. First, the gap between the two conditions reflects the curvature of v over the range covered by the public good, and it goes to zero as the reform becomes small. Second, (28) has no factor $1 - m_j$. After the reform $m_j = 0$, so a unit increase in τ_j costs the owners of profit produced in j the full unit, not the fraction $1 - m_j$ of it. The marginal expression (21) is evaluated at the pre-reform shifting margin, and for this reason it understates the discrete externality. Third, revealed preference ensures that re-optimising its own rate can only raise a country's welfare, but it does not apply to the rate of the other non-haven. When $\Omega_i = 1$, $a_i = 1$ and the two rates are equal, condition (27) becomes $MRS_i^+ > 1/2$. The domestic-ownership result that a high floor is beneficial then holds, at fixed rates and with own re-optimisation, provided the public good is still worth more than half a unit of private consumption after the reform. When the two rates are equal and $\Omega_i a_i > 2MRS_i$, the reform is harmful at fixed rates, whatever the curvature of v. Once the other country adjusts, the term (28) must be added, and in the calibration below it turns a gain into a loss for the headquarters country. Proposition 5 is therefore a bound at fixed rates, not a full characterisation of the reform with equilibrium rates.

4 Numerical results

I calibrate the model to the polar case that motivates the analysis. Country 1 is a headquarters country: its multinational produces one unit of profit at home and one unit in country 2. Country 2 is a host country: its multinational produces one unit at home and nothing abroad. Formally, $\pi_{11} = \pi_{12} = \pi_{22} = 1$ and $\pi_{21} = 0$. In the baseline, each multinational is wholly owned at home, so $\sigma_{11} = \sigma_{22} = 1$ and $\sigma_{12} = \sigma_{21} = 0$. I set $\gamma = 1$ in (3), and preferences are $U(C, G) = C + 1.6\,G - 0.3\,G^2$.

These values give $B_1 = 1$ and $B_2 = 2$, so that $\Omega_1 = 1$ and $\Omega_2 = 1/2$. Half of the profit taxed by the host country belongs to non-residents. As Huizinga and Nielsen (1997) would predict, the host country therefore sets the higher rate. The exposure statistics are $a_1 = (m_1 + m_2)/m_1 > 1$ and $a_2 = 1$.

Haufler et al. (2025) obtain the same ranking of rates from a different mechanism: the country with weaker enforcement can discriminate in favour of mobile firms. The two explanations predict different effects of the floor. In their model, when competition for real investment is strong, a higher floor lowers both rates. Here, a higher floor raises both rates whenever condition (19) holds, as it does throughout Table 1.

Table 1: Equilibrium as the global minimum rate rises

τ_M	τ_1	τ_2	m_1	m_2	G_1	G_2	W_1	W_2	a_1	a_2
0.00	0.2471	0.3828	0.2471	0.3828	0.1860	0.4725	1.7612	1.3795	2.549	1.000
0.05	0.2566	0.3986	0.2066	0.3486	0.2036	0.5193	1.7402	1.4121	2.688	1.000
0.10	0.2656	0.4138	0.1656	0.3138	0.2216	0.5679	1.7234	1.4473	2.894	1.000
0.15	0.2742	0.4282	0.1242	0.2782	0.2402	0.6181	1.7110	1.4849	3.239	1.000
0.20	0.2824	0.4418	0.0824	0.2418	0.2591	0.6699	1.7029	1.5247	3.935	1.000

Table 1 reports the equilibrium. As the floor rises, both countries raise their rates and shifting falls in both. This is the direction predicted by Lemma 4. At $\tau_M = 0$, the left-hand side of (19) is $\widehat{G} = 2.667$, while $\gamma B_i(1 - m_i)^2$ is 0.567 for country 1 and 0.762 for country 2. The condition holds by a wide margin, and national rates and the floor are strategic complements. Welfare moves in opposite directions: the headquarters country loses throughout and the host country gains throughout. The exposure statistic of country 1 rises with the floor, because m_2 falls by less than m_1 in proportional terms. The critical value (23) rises faster, from 1.49 at $\tau_M = 0$ to 4.95 at $\tau_M = 0.20$. The direct trade-off therefore improves as the floor rises, and it becomes positive between $\tau_M = 0.15$ and $\tau_M = 0.20$. The total effect stays negative because of the ownership externality, which is almost constant over this range.

Table 2: Decomposition of the marginal welfare effect

τ_M	Country	Mechanical	Revenue	Externality	Total
0.00	1	−0.6299	+0.3677	−0.1990	−0.4611
0.00	2	−0.3828	+1.0079	0.0000	+0.6251
0.10	1	−0.4794	+0.3897	−0.2032	−0.2929
0.10	2	−0.3138	+1.0421	0.0000	+0.7283
0.20	1	−0.3242	+0.4079	−0.1994	−0.1157
0.20	2	−0.2418	+1.0585	0.0000	+0.8168

Table 2 decomposes (21). The response $d\tau_j/d\tau_M$ is taken from (18), not computed numerically; at $\tau_M = 0$ it is 0.194 for country 1 and 0.322 for country 2. The externality is zero for the host country, whose residents own no profit produced abroad. It is large for the headquarters country: it accounts for 43 per cent of the total effect at $\tau_M = 0$ and, since it is almost constant in τ_M while the direct trade-off improves, for 98 per cent of it at $\tau_M = 0.15$. This share depends on the chosen parameters and should be read as an order of magnitude, not as an estimate. Its importance is not only quantitative. At $\tau_M = 0.20$, the semi-elasticity of country 1 is 12.14 and the threshold from (22) is 10.30. The condition evaluated at the country's own optimum is therefore met, yet the total effect is still negative. A welfare analysis that stops at the envelope theorem would reach the wrong conclusion.

Table 3: Portfolio cross-ownership: residents of country 2 hold a share s of the multinational headquartered in country 1

s	Ω_1	Ω_2	a_1	a_2	$dW_1/d\tau_M$	$dW_2/d\tau_M$
0.00	1.000	0.500	2.549	1.000	−0.4611	+0.6251
0.10	0.900	0.550	2.310	1.069	−0.3399	+0.5232
0.20	0.800	0.600	2.129	1.148	−0.2172	+0.4137
0.30	0.700	0.650	1.987	1.234	−0.0938	+0.2981
0.40	0.600	0.700	1.871	1.328	+0.0295	+0.1778

Table 3 drops the assumption that each multinational is wholly owned at home. The row $s = 0$ reproduces the baseline of Table 2. With the activity matrix of this section, $D_{11} = D_{12} = 1 - s$. Hence $a_1 = (m_1 + m_2)/m_1$ does not depend directly on s, while $a_2 = 1 + s\, m_1/[(1 + s)m_2]$ rises with s at given shifted fractions, because the bracket in (13) equals $\pi_{11}\pi_{22} > 0$. The fall in a_1 in the table is therefore entirely due to the tax response: Ω_1 falls from 1 to 0.60, the rate of country 1 rises from 0.2471 to 0.3707, and m_1 rises relative to m_2. As residents of the host country buy shares in the multinational headquartered abroad, the two welfare effects move closer. At $s = 0.3760$ the loss of the headquarters country becomes a gain, while the host country still gains. Cross-border portfolio ownership therefore reduces the conflict of interest over the floor and, above a threshold, removes it. The mechanism relies on the rate response of Lemma 4 and on the direction in which a_2 moves. Both depend on the specification and on the activity matrix, so the threshold value is an illustration, not a general magnitude.

Under the quadratic utility used so far the reaction functions are flat. Appendix B adds an interaction between private and public consumption to these preferences and shows that both signs of Lemma 3 arise. With a portfolio share $s = 0.2$, the reaction functions slope down when the public good is normal and up when it is inferior, and when preferences differ across countries the two patterns are present at once (Figure 1). The slopes are of the order of 10^{-2}, and the response of each rate to the floor remains positive.

Finally, consider a floor high enough to stop shifting. Shifting stops in the headquarters country at $\tau_M = 0.2967$ and in the host country at $\tau_M = 0.5$. These are the floors at which the second inequality in (25) starts to hold. The rates that solve (24) are $\tau_1^0 = 1$ and $\tau_2^0 = 0.9167$. The headquarters country is therefore at the kink for $0.2967 \leq \tau_M \leq 1$ and the host country for $0.5 \leq \tau_M \leq 0.9167$. Both governments set $\tau_1 = \tau_2 = \tau_M$ only for $0.5 \leq \tau_M \leq 0.9167$. For higher floors, the host country is in the interior case with $\tau_2 = \tau_2^0$, while for the headquarters country the kink and the interior solution coincide

at $\tau_M = 1$. From $\tau_M = 1$ on, the allocation no longer depends on the floor. These rates are set by $MRS_i = \Omega_i$, not by satiation, which would require $G_i = \widehat{G} = 2.667$. At τ_1^0 the headquarters country provides $G_1 = 1$, and at τ_2^0 the host country provides $G_2 = 1.833$. Both are well below satiation.

The calibration shows both cases of Section 3.6. At $\tau_M = 0.6$, where both governments are at the kink, $MRS_1 = 1.24$ and $MRS_2 = 0.88$. The headquarters country underprovides the public good relative to the benchmark $MRS_i = 1$, the host country overprovides it, and neither is at Ω_i. At $\tau_M = 0.5$ the host country is at the kink with $MRS_2 = 1$ exactly, since $G_2 = 1$. A kink can thus meet the benchmark with $\Omega_2 < 1$, but only at that floor. At $\tau_M = 1$, the host country is in the interior case and the headquarters country is at the boundary $\tau_1 = \tau_M = \tau_1^0$. Both satisfy $MRS_i = \Omega_i$, so $MRS_1 = 1$ and $MRS_2 = 0.5$, and only the host country is still distorted. The direction of the remaining distortion therefore depends on the case and on the floor, not on the reform as such.

The welfare split appears in both cases. At $\tau_M = 0.6$, welfare in the headquarters country is 1.6520, against 1.7612 before the reform, a loss of 0.1092. Welfare in the host country is 1.8880, against 1.3795, a gain of 0.5085. At $\tau_M = 1$, the headquarters country reaches 1.3833 and the host country 2.0083, so both the loss and the gain are larger.

The loss of the headquarters country is entirely due to the ownership externality. Suppose the rate of the host country stays at its pre-reform value of 0.3828 and only the headquarters country re-optimises at $\tau_M = 0.6$. Its welfare then rises to 1.8692, a gain of 0.1080. When the host country moves to the kink, φ_2 falls by $\Delta\tau_2 = 0.2172$. By (28), this costs the headquarters country $D_{12}\Delta\tau_2 = 0.2172$ and turns the gain into the loss of 0.1092 reported above. The two figures differ by exactly (28), the discrete counterpart of the term that the envelope theorem does not remove. Had the factor $1 - m_2$ of the marginal expression been kept, the term would have been 0.1341 and the loss would have been 0.0260 instead of 0.1092, about four times smaller. The conclusion that a high floor always benefits non-havens therefore does not hold once ownership crosses borders.

5 Conclusion

When real activity is fixed and the floor is effective on shifted profit, the global minimum tax transfers resources from the owners of multinationals to the governments of the countries where profit is produced. This transfer is not the whole effect. Less shifting also frees the resources spent on concealment, and the rate of the other non-haven adjusts. When ownership and production are in the same country, the transfer nets out and the welfare effect depends on the elasticity of profit shifting. When they are not, the transfer crosses borders and the sign of the welfare effect depends on the structure of ownership.

The model leaves three questions open. The first is the Side-by-Side package agreed by the Inclusive Framework. A carve-out based on the residence of the parent makes the shifted fraction specific to each pair of parent and source jurisdiction. The exposure statistic then splits into two parts: the exposure of resident ownership to profit that is still covered, and the share of the domestic base due to covered groups. The second is real investment, which would add a relocation externality to the ownership externality studied here. The third is the joint choice of ownership and shifting. The model takes the ownership matrix as given, whereas in debt-shifting models with minority owners ownership and financing are chosen together (see Section 2). Ownership would then enter twice: through the statistics that govern incidence, and through the shifted fractions at which these statistics are evaluated. The two channels need not work in the same

direction.

Within the model, I have shown that a single statistic summarises the ownership structure for the direct trade-off. The foreign exposure of resident ownership sets the threshold that the semi-elasticity of shifting must exceed for the direct trade-off to be favourable. The threshold rises with exposure and is bounded, and the critical exposure has a closed form. At any interior optimum the semi-elasticity is below the bound. Hence, in every admissible equilibrium, a country whose residents own enough profit abroad faces an adverse direct trade-off, although the cutoff changes with the equilibrium. Such a country can also lose through the response of the other non-haven's tax rate. The envelope theorem does not remove this term, and the exposure statistic does not summarise it. The term is first order for any preferences and proportional to the profit that residents own abroad. Its sign depends on the response of the other rate to the floor. This response is positive under a closed-form condition, and with additively separable preferences concavity in private consumption can only weaken it. The same channel shapes the reaction functions of the non-havens, which slope down when the public good is normal and up when it is inferior. When preferences differ across countries, strategic complementarity and substitutability coexist. Finally, a floor high enough to stop shifting does not in general restore the Samuelson condition, and it does not guarantee a gain. For policy, the implication is that the incidence of the floor across the countries that adopt it cannot be read from profit-shifting elasticities alone: it requires information on who ultimately owns the profit that is shifted.

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Data and code availability. No new data were created or analysed in this study. The Python code that reproduces all numerical results is provided as supplementary material.

Appendix A. Proofs

Proof of Lemma 1

The multinational headquartered in i chooses $\{m_k\}$ to maximise (5). Since $\pi_{ik} > 0$ enters multiplicatively and φ_k depends on m_k alone, the problem separates across countries and the first-order condition for m_k at an interior solution is $\pi_{ik}\,[\tau_k - \widetilde{\tau} - \gamma m_k] = 0$. Since φ_k is strictly concave in m_k, the solution on $[0, 1]$ is the projection of $(\tau_k - \widetilde{\tau})/\gamma$ on that interval, which is (6). The solution does not depend on i, so all multinationals producing in k shift the same fraction and the reported base of k is $B_k(1 - m_k)$. Differentiating φ_j

and using (6),

$$\frac{\partial \varphi_j}{\partial \tau_j} = -(1 - m_j) + [\tau_j - \widetilde{\tau} - \gamma m_j] \frac{\partial m_j}{\partial \tau_j} = -(1 - m_j),$$

and similarly $\partial \varphi_j / \partial \tau_M = -m_j$. □

Proof of Lemma 2

Let $e \geq \tau_M$ be the lowest effective rate offered by the havens and $X(e) \equiv \sum_k B_k m_k$ the shifted profit it attracts, which by (6) is continuous and non-increasing in e. By the two rules of Section 3, a haven with statutory rate τ_H that offers e, together with $n-1$ other havens, collects $\tau_H X(e)/n$, and a haven offering a higher effective rate collects nothing. Suppose $X(e) > 0$.

First, no haven sets $\tau_H < \tau_M$. Its effective rate is τ_M by (4), so raising its statutory rate to τ_M leaves e and n unchanged and raises its revenue. Hence the havens that attract profit set $\tau_H = e$.

Second, $e = \tau_M$. If $e > \tau_M$ and $n \geq 2$, a haven offering e can lower its rate to $e - \delta \geq \tau_M$ and collect $(e - \delta) X(e - \delta) \geq (e - \delta) X(e)$, which exceeds $e X(e)/n$ for δ small. If $e > \tau_M$ and $n = 1$, then, since $H \geq 2$, some haven collects nothing and can set $e - \delta \geq \tau_M$ to collect $(e - \delta) X(e - \delta) > 0$.

Third, every haven sets τ_M. A haven with $\tau_H > \tau_M$ collects nothing and would collect $\tau_M X(\tau_M)/(n+1) > 0$ at τ_M.

Conversely, when all havens set τ_M, a haven that lowers its rate keeps its share and collects less, and a haven that raises it collects nothing, so the profile is an equilibrium. Revenue in each haven is $\tau_M \sum_k B_k m_k / H$, and since no profit is reported at an effective rate below τ_M the top-up tax collects nothing. If $X = 0$, haven rates enter no payoff. □

Proof of Proposition 1

Differentiating (9) with respect to τ_i and using (7), only the term $k = i$ of C_i depends on τ_i, so

$$\frac{\partial C_i}{\partial \tau_i} = -D_{ii} (1 - m_i), \qquad \frac{\partial G_i}{\partial \tau_i} = B_i \left[(1 - m_i) - \frac{\tau_i}{\gamma} \right],$$

where the second uses $\partial m_i / \partial \tau_i = 1/\gamma$ from (6). Setting $U_C \partial C_i / \partial \tau_i + U_G \partial G_i / \partial \tau_i = 0$ and dividing by $B_i (1 - m_i)$ gives

$$MRS_i = \frac{D_{ii} (1 - m_i)}{B_i [(1 - m_i) - \tau_i / \gamma]} = \frac{\Omega_i}{1 + \varepsilon_i},$$

by the definitions in (11). □

Proof of Lemma 3

Write $c_i \equiv \partial C_i / \partial \tau_i = -D_{ii}(1 - m_i) < 0$ and $g_i \equiv \partial G_i / \partial \tau_i = B_i [(1 - m_i) - \tau_i / \gamma] > 0$, the latter because $1 + \varepsilon_i > 0$. Neither depends on τ_j, since by Lemma 1 the shifted fraction m_i depends on τ_i and τ_M alone. Hence $F_i = U_C c_i + U_G g_i$ and τ_j enters F_i only through the

arguments of U_C and U_G, and only through C_i, since G_i does not involve τ_j. Therefore

$$F_{i\tau_j} = [U_{CC}c_i + U_{CG}g_i]\,\frac{\partial C_i}{\partial \tau_j} = -D_{ij}\,(1-m_j)\,[U_{CC}c_i + U_{CG}g_i]\,,$$

using (20). At the equilibrium $F_i = 0$, so $U_C c_i = -U_G g_i$ and

$$U_{CC}c_i + U_{CG}g_i = g_i\left(U_{CG} - \frac{U_G\,U_{CC}}{U_C}\right) = U_C\,g_i\,\frac{\partial MRS_i}{\partial C_i},$$

since $\partial MRS_i/\partial C_i = (U_{CG}U_C - U_G U_{CC})/U_C^2$. Hence $F_{i\tau_j} = -D_{ij}(1-m_j)\,U_C\,g_i\,\partial MRS_i/\partial C_i$, and $R_i' = -F_{i\tau_j}/F_{i\tau_i}$ is the first part of (16). On the domain (14), $m_j < 1$; moreover $U_C > 0$, $g_i > 0$ and $F_{i\tau_i} < 0$ by the second-order condition. Therefore R_i' has the sign of $-D_{ij}\,\partial MRS_i/\partial C_i$, which gives the two equivalences and the case $R_i' = 0$. If $U_{CC} \le 0$ and $U_{CG} \ge 0$, not both zero, then $U_{CG}U_C - U_G U_{CC} > 0$ because $U_C, U_G > 0$, so $\partial MRS_i/\partial C_i > 0$. Under preferences quasi-linear in private consumption MRS_i does not depend on C_i and both slopes are zero.

For the second part, totally differentiating $F_1 = F_2 = 0$ with respect to τ_M gives

$$F_{i\tau_i}\,d\tau_i + F_{i\tau_j}\,d\tau_j + F_{i\tau_M}\,d\tau_M = 0, \qquad i = 1, 2.$$

Dividing the equation for i by $F_{i\tau_i}$ yields $d\tau_i - R_i'\,d\tau_j = \widehat{d}_i\,d\tau_M$. Solving the two-equation system, whose determinant is $1 - R_1'R_2' > 0$ by hypothesis, gives the multiplier formula. Under preferences quasi-linear in private consumption both slopes vanish, as shown above, and the multiplier formula reduces to $d\tau_i/d\tau_M = \widehat{d}_i$. □

Proof of Lemma 4

Write $A_i \equiv \gamma + \tau_M - \tau_i$, so that $1 - m_i = A_i/\gamma$, and set $\Lambda_i \equiv A_i - \tau_i$ and $\kappa_i \equiv 2cB_i/\gamma$. Then $G_i = \tau_i B_i A_i/\gamma$ and $MRS_i = b - \kappa_i \tau_i A_i$. Since preferences are quasi-linear, by Lemma 3 country i maximises $V_i(\tau_i) = D_{ii}\varphi_i + bG_i - cG_i^2$ over τ_i alone. Differentiating and using $D_{ii} = \Omega_i B_i$,

$$V_i'(\tau_i) = \frac{B_i}{\gamma}\,F(\tau_i, \tau_M), \qquad F \equiv MRS_i\Lambda_i - \Omega_i A_i.$$

The first-order condition $F = 0$ is (15), since $\Lambda_i/A_i = 1 + \varepsilon_i$, and the second-order condition is $F_{\tau_i} < 0$. From $\partial A_i/\partial\tau_i = -1$, $\partial A_i/\partial\tau_M = 1$, $\partial\Lambda_i/\partial\tau_i = -2$, $\partial\Lambda_i/\partial\tau_M = 1$, $\partial MRS_i/\partial\tau_i = -\kappa_i\Lambda_i$ and $\partial MRS_i/\partial\tau_M = -\kappa_i\tau_i$,

$$F_{\tau_i} = -\kappa_i\Lambda_i^2 - 2MRS_i + \Omega_i, \qquad F_{\tau_M} = -\kappa_i\tau_i\Lambda_i + MRS_i - \Omega_i.$$

The implicit function theorem gives $d\tau_i/d\tau_M = -F_{\tau_M}/F_{\tau_i}$. Eliminating Ω_i by $\Omega_i = MRS_i\Lambda_i/A_i$ from $F = 0$ and multiplying numerator and denominator by $A_i > 0$, using $A_i - \Lambda_i = \tau_i$ and $2A_i - \Lambda_i = A_i + \tau_i$,

$$\frac{d\tau_i}{d\tau_M} = \frac{\tau_i\,(MRS_i - \kappa_i\Lambda_i A_i)}{\kappa_i\Lambda_i^2 A_i + MRS_i\,(A_i + \tau_i)}.$$

The numerator collapses because $MRS_i - \kappa_i\Lambda_i A_i = b - \kappa_i A_i\,(\tau_i + \Lambda_i) = b - \kappa_i A_i^2$. Substituting $A_i = \gamma(1-m_i)$ and $\kappa_i = 2cB_i/\gamma$ gives (18). The denominator equals $-A_i F_{\tau_i}$ and is therefore positive whenever the second-order condition holds, while $b - 2c\gamma B_i(1-m_i)^2 =$

$2c\left[\widehat{G} - \gamma B_i(1-m_i)^2\right]$, which gives (19). □

Proof of Proposition 2

Total differentiation of $W_i = U(C_i, G_i)$ with respect to τ_M gives

$$\frac{dW_i}{d\tau_M} = \left[U_C \frac{\partial C_i}{\partial \tau_i} + U_G \frac{\partial G_i}{\partial \tau_i}\right] \frac{d\tau_i}{d\tau_M} + U_C \frac{\partial C_i}{\partial \tau_j}\frac{d\tau_j}{d\tau_M} + U_C \frac{\partial C_i}{\partial \tau_M} + U_G \frac{\partial G_i}{\partial \tau_M}.$$

The first bracket vanishes by Proposition 1. Substituting (20) and dividing U_G by U_C,

$$\frac{dW_i}{d\tau_M} = U_C \left\{ -\sum_k D_{ik} m_k + MRS_i \frac{\tau_i B_i}{\gamma} - D_{ij}\left(1 - m_j\right) \frac{d\tau_j}{d\tau_M} \right\}.$$

By (12), $\tau_i B_i/\gamma = \tau_i B_i m_i \eta_i$ and $\sum_k D_{ik} m_k = D_{ii} m_i a_i = \Omega_i B_i m_i a_i$. Collecting the common factor $B_i m_i$ gives (21). □

Proof of Proposition 3

The bracket in (21) is positive if and only if $MRS_i \tau_i \eta_i > \Omega_i a_i$. Substituting $MRS_i = \Omega_i/(1+\varepsilon_i)$ from Proposition 1 and dividing by $\Omega_i > 0$,

$$\frac{\tau_i \eta_i}{1+\varepsilon_i} > a_i.$$

By (11) and (12), $\varepsilon_i = -\tau_i \eta_i m_i/(1-m_i)$. With $1+\varepsilon_i > 0$ the inequality is equivalent to $\tau_i \eta_i \left[(1-m_i) + a_i m_i\right] > a_i(1-m_i)$, which is (22). Differentiating T,

$$\frac{\partial T}{\partial a_i} = \frac{(1-m_i)^2}{\tau_i \left[(1-m_i) + a_i m_i\right]^2} > 0,$$

and $T(1) = (1-m_i)/\tau_i$ while $\lim_{a\to\infty} T(a) = (1-m_i)/(\tau_i m_i)$. □

Proof of Corollary 1

By (12), $\eta_i = 1/(\gamma m_i)$. Condition (22) then reads

$$\tau_i \left[(1-m_i) + a_i m_i\right] > \gamma\, a_i m_i \left(1 - m_i\right).$$

Collecting terms in a_i,

$$\tau_i \left(1 - m_i\right) > a_i m_i \left[\gamma \left(1 - m_i\right) - \tau_i\right],$$

which gives (23) provided the bracket is positive. If the bracket is non-positive the condition holds for every a_i. □

Proof of Proposition 4

By hypothesis $\eta_1 = \eta_2 = \eta$ and the two countries share the same τ and m, so the threshold function T in (22) is common. By Proposition 3, T is strictly increasing, so $a_1 > a_2$ implies

$T(a_1) > T(a_2)$ and the interval is non-empty. For $\eta \in (T(a_2), T(a_1))$ the bracket in (21) is positive for country 2 and negative for country 1.

For the second part, $a_2 = 1$ means $\sum_k D_{2k} m_k = D_{22} m_2$ by (12), hence $D_{21} m_1 = 0$. Since $m_1 > 0$ on the domain (14), $D_{21} = 0$ and the externality of country 2 in (21), namely $-D_{21}(1-m_1)\, d\tau_1/d\tau_M$, vanishes. Its total effect is therefore its direct component, which is positive. For country 1, $a_1 > a_2 = 1$ requires $D_{12} m_2 > 0$ and hence $D_{12} > 0$, so its externality $-D_{12}(1 - m_2)\, d\tau_2/d\tau_M$ is non-positive whenever $d\tau_2/d\tau_M \geq 0$, because $m_2 < 1$. Its total effect is then the sum of a negative direct component and a non-positive externality. □

Proof of Proposition 5

Holding both rates at their pre-reform values, the reform moves m_k from τ_k/γ to zero for every k. By (9) and (5), φ_k falls by $\tau_k m_k - \gamma m_k^2/2$, so $\Delta C_i = -\sum_k D_{ik} [\tau_k m_k - \gamma m_k^2/2]$ and $\Delta G_i = \tau_i B_i m_i > 0$. With $U = C + v(G)$ the exact welfare change is

$$\Delta W_i = \Delta C_i + v(G_i + \Delta G_i) - v(G_i)\,.$$

Since v is concave and $\Delta G_i > 0$,

$$MRS_i^+ \,\Delta G_i \;\leq\; v(G_i + \Delta G_i) - v(G_i) \;\leq\; MRS_i \,\Delta G_i,$$

where $MRS_i = v'(G_i)$ and $MRS_i^+ = v'(G_i + \Delta G_i)$. Hence $MRS_i^+ \Delta G_i + \Delta C_i > 0$ implies $\Delta W_i > 0$, and $MRS_i \Delta G_i + \Delta C_i < 0$ implies $\Delta W_i < 0$. With (3) and $m_k = \tau_k/\gamma$, $\tau_k m_k - \gamma m_k^2/2 = \tau_k m_k/2$, so $\Delta C_i = -\sum_k D_{ik} \tau_k m_k/2$ and both conditions take the form of a comparison with R_i in (27). If all rates are equal, R_i becomes $\sum_k D_{ik} m_k/(2 B_i m_i) = \Omega_i a_i/2$ by (12).

If country i re-optimises its own rate after the reform while τ_j is held fixed, its pre-reform rate remains feasible, so its welfare is at least the fixed-rate value and $MRS_i^+ > R_i$ still implies a gain.

For the last statement, in the post-reform state $m_j = 0$ and $\varphi_j = 1 - \tau_j$ by (5). Replacing τ_j by $\tau_j + \Delta\tau_j$ therefore changes φ_j by exactly $-\Delta\tau_j$, which multiplied by D_{ij} gives (28). □

Appendix B. Additional results

This appendix contains three results that complete Section 3: the role of the quadratic concealment cost, the size of the private-income group in (17), and a specification of preferences under which the reaction functions of Lemma 3 slope in either direction.

The role of the quadratic concealment cost

Replace the quadratic cost (3) with any s such that $s(0) = s'(0) = 0$, $s' > 0$ and $s'' > 0$. On the interior domain, the shifted fraction then solves $s'(m_i) = \tau_i - \tau_M$, and the response elasticities become $\eta_i \equiv 1/[m_i s''(m_i)]$ and $\varepsilon_i \equiv -\tau_i/[s''(m_i)(1 - m_i)]$. With these definitions, and with γ replaced by $s''(m_i)$ in (20) and (23), Lemma 2, Lemma 3, Propositions 1 to 4, Corollary 1 and the envelope results of Lemma 1 hold as stated. A generic cost does not satisfy $s'(m) = m\, s''(m)$, so the results that use this link, or

the constant curvature of the quadratic, do not carry over: the closed form (6), the decomposition of the first group in (17), Lemma 4, Proposition 5 and the numerical results. The main claims of the paper do not need the quadratic form: the sufficient statistic and its threshold, the first-order nature of the ownership externality, and the condition $MRS_i = \Omega_i$ at an interior optimum without shifting.

The private-income group in the response to the floor

The size of the second group in (17) is a quantitative question. With $U_{CG} = 0$, the ratio between its absolute value and the first group is

$$\rho_j \frac{D_{jj}(1 - m_j)}{C_j} \cdot \frac{\gamma \sum_k D_{jk} m_k}{B_j \left(MRS_j - \Omega_j\right)}, \tag{B.1}$$

where $\rho_j \equiv -C_j U_{CC}/U_C$ is the coefficient of relative risk aversion. The first ratio is the share of resident consumption that comes from domestic profit owned by residents and reported at home. The second ratio depends on the structure of the model and has no general bound. At the equilibrium of Section 4 with $\tau_M = 0$, for the host country and with zero exogenous income, (B.1) equals twenty-one per cent when relative risk aversion is one. It falls to fourteen per cent when exogenous income equals half of dividend income, and to ten per cent when it equals dividend income. These figures keep the equilibrium fixed. They show orders of magnitude, not the outcome of a re-solved model.

Reaction functions of either sign

To show that both signs of Lemma 3 arise, I now let the preferences of the calibration depend on the interaction between private and public consumption. Keep the quadratic concealment cost (3) and let

$$U(C, G) = C + bG - cG^2 - \theta\, CG, \qquad b, c > 0, \tag{B.2}$$

which reduces to the quadratic utility of Assumption 2 when $\theta = 0$. Then $U_{CC} = 0$, $U_{CG} = -\theta$ and $\partial MRS_i/\partial C_i = -\theta/(1 - \theta G_i)$, and (16) becomes

$$R_i' = -\frac{\theta\, D_{ij}\,(1 - m_j)\, g_i}{F_{i\tau_i}}, \qquad F_{i\tau_i} = \frac{U_C D_{ii} - 2U_G B_i}{\gamma} - 2\theta\, c_i\, g_i - 2c\, g_i^2, \tag{B.3}$$

with $c_i = -D_{ii}(1 - m_i)$, $g_i = B_i[(1 - m_i) - \tau_i/\gamma]$, $U_C = 1 - \theta G_i$ and $U_G = b - 2cG_i - \theta C_i$. By the second-order condition, $F_{i\tau_i} < 0$. Hence, whenever $D_{ij} > 0$, $R_i' \gtrless 0$ if and only if $\theta \gtrless 0$. If $\theta > 0$, private and public consumption are substitutes in utility and the public good is inferior. A higher foreign rate lowers private income, raises the marginal value of the public good and leads to a higher domestic rate. If $\theta < 0$, they are complements, the public good is normal and the domestic rate falls. On the convex region where C and G are non-negative, $1 - \theta G > 0$ and $b - 2cG - \theta C > 0$, preferences (B.2) are increasing and, for every $\theta < c/b$, strictly quasi-concave. Through D_{ij}, the activity and ownership matrices determine which reaction functions slope. The sign of θ determines in which direction. If θ_i differs across countries and has opposite signs, complementarity and substitutability coexist.

Levaggi and Panteghini (2021) obtain the same coexistence from expenditure spillovers. The comparison shows what the ownership channel can and cannot generate.

Spillovers are specific to each pair of jurisdictions, so a jurisdiction can respond with opposite signs to different neighbours. Here, the sign of the response depends on the preferences of the responding country, and $D_{ij} \geq 0$ only scales it. With more than two non-havens, the slope of the best response of i to the rate of partner k would be proportional to $D_{ik}(1 - m_k)$, with a factor common to all partners. The ownership channel therefore generates one asymmetry of their model, namely that the response of i to j and that of j to i may have opposite signs. It does not generate the other, namely responses of opposite sign to different partners. The case $\theta < 0$ is consistent with the result of Mintz and Tulkens (1986) recalled in Section 2. The distinction matters for estimation. Since the slope of the best response of i is proportional to D_{ij}, the ownership channel predicts that a jurisdiction whose residents own no profit abroad has a flat reaction function, whatever its preferences, and that the response of i to j and that of j to i may differ in sign. Specifications that impose one common slope, or one sign, cannot capture either feature; Miniaci et al. (2022) allow the sign to vary and find both.

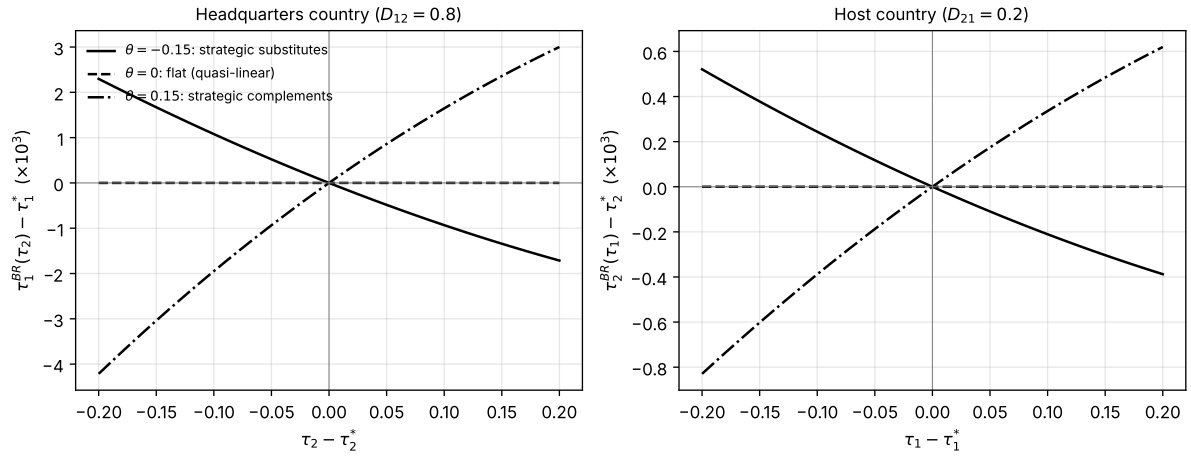

Figure 1: Reaction functions of the two non-havens under the utility (B.2), with $s = 0.2$ and $\tau_M = 0$, for $\theta_1 = \theta_2 = \theta$. Each panel plots the best response of a country to the rate of the other, measured as a deviation from its own Nash value, against the deviation of the other rate from its Nash value. The vertical axis is scaled by 10^3.

Figure 1 evaluates (B.2) with $b = 1.6$, $c = 0.3$ and $\gamma = 1$ at $\tau_M = 0$. I use the activity matrix of Section 4 with a portfolio share $s = 0.2$. Then $D_{12} = 0.8$ and $D_{21} = 0.2$ are both positive, so both reaction functions can slope. Since the slopes are of the order of 10^{-2}, each best response is drawn as a deviation from its Nash value, so that the curves cross at the origin and only their slopes differ. With $\theta = -0.15$ the public good is normal and both curves slope down: the rates are strategic substitutes, with $R_1' = -0.010$ and $R_2' = -0.002$. With $\theta = 0.15$ the public good is inferior and both slope up: the rates are strategic complements, with $R_1' = 0.018$ and $R_2' = 0.004$. With $\theta = 0$ both are flat, and the equilibrium is the one behind the row $s = 0.20$ of Table 3. When the two countries differ, with $\theta_1 = 0.15$ and $\theta_2 = -0.15$, the headquarters country responds positively and the host country negatively, so that both patterns are present at once. The slopes given by (B.3) coincide with those obtained by perturbing the best responses numerically, and in every case they have the sign of θ_i. The slope of the headquarters country is about four times that of the host country, in line with $D_{12} = 0.8$ against $D_{21} = 0.2$ in (B.3). The slopes are small because the income effect works only through the interaction term, which

the bound $\theta < c/b = 0.1875$ keeps small; the example is meant to show their sign. The response of each rate to the floor is positive in every case, between 0.26 and 0.30, and the multiplier formula (16) reproduces it from the partial responses $\widehat{d}_i$. At every point, U_C and U_G are positive, the second-order conditions hold and each rate is a global best response. Without cross-ownership, $D_{21} = 0$ and the reaction function of the host country is flat for any θ_2, as noted after Lemma 3. The reaction function of the headquarters country then has slope 0.034 for $\theta_1 = 0.15$ and -0.016 for $\theta_1 = -0.15$.

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