A Global Minimum Tax for Large Firms Only: Implications for Tax Competition[1]

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Abstract

The Global Minimum Tax (GMT) is applied only to firms above a certain size threshold, permitting countries to set differential tax rates for small and large firms. We analyze tax competition among multiple tax havens and a non-haven country for heterogeneous multinationals to evaluate the effects of this partial coverage of GMT. Upon the introduction of a moderately low GMT rate, the havens commit to the single uniform GMT rate for all multinationals. However, gradual increases in the GMT rate induce the havens, and subsequently the non-haven, to adopt discriminatory, lower tax rates for small multinationals. Our calibration exercise shows that the implementation of a 15% GMT rate results in a regime where only the havens adopt split tax rates. Upon GMT introduction, welfare and tax revenues fall in the tax havens but rise in the non-haven, yielding a positive net gain worldwide.

Keywords: multinational firms; tax avoidance; global minimum tax; profit shifting; tax competition

JEL classification: F23, H25, H87

1 Introduction

Profit shifting by multinational enterprises (MNEs) has long been a major problem for corporate taxation worldwide. According to estimates by Tørsløv et al. (2023), more than one third of all foreign-earned corporate profits of multinationals are shifted to tax havens. The important role of tax havens for profit shifting is confirmed in many other studies (e.g., Davies et al., 2018; Bilicka, 2019). In response to the large revenue losses caused by profit shifting, the OECD has launched an action plan to fight base erosion in OECD countries, and in particular the profit shifting to tax havens (OECD, 2013). A core development in this endeavor is the introduction of a global minimum tax (GMT), which is applied to large MNEs (OECD, 2020a,b). The GMT with a tax rate of 15% has been agreed upon by a group of more than 130 countries in 2021 including many tax havens, and most of these countries are expected to have the GMT enacted by 2026.[1] The global revenue gains from a 15% GMT are estimated to be in the range of 155 to 192 billion USD, or 6.5 to 8.1% of global corporate tax revenues (Hugger et al., 2024, Section 8.2).[2]

An important limitation of the GMT is, however, that it applies only to "large" multinationals, defined as multinational groups that have had no less than 750 million EUR in total annual revenues in at least two out of the last four years.[3] Fig. 1 shows that, according to the Orbis database of Bureau van Dijk, about 30% of all MNEs, which are responsible for about 90% of all MNE profits, have consolidated accounts above this threshold and are therefore covered by the GMT.[4] Nevertheless, a substantial amount of MNE profits exceeding 300 billion EUR remain outside the scope of the GMT. Moreover, the MNE sample in Orbis is not comprehensive and the database is known for oversampling large firms (Bajgar et al., 2020). Therefore, a coverage rate of the GMT of 90% of all MNE profits can be considered as an upper bound of the true profit share covered by

[1]The list of countries joining the agreement on the GMT, also known as *Pillar 2*, is found in OECD (2021). The United States has already enacted, in its 2017 Tax Cuts and Jobs Act, a tax on Global Intangible Low-Tax Income (GILTI) that works in many respects like a GMT (see Chodorow-Reich et al., 2024 for details).

[2]Baraké et al. (2022, Table 1) break down the global revenue changes of the GMT by country and arrive at a revenue gain of around 55 to 67 billion EUR for the US, and a gain of similar magnitude for the EU as a whole. Estimates of both Hugger et al. (2024) and Baraké et al. (2022) are based on models where governments and multinational firms mechanically respond to the GMT. Wang (2020) sets up a quantitative corporate tax framework that endogenizes the behavior of both firms and governments. Using similar frameworks, Ferrari et al. (2023) and Shen (2024) quantify the effects of the GMT. While no econometric estimates exist for the global minimum tax yet, there are experiences from similar policies enacted at the national level. See Buettner and Poehnlein (2024) for an analysis of the effects of a minimum tax rate for German municipalities.

[3]Since 2016, multinational groups above this threshold size are also required to file individual reports on their activities, profits, and taxes paid in each of the countries in which they have a presence (*country-by-country reporting*).

[4]This corresponds to the estimate of the OECD, which arrives at a coverage rate of 90% of profits, using the Orbis database and other data sources (OECD, 2020a, # 505, p. 233).

the GMT.

One implication of this incomplete coverage is that low-tax countries might respond to the introduction of the GMT by using a split corporate tax system, where a lower tax rate applies to firms below the GMT threshold. In fact, such a split is inherent in the regulation that tax havens are allowed to implement the GMT by raising their (low) general tax rate only for MNEs above the GMT threshold through a specific top-up tax.[5] Tax havens are fully aware of this option. Ireland and Liechtenstein, for example, have already decided to keep their general tax rates at 12.5%, but top up the tax rate to 15% for affiliates of foreign MNEs above the threshold (Government of Ireland, 2023; PwC, 2024 for Liechtenstein). Hungary and Bulgaria have adopted a similarly split tax rate by joining the GMT agreement while maintaining their regular tax rates of 9% and 10%, respectively, for firms not covered by the GMT (Ernst & Young, 2023 for Hungary; PwC, 2023 for Bulgaria).[6] These responses indicate that the effects of the GMT cannot be analyzed assuming a single, uniform corporate tax rate across all countries.

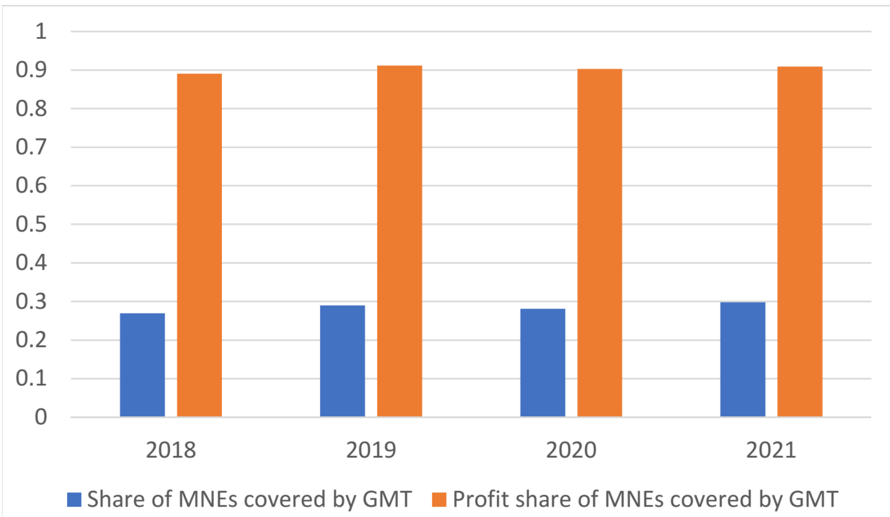


Fig. 1. GMT coverage.

Source: Orbis database, own calculations.

Notes: The left bar in each year shows the share of MNEs covered by the GMT out of all MNEs. The right bar in each year shows the share of pre-tax profits earned by MNEs covered by GMT out of pre-tax profits by all MNEs. The MNEs covered by GMT are those whose annual revenues exceed 750 million EUR in at least two of the last four years out of all MNEs. See Appendix B for details.

Against this background, this paper analyzes under which conditions tax competition leads countries to differentiate their tax rates for large and small MNEs in response to the

[5]This is known as the Qualified Domestic Marginal Top-Up Tax (QDMTT). See Devereux (2023) for a discussion.

[6]The split corporate tax system is also expected to be introduced in Bermuda and Jersey (Government of Bermuda, 2024; Government of Jersey, 2023).

introduction of a GMT. We also study the welfare implications of such split tax system. Finally, we explore whether gradual reforms to the GMT—either through an increase in the GMT rate or an expansion of its coverage—enhance welfare for each country and for the world as a whole.

To answer these questions, we build a simple model where heterogeneous MNEs headquartered in a non-haven country shift profits from there to a set of symmetric tax-haven countries. Countries maximize their welfare, a weighted sum of tax revenues and (for the non-haven) the post-tax income of MNEs' owners, and they compete for the MNEs' profits under the GMT with incomplete coverage. Both the non-haven and the havens can decide to commit, in the first stage, to set a uniform tax rate for *all* their multinationals, or not. In the second stage, all countries choose their tax rates, either uniform or split, where the tax rate applicable for large MNEs must be at or above the GMT level. In the third stage, multinationals make their profit-shifting choices.

Our analysis shows that the introduction of a partial GMT leads to a sequence of tax competition regimes between the non-haven and the havens. If the GMT rate is binding for the tax havens, but still low enough, each of the tax havens will choose to commit to the GMT rate for all MNEs, in order to increase the (uniform) tax rate in the non-haven country. As the GMT rate is further increased, however, the non-cooperative tax equilibrium regime transitions to one where the havens split their tax rates by setting a GMT for large MNEs and a rate lower than the GMT for small MNEs. For sufficiently high GMT rates, a tax regime eventually emerges where the non-haven splits its tax rate as well. This is because a higher GMT rate limits competition for profits from large MNEs, leading the countries to focus instead on profits from small MNEs.

The implications for welfare and tax revenues are as follows. At the regime-switching GMT rates, if one country starts to split its tax rate, the other country discretely loses welfare and tax revenues. In general, however, the non-haven always gains from gradual increases in the GMT rate, whereas the havens weakly gain only for sufficiently low levels of the GMT, and lose otherwise. Gradual increases in the coverage rate of the GMT have similar effects, with the important difference that they never reduce tax revenues in the non-haven country or globally. These results suggest that, although both countries benefit from the introduction of a moderate GMT rate, conflicts of interest will arise once the GMT rate or coverage is increased.

In the final step, we calibrate our model using estimates of profit shifting from a global sample of countries (Tørsløv et al., 2023). In our benchmark calibration, the introduction of a 15% GMT rate causes a regime shift: tax haven countries adopt split tax rates, while the non-haven maintains a uniform tax rate above the GMT. This result aligns with the actual responses observed in several tax haven countries, as described above. Regarding welfare and tax revenues, the introduction of the GMT benefits the non-haven while harming havens, leading to net welfare gains worldwide. This conflict of interest between the two groups of countries persists in the two gradual reforms likely to follow: increasing the GMT rate from 15% to 18% and expanding GMT coverage to all MNEs. However, the conflict is less pronounced for the latter reform.

Our model contributes to the recent theoretical literature on the effects of tax competition in the presence of a GMT. In a model with many non-haven and haven countries, Johannesen (2022) shows that introducing a GMT will always benefit the tax havens, because the GMT reduces the competition between them. In contrast, the welfare effects of the GMT are generally ambiguous for the non-haven country, because of the offsetting changes in tax revenues and firms' post-tax profits. Hebous and Keen (2023) also analyze the effects on welfare in a model where two countries differ in terms of both their size and their valuation of public spending. Their quantitative results indicate that GMT levels up to a range of 17 to 20% can constitute strict Pareto improvements, increasing welfare in both high-tax and low-tax countries. Hindriks and Nishimura (2022) consider governments who choose not only tax rates but also tax enforcement levels. They show that the introduction of the GMT hinders tax enforcement cooperation between the high-tax and the low-tax country, making the high-tax country worse off. Finally, Janeba and Schjelderup (2023) study a three-country model where two non-haven countries compete for real foreign direct investment (FDI) while simultaneously competing for profit shifting with a third, tax-haven country. In this setting the introduction of the GMT intensifies tax competition for real FDI. While tax revenues in the non-haven countries will still increase if countries compete via corporate tax rates, net revenue gains are zero if competition is via lump-sum subsidies.

All these models have in common that the GMT must be levied uniformly on all firms, thus ignoring the existence of a threshold below which the GMT does not apply. In our model, by contrast, this threshold plays a critical role as it allows countries to use different tax rates on firms with revenues above and below the threshold. This feature links our model to the literature on discriminatory tax competition. This literature has analyzed whether tax revenues are higher in the non-cooperative tax equilibrium when countries may, or may not, set different tax rates on tax bases with different degrees of international mobility (Janeba and Peters, 1999; Keen, 2001; Janeba and Smart, 2003).[7] In our setting, tax discrimination will not be profitable for either country in the absence of the GMT, but it will arise in equilibrium if a sufficiently high level of the GMT is imposed. A distinct, but closely related literature has addressed the issue of whether the existence of tax havens—by allowing non-haven countries to tax-discriminate in favor of

[7] This literature has been extended to cover differences in country size (Bucovetsky and Haufler, 2007), and imperfect competition in product markets (Gaigné and Wooton, 2011). A related type of discrimination arises when profit shifting is monitored by governments in a deliberately loose way (Peralta et al., 2006).

mobile, multinational firms—raises or reduces tax revenues and welfare in the non-haven countries (Slemrod and Wilson, 2009; Hong and Smart, 2010; Johannesen, 2010; Elsayyad and Konrad, 2012).

Our analysis proceeds as follows. In Section 2 we set up our model of tax competition and characterize the sub-game perfect Nash equilibria that result in different tax regimes. Section 3 then turns to the welfare effects of introducing a GMT, and of increasing its tax rate and coverage. Section 4 calibrates our model to real-world data and quantifies its effects. Section 5 concludes.

2 The model

2.1 Setup

We consider a tax competition model between a non-haven country, indexed by n, and a finite set of H symmetric tax-haven countries, indexed by h. Tax competition arises between each of the tax havens and the non-haven. There are a large number of heterogeneous, multinational enterprises (MNEs) owned by individuals in the non-haven, each having a headquarters in the non-haven and an affiliate in each of the tax havens. The headquarters in the non-haven makes exogenous profits in this country, π, which are distributed in the range $[\underline{\pi}, \infty)$, with a cumulative distribution function $F(\pi)$. Hence, all real activity occurs in the non-haven, and this is where the "true" profits accrue in its entirety. MNEs can shift a share $\theta \in [0, 1]$ of their non-haven headquarters' profits to the set of tax haven affiliates, in order to maximize their post-tax profits.[8]

We assume that the non-haven and all tax havens have signed the GMT agreement, and are therefore bound to set tax rates of at least the GMT rate, t_M.[9] However, the GMT applies only to MNEs that make exogenous profits no smaller than π_M, called "large MNEs" in our analysis. Therefore, countries remain free to set a lower tax rate than the GMT for all MNEs that make profits less than π_M, called "small MNEs."

The non-haven country maximizes a welfare function that consists of a weighted sum of tax revenues and the post-tax profits of the heterogeneous multinationals, which are all owned by residents of the non-haven country. Since tax havens do not have any ownership

[8]This is the simplest possible setting for profit shifting. See e.g., Johannesen (2022) or Krautheim and Schmidt-Eisenlohr (2011) for a similar assumption. In particular, this setting avoids the possible non-existence of Nash equilibria that arise in models where the location of heterogeneous firms is endogenous (Baldwin and Okubo, 2009; Davies and Eckel, 2010; Haufler and Stähler, 2013).

[9]Devereux (2023) discusses how the specific institutional setting of the GMT, in particular the Under-Taxed Payments Rule (UTPR), gives incentives to both non-haven countries and haven countries to join the GMT agreement, once this has been initiated by a critical number of large non-havens. Note also that we assume the tax base of the GMT to be the same as that of national corporate taxes, thus ignoring extra tax deductions (labelled "substance-based income exclusion") under the GMT. See Schjelderup and Stähler (2024) for a study focusing on the latter issue.

in the firms' profits, the welfare of tax havens corresponds to their tax revenues.

We consider a three-stage game. In the first stage, the non-haven and haven countries simultaneously choose whether to commit to a single tax rate for *all* MNEs, or not.[10] To comply with the GMT agreement, this single tax rate has to be equal to, or higher than, the GMT rate. In our main model, we assume that the set of tax havens collectively decides on whether to set a single GMT rate, or split their tax rates. This assumption simplifies the algebra, but it does not change the qualitative nature of our results.[11] In the second stage, all countries choose their tax rate(s) in a non-cooperative way. Countries that have committed to a single tax rate in the first stage set a single tax rate, whereas countries that have not committed choose different tax rates for large and small MNEs (where the tax rate on large MNEs has to be at least t_M). In the final stage, MNEs engage in profit shifting, given the tax rates in the non-haven and the symmetric tax havens. We solve this three-stage game by backward induction. The equilibrium concept we rely on is the sub-game perfect Nash equilibrium, which we call the tax-competition equilibrium.

2.2 Profit shifting by multinationals

Each MNE shifts a share θ_h of its exogenous pre-tax profits π from their non-haven affiliate to each of the tax haven affiliates h. Firms incur transaction costs when shifting profits. These costs can either be thought of as concealment costs, which have to be incurred to hide the profit shifting from the non-haven country's tax authorities, or as the expected fine that is to be paid when profit-shifting is detected and sanctioned. We assume that the costs of shifting $\theta_h \pi$ of profits to each haven h, given by $C_h(\cdot)$, are convex and, for analytical simplicity, quadratic in the level of profit-shifting, $\theta_h \pi$. Higher total (true) profits make it easier, however, to hide a given amount of profit-shifting.[12] Therefore, the shifting costs for a firm with profits π to a haven h are $C_h(\theta_h \pi) = \delta(\theta_h \pi)^2/(2\pi) = \delta\theta_h^2 \pi/2$, resulting in total shifting costs of $\sum_{h=1}^{H} C_h(\theta_h \pi)$. The exogenous parameter δ captures the ease with which profits can be shifted across countries. It incorporates any efforts that countries take to prevent profit-shifting.[13]

Given the tax rates t_n and t_h respectively in the non-haven and each of the tax haven countries, a MNE maximizes its global post-tax profits net of profit-shifting costs, denoted

[10] This is related to the literature on endogenous timing, or leadership, in tax competition, where countries commit in a pre-play stage to set taxes early or late. See Kempf and Rota-Graziosi (2010).

[11] We discuss the alternative of a decentralized first stage decision of the tax havens in Appendix A.2.

[12] This specification is widely used in the literature on profit shifting (e.g., Hines and Rice, 1994; Huizinga and Laeven, 2008; Suárez Serrato, 2018).

[13] In Hindriks and Nishimura (2022), this cost parameter is endogenously chosen by governments, either cooperatively or non-cooperatively.

by $\widetilde{\Pi}$, by choosing the share of profit shifting to each haven:

$$\max_{\{\theta_h\}_{h=1}^{H}} \widetilde{\Pi}\left(\{\theta_h\}_{h=1}^{H};\pi\right) = (1-t_n)\left(1-\sum_{h=1}^{H}\theta_h\right)\pi + \sum_{h=1}^{H}(1-t_h)\theta_h\pi - \sum_{h=1}^{H}\frac{\delta(\theta_h\pi)^2}{2\pi}. \quad (1)$$

The MNEs' optimal level profit shifting to each tax haven, θ_h is then:

$$\theta_h = \frac{t_n - t_h}{\delta}, \quad (2)$$

which is independent of π and therefore holds for all MNEs simultaneously.[14]

The optimal θ defined by (2) allows us to incorporate the MNEs' adjustment to tax differentials in a very simple and compact form. It implies that MNEs of different size will respond to international tax differentials with the same tax base elasticity. Substituting (2) into (1) and using the symmetry of tax havens, the tax base of a MNE with profits π in the non-haven country is $TB_n = (1 - \sum_{h=1}^{H}\theta_h)\pi = [1 - H(t_n - t_h)/\delta]\pi$. This yields a tax base elasticity of an individual MNE in the non-haven country such that $\varepsilon_n = -\frac{dTB_n/TB_n}{dt_n/t_n} = \frac{t_n}{\delta - H(t_n - t_h)}$, which is independent of π.

The empirical evidence on the relationship between the size of firms and their responsiveness to tax is inconclusive. Media coverage of tax avoidance by very large multinationals gives an impression that bigger firms have a higher tax-base elasticity. However, there are several studies which find the opposite result that the tax-base elasticity is indeed higher for small firms (not necessarily MNEs).[15] Therefore, assuming the tax base elasticity to be independent of firm size may be considered a useful and not unrealistic benchmark. As a consequence, there is no reason *per-se* in our model that countries differentiate tax rates between MNEs of different size. However, as we will see below, a split tax regime can nevertheless occur in equilibrium as a result of introducing a GMT for large firms only.

2.3 Governments' tax setting choices

Before examining the effects of GMT, we first solve the *unconstrained* optimization problem in the absence of a GMT. The non-haven country n maximizes a weighted sum of private income and tax revenues, where private income are the profits (net of taxes and profit-shifting costs) of all MNEs, where all MNE owners reside exclusively in the non-

[14]In principle, our analysis can incorporate $\theta < 0$, which occurs if $t_n < t_h$. However, this case will never arise in the tax-competition equilibrium we will see shortly.

[15]Making use of bunching in the distribution of taxable income of firms in the UK, Devereux et al. (2014) find that small-sized firms change their taxable income more significantly in response to statutory tax rate changes, as compared to medium-sized firms. Applying a similar empirical strategy to US firms, Coles et al. (2022) also find that the elasticity of taxable income with respect to effective tax rates is monotonically decreasing in firm size. See also Auliffe et al. (2023) and the references therein for the heterogeneous tax elasticities of tangible asset investments among firms of different size.

haven country. The non-haven's tax revenues are weighted with a factor $\lambda > 1$, which represents the marginal valuation of public funds.

The welfare premium on tax revenues, relative to private income, is a standard assumption in international taxation, which motivates positive tax rates in equilibrium. It can be given two alternative interpretations. The first is a redistributive (or political-economy) motive, when the government uses the corporate tax to redistribute income from capital owners to other households in the economy, which possess no earned income. The other interpretation is that corporate tax revenue is used to reduce other distortive taxes, and the (exogenous) deadweight loss associated with them.[16] Either setting leads to a welfare gain for the non-haven country from levying a positive corporation tax on its MNEs. Finally, for $\lambda \to \infty$, we obtain the special case of a Leviathan government that is solely interested in maximizing its tax revenues. This special case underlies, for example, the analyses in Hindriks and Nishimura (2022) or Janeba and Schjelderup (2023).

The government of country n therefore maximizes

$$\begin{aligned} G_n &= \underbrace{\int_{\underline{\pi}}^{\infty} \widetilde{\Pi}\left(\{\theta_h\}_{h=1}^{H};\pi\right) dF}_{\text{Private benefit}} + \lambda \underbrace{\int_{\underline{\pi}}^{\infty} t_n \left(1-\sum_{h=1}^{H}\theta_h\right)\pi dF}_{\text{Tax revenues}} \\ &= (1-t_n)\left(1-\frac{Ht_n-\sum_{h=1}^{H}t_h}{\delta}\right)\Pi + \sum_{h=1}^{H}(1-t_h)\left(\frac{t_n-t_h}{\delta}\right)\Pi - \sum_{h=1}^{H}\frac{\delta}{2}\left(\frac{t_n-t_h}{\delta}\right)^2\Pi \\ &\quad + \lambda t_n\left(1-\frac{Ht_n-\sum_{h=1}^{H}t_h}{\delta}\right)\Pi, \end{aligned} \tag{3}$$

where $\Pi \equiv \int_{\underline{\pi}}^{\pi_M} \pi dF$ are the aggregate real profits of MNEs.

Each of the tax haven countries h only cares about its tax revenues (multiplied by the same marginal value of public funds, λ, as for country n), as the affiliate located in h is owned by their headquarters in the non-haven. This gives

$$G_h = \lambda \int_{\underline{\pi}}^{\infty} t_h\theta_h\pi dF = \lambda t_h\left(\frac{t_n-t_h}{\delta}\right)\Pi. \tag{4}$$

To determine world welfare, we take a utilitarian approach and define $G_W \equiv G_n + \sum_{h=1}^{H} G_h$, using (3) and (4).

Solving the first-order conditions of the two countries yields best responses:[17]

$$t_n = \frac{(\lambda-1)\left(\sum_{h=1}^{H}t_h+\delta\right)}{H(2\lambda-1)}, \qquad t_h = \frac{t_n}{2}. \tag{5}$$

[16] The latter argument assumes that there is a fixed excess burden of taxation in a country's tax system (see e.g., Keen and Lahiri, 1998). This is a plausible assumption in our setting, as we focus on the corporation tax, which accounts for less than 10% of total tax revenue in all developed countries.

[17] The second-order conditions of both countries' optimal tax problems are trivially satisfied.

Solving for the optimal tax rates in the unconstrained benchmark ("Regime 0") then gives

$$t_n^0 = \frac{2\delta(\lambda - 1)}{H(3\lambda - 1)}, \qquad t_h^0 = \frac{\delta(\lambda - 1)}{H(3\lambda - 1)}. \tag{6}$$

We hereafter assume $\delta \in (0,\, 3H/2)$ to ensure that t_n^0 is in $(0, 1)$.

A few comments on (6) are in order. First, tax rates in all countries are rising in the profit-shifting costs δ and falling in the number of tax havens H. Second, they are rising in the marginal value of public funds, λ. A higher value of λ raises the optimal tax rate in the non-haven by increasing the valuation of tax revenues vis-à-vis the post-tax profits of MNEs. The higher tax rate in the non-haven in turn leads each of the havens to raise its tax rate as well. Finally, each of the havens without an independent tax base will choose one-half of the tax rate of the non-haven.[18]

We can also derive the share of shifted profits in this unconstrained tax equilibrium. This is given by:

$$\sum_{h=1}^{H} \theta_h^0 = H \cdot \left(\frac{t_n^0 - t_h^0}{\delta} \right) = \frac{H}{\delta} \cdot \frac{\delta(\lambda - 1)}{H(3\lambda - 1)} = \frac{\lambda - 1}{3\lambda - 1} < \lim_{\lambda \to \infty} \sum_{h=1}^{H} \theta_h^0 = \frac{1}{3}. \tag{7}$$

Hence, when the non-haven country maximizes tax revenues ($\lambda \to \infty$), the international tax differential between the non-haven and the havens is maximal, resulting in one-third of all profits of MNEs being shifted to the havens in equilibrium. For lower values of λ, the equilibrium tax differential is reduced, and the share of shifted profits is accordingly lower.

2.4 Tax regimes

With a GMT in place, there is a first stage of the game in which each country chooses to commit or not to a single tax rate, which can either be the GMT rate or a tax rate above the GMT. If a country does not commit to a single tax rate, then it will choose to split tax rates in the second stage, and set different tax rates for large and small MNEs. MNEs with profits equal to or greater than the threshold π_M, i.e., $\pi \in [\pi_M, \infty)$, are subject to the GMT requirement (large MNEs), whereas those with $\pi \in [\underline{\pi}, \pi_M)$ are not (small MNEs). We denote by ϕ the share of total profits earned by large MNEs, or the *coverage*

[18] Note the important difference between this result and the analysis in Johannesen (2022), where the tax rate in each of the tax havens is zero in the absence of the GMT. This contrast arises from different specifications of profit-shifting costs. Johannesen (2022) assumes that shifting profits from a high-tax to a low-tax country incurs zero cost so that MNEs shift their profits only to the lowest-tax country. This winner-takes-all situation among the havens drives their equilibrium tax rates to zero. By contrast, we assume that profit shifting from the high-tax country to a given low-tax country has convex costs. Hence each MNEs has an incentive to diversify its allocation of shifted profits across all havens. As we discuss in our calibration in Section 4, a setting with positive tax rates in haven countries in the unconstrained tax equilibrium is more in line with the empirical evidence.

rate of the GMT, which is exogenously given:

$$\phi \equiv \frac{\int_{\pi_M}^{\infty} \pi dF}{\int_{\underline{\pi}}^{\infty} \pi dF} \equiv \frac{\int_{\pi_M}^{\infty} \pi dF}{\Pi}. \tag{8}$$

Table 1
Possible regimes of the non-cooperative tax game.

Non-haven	Haven		
	single non-GMT rate	single GMT rate	split tax rate
single non-GMT rate	Regime 0	Regime 1	Regime 2
single GMT rate	—	—	Regime 3
split tax rate	—	—	Regime 4

Table 1 shows that this sequence yields three potential choices for each of the two sets of countries. Of the nine potential tax regimes, four regimes cannot occur in equilibrium. In these potential regimes, if the non-haven sets a single GMT rate, the havens would choose a single tax that is at the same level or even higher. Hence tax revenues in each haven country would be zero. Clearly, this cannot be an equilibrium because each haven can secure strictly positive tax revenues by splitting its tax rate and underbidding the tax rate of the non-haven country for small MNEs. Alternatively, if the haven sets a single non-GMT or a single GMT tax rate, the non-haven will never want to split its tax rate, because the tax base elasticity of its MNEs is independent of profits. Hence only five possible tax regimes remain.

In Regime 0, the GMT rate is not binding for any country; this is the case of unconstrained tax competition analyzed in the previous section. As the GMT rate is continuously increased, the tax competition equilibrium passes through four other regimes. In the following, we first state the full characterization of the sub-game perfect Nash equilibrium of the three-stage tax competition game, before commenting on each of these regimes.

Proposition 1 (Equilibrium regimes with binding GMT)

Consider a GMT rate $t_M \geq t_M^0 \equiv t_h^0$, a GMT coverage rate $\phi \in (0,1)$, a marginal valuation of public funds $\lambda > 1$, and a cost parameter of profit shifting $\delta \in (0, 3H/2)$. As t_M is continuously increased, the tax-competition equilibrium is characterized by the following four regimes, with all symmetric haven countries choosing the same tax schedule.

(i) Regime 1: $t_M \in \left[t_M^0, t_M^1 \equiv \frac{\delta(\lambda-1)(2\lambda-1)}{H[\lambda(3\lambda-1)-\phi(\lambda-1)^2]}\right]$. *The non-haven chooses a single*

non-GMT rate, and the (representative) haven chooses a single GMT rate:

$$t_n^1 = \frac{(\lambda-1)(Ht_M+\delta)}{H(2\lambda-1)} \quad \textit{for } \pi \in [\pi_M, \infty), \qquad t_h^1 = t_M \quad \textit{for } \pi \in [\pi_M, \infty).$$

(ii) *Regime 2:* $t_M \in \left(t_M^1, t_M^2 \equiv \frac{2\delta(\lambda-1)}{H[3\lambda-1-\phi(\lambda-1)]}\right]$. *The non-haven sets a single non-GMT rate, and the haven splits its tax rate and chooses the GMT rate for large MNEs, but a lower rate than the GMT for small MNEs:*

$$t_n^2 = \frac{2(\lambda-1)(\phi Ht_M+\delta)}{H[\lambda(3+\phi)-(1+\phi)]} \ \textit{for } \pi \in [\pi_M, \infty), \qquad t_h^2 = \begin{cases} \frac{(\lambda-1)(\phi Ht_M+\delta)}{H[\lambda(3+\phi)-(1+\phi)]} & \textit{for } \pi \in [\underline{\pi}, \pi_M) \\ t_M & \textit{for } \pi \in [\pi_M, \infty) \end{cases}.$$

(iii) *Regime 3:* $t_M \in \left(t_M^2, t_M^3 \equiv \frac{2\delta(\lambda-1)(8\lambda-3)}{H(3\lambda-1)(4\lambda-1)}\right]$. *The non-haven chooses a single GMT rate, and the haven splits its tax rate and chooses a GMT rate for large MNEs, but a lower rate than the GMT for small MNEs:*

$$t_n^3 = t_M \quad \textit{for } \pi \in [\underline{\pi}, \infty), \qquad t_h^3 = \begin{cases} t_M/2 & \textit{for } \pi \in [\underline{\pi}, \pi_M) \\ t_M & \textit{for } \pi \in [\pi_M, \infty) \end{cases}.$$

(iv) *Regime 4:* $t_M \in (t_M^3, 1]$. *Both the non-haven and the haven split their tax rates and choose the GMT rate for large MNEs, but a lower tax rate for small MNEs:*

$$t_n^4 = \begin{cases} \frac{2\delta(\lambda-1)}{H(3\lambda-1)} & \textit{for } \pi \in [\underline{\pi}, \pi_M) \\ t_M & \textit{for } \pi \in [\pi_M, \infty) \end{cases}, \qquad t_h^4 = \begin{cases} \frac{\delta(\lambda-1)}{H(3\lambda-1)} & \textit{for } \pi \in [\underline{\pi}, \pi_M) \\ t_M & \textit{for } \pi \in [\pi_M, \infty) \end{cases}.$$

Proof: See Appendix A.1.

In the following we go through the different regimes, which are divided by the three threshold GMT rates $\{t_M^i\}_{i=1,2,3}$. We call these the *regime-switching rates*. Our discussion below will focus on tax revenue effects. This is strictly correct only for the tax havens. It is also possible for the non-haven, however, because the marginal value of public funds, λ, is constant in our analysis, and it always exceeds the valuation of private income. All formal proofs are relegated to the Appendix.

In Regime 1, where t_M rises above the haven's unconstrained tax rate t_h^0, the haven is forced to set t_M for large MNEs. By contrast, the non-haven's unconstrained rate is still above the GMT. As the non-haven is not bound by the GMT, it will continue to choose a single tax rate above the GMT for all MNEs. For the tax havens, the choice is therefore whether to apply the GMT also to small MNEs, or use a split tax schedule. By committing to a single GMT rate for all MNEs, the havens can induce the non-haven to set a higher uniform tax rate than in the unconstrained equilibrium. This argument is strongest when tax havens collectively decide on whether to commit to a single tax rate, as we assume in our main model.[19] However, as we show in Appendix A.2, the same qualitative argument also holds for decentralised decision-making of tax havens. Havens therefore trade off the gains from inducing a higher uniform tax rate in the non-haven against the revenue losses from not undercutting the non-haven's tax rate even more for small MNEs. In Regime 1, the first effect dominates and the havens find it profitable to commit to the GMT for all MNEs. As a result, all countries choose higher uniform tax rates in Regime 1, as compared to the unconstrained equilibrium without a GMT.

In Regime 2, where t_M rises above the regime-switching rate t_M^1, the non-haven is still not bound by the GMT, and will continue to set a single tax rate above the GMT for all MNEs. For the havens, however, the trade-off described in Regime 1 above changes. As the GMT is now higher, there is less to gain from setting a uniform GMT rate for all MNEs, because the tax differential and thus shifted profits are reduced.[20] At the same time, given the higher GMT rate, there is more to gain for the havens from undercutting the non-haven's tax rate for small MNEs. In Regime 2, therefore, the havens will find it optimal to split their tax rate and set t_M only for the large MNEs, but choose a lower tax rate for small MNEs.[21] Note, finally, that the upper boundary of Regime 2, t_M^2, is rising in the GMT coverage rate, ϕ. This is because the non-haven country faces less competition from the havens (i.e., higher tax rates t_h) for large firms. If large MNEs make up a large part of the corporate tax base, the non-haven country will therefore be able to set a uniform tax rate above t_M for a wider range of GMT rates.

In Regime 3, where t_M rises above the regime-switching rate t_M^2, the non-haven will no longer charge a tax rate *above* the GMT level, but it is bound by the GMT tax rate t_M for large firms. By committing to set t_M for all MNEs, it induces the haven countries to charge a higher tax rate for small MNEs. This argument is analogous to the one that applied to the tax havens in Regime 1. In equilibrium, therefore, the non-haven sets t_M for all firms, rather than splitting its tax rate, and the havens respond by charging $t_M/2$ for small firms.

Finally, in Regime 4, where $t_M > t_M^3$, the international tax differential for small MNEs becomes very large, if the non-haven keeps its commitment to set the GMT rate for all firms.[22] To avoid large tax base losses from small MNEs, the non-haven therefore

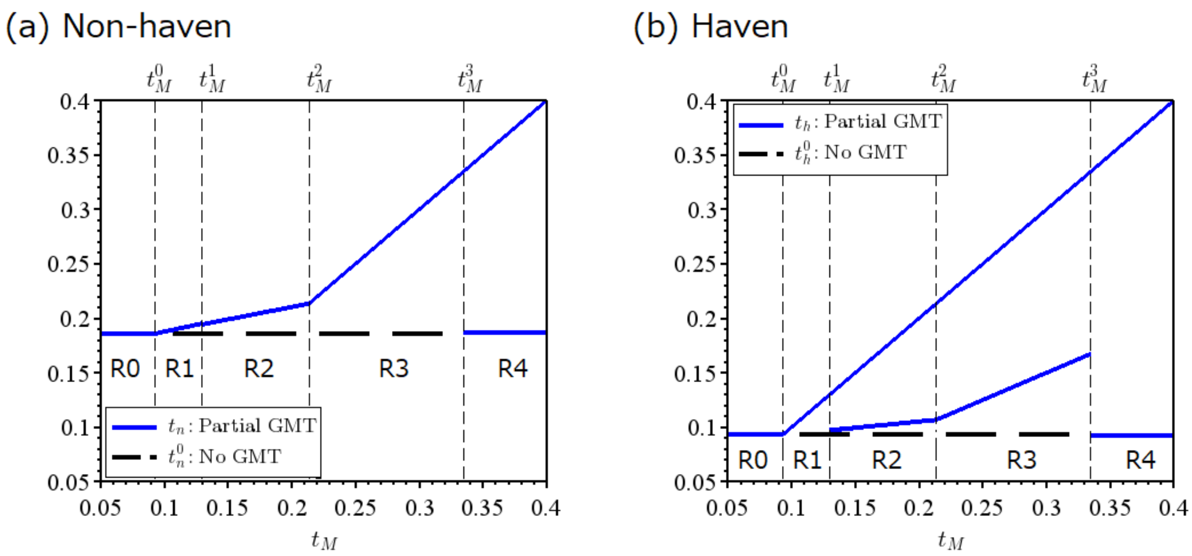
[19] This is seen from the non-haven's best response function (5), which is increasing in t_h.

[20] This is seen from Regime 2 of Proposition 1, where the tax differential, $t_n^2 - t_h^2 = [\delta(\lambda - 1) - \lambda H t_M]/[H(2\lambda - 1)]$ decreases in t_M.

[21] In practice, this split is done by choosing the lower tax rate for small MNEs as the general corporate tax rate, but topping up this tax rate for large MNEs. See footnote 5 in the introduction. Johannesen (2022) has shown formally that it is always rational for tax havens to use the QDMTT up to the total tax level of the GMT, rather than leaving the top-up taxation to the home countries of the MNEs.

[22] This is seen from Regime 3 of Proposition 1, where the tax differential $t_n^3 - t_h^3 = t_M/2$ increases in t_M.

abandons its commitment and also undercuts the GMT for small MNEs. Again, this argument is analogous to the one for the havens to end their commitment in Regime 2. In the Regime 4 equilibrium, both countries therefore split their tax rates and set their unconstrained tax rates for small MNEs, while adhering to the GMT for large MNEs.



(c) Equilibrium regimes

	0 R0 t_M^0	R1 t_M^1	R2 t_M^2	R3 t_M^3	R4 1
Non-haven	Single non-GMT	Single non-GMT	Single non-GMT	Single GMT	Split
Haven	Single non-GMT	Single GMT	Split	Split	Split

Fig. 2. Equilibrium tax rates for different GMT rates.

Notes: The figure shows the equilibrium tax rates in the non-haven (a) and the haven (b) for different GMT rates t_M, and the summary of equilibrium regimes (c). Parameter values given in Table 2 affect the precise levels of tax rates and regime-switching points, but do not affect qualitatively the sequence and pattern of tax-competition equilibria.

Figure 2 shows the equilibrium tax rates in the different regime-specific equilibria for varying values of t_M. The non-haven's tax rates are given in panel (a), while the havens' tax rates are in panel (b). The equilibrium regimes are summarized in panel (c). The solid curves give the tax rate(s) in the tax-competition equilibrium under the GMT; the dashed horizontal line is the unconstrained equilibrium tax rate t_i^0 (in Regime 0). Tax rates in both countries generally rise as the GMT increases, but there are distinct patterns in the different regimes. At the switch from Regime 1 to 2, the haven countries start splitting their tax rates and their tax rate on small MNEs drops discontinuously. At the switch from Regime 3 to 4, the non-haven splits its tax rate and discretely cut its tax rate for small MNEs to the level in the unconstrained Regime 0. The haven countries respond to that by also discontinuously reducing their tax rates on small MNEs to the Regime 0 level.

3 Welfare effects of the GMT

Having fully described the tax-competition equilibrium in each regime, we can now turn to the welfare effects of the introduction of the GMT and of two gradual reforms: (i) a marginal increase in the GMT rate, t_M, and (ii) a marginal increase in the GMT coverage rate, ϕ. As in Proposition 1, the qualitative nature of the propositions below holds independently of the marginal valuation of public funds, λ, and it includes revenue maximization ($\lambda \to \infty$) as a special case. Our discussion of the results will therefore focus on the implications that the GMT has on tax revenues.

3.1 Introduction of the GMT

We first compare welfare levels in the tax-competition equilibrium to those in the unconstrained equilibrium, Regime 0. This is summarized in:

Proposition 2 (GMT introduction)

Consider the tax-competition equilibrium with GMT, as summarized in Proposition 1, and assume the GMT coverage rate is not too low so that $\phi \in (3/4, 1)$. Compared to the unconstrained equilibrium (Regime 0), the introduction of a binding GMT rate leads to:

(i) a rise in welfare in the non-haven country for all Regimes 1 to 4.

(ii) a rise in welfare in the haven country for the first part of Regime 1 ($t_M < t_M^+ \equiv \frac{\delta(\lambda-1)(2\lambda-1)}{H\lambda(3\lambda-1)}$), but a fall in welfare in the rest of Regime 1 and in Regimes 2 to 4 ($t_M > t_M^+$).

(iii) a rise in world welfare for all Regimes 1 to 4.

Proof: See Appendix A.3.

Introducing a small GMT slightly higher than the havens' unconstrained rate t_h^0 leads to an equilibrium in Regime 1, with higher tax rates in both the non-haven and the haven countries. At the same time, profit shifting is reduced in comparison to the no-GMT benchmark due to a smaller tax differential. The sum of these effects must certainly benefit the non-haven. It also benefits the tax havens, as long as the gain from higher rates exceeds the loss of the havens' tax base, i.e., shifted profits. However, once the GMT rate exceeds a certain threshold, t_M^+, which still lies in Regime 1, the reduced tax differential and thus the fall in shifted profits will dominate from the perspective of the haven countries. Therefore, for all levels of the GMT above t_M^+, tax havens lose from the introduction of the GMT while the non-haven gains.[23]

In the remaining Regimes 2 to 4, the tax differential for large MNEs is always smaller than the one in Regime 0. As long as large MNEs covered by the GMT account for a sufficiently high share of aggregate profits, $\phi \in (3/4, 1)$, the havens lose from the introduction of t_M higher than t_M^+ due to the reduced profit shifting of large MNEs. In this case, the effects of introducing the GMT on tax revenues and welfare in the non-haven and the haven countries remain opposed to each other throughout Regimes 2 to 4.[24] Finally, the gains to the non-haven exceed the losses (if any) to the havens, so that the GMT introduction raises tax revenues and welfare worldwide in all regimes. These aggregate welfare gains result from the higher tax rates in both countries and the reduced levels of profit shifting.

3.2 Gradual reforms of the GMT

We now turn to two likely reform options after the GMT has been introduced. We first study the effects of a gradually increasing GMT rate. The welfare effects of this reform are summarized in:

Proposition 3 (Gradual reform: increasing GMT rate t_M)

Consider the tax-competition equilibrium with GMT, as summarized in Proposition 1. A marginal increase in the GMT rate has the following effects:

(i) welfare in the non-haven country increases in all regimes, except at the regime-switching point t_M^1, where it discretely falls.

(ii) welfare in the haven country increases in Regime 1 as long as $t_M < t_M^{++} \equiv \frac{\delta(\lambda-1)}{2H\lambda}$, then decreases for the remainder of Regime 1 and in Regime 2. It increases in Regime 3 and discretely falls at the last regime-switching point, t_M^3. It does not change in Regime 4.

(iii) welfare in the world increases in all regimes, except at the two regime-switching points t_M^1 and t_M^3, where it discretely falls.

[23]This conflict of interest does not arise in (Johannesen, 2022, Proposition 6), where havens gain from the introduction of a GMT at any level, as long as profit shifting is not completely eliminated. In his setting where MNE shift profits only to the lowest-tax country, all the tax havens end up setting their tax rate to zero. Therefore, revenues in the unconstrained tax competition equilibrium are zero for each haven, and any positive GMT rate generates a revenue increase for the representative haven. See also footnote (18).

[24]If small MNEs not covered by the GMT account for a sufficiently large share of aggregate profits so that $\phi \in (0, 3/4)$, then the introduction of the GMT rate will instead benefit the havens in Regime 3. See Appendix A.3 for details.

Proof: See Appendices A.3 and A.4.

As is true for the introduction of the GMT (Proposition 2), the non-haven generally gains from a gradual increase in the GMT rate t_M, as this reduces profit-shifting to the havens in equilibrium. An exception is the regime-switching point t_M^1 where the havens start splitting their tax rate and set a discretely lower tax rate for small MNEs. Small MNEs then shift more profits to the havens, hurting the non-haven.

For the havens, the welfare (tax revenue) effects of an increase in the GMT depend on the negative effect of reduced profit-shifting opportunities and the positive effect of a higher tax rate in the non-haven. This leads to non-monotonic changes in the havens' welfare. In Regime 1, the induced higher tax rate in the non-haven dominates initially, but as the GMT continues to rise, this is overcompensated by the reduced levels of profit shifting. The latter is also true throughout Regime 2. In Regime 3, the effect of a higher tax rate dominates again, as the non-haven commits to the uniform GMT rate in order to raise the havens' tax rates. This regime, where commitment induces effective tax coordination, is similar to (the first part of) Regime 1. It ends at the regime-switching point t_M^3 where the non-haven starts splitting its tax rate. This leads to a discrete fall in the non-haven's tax rate on small MNEs, which must hurt the tax havens.

The marginal effects of t_M on world welfare are dominated by the effects on the non-haven, and are therefore generally positive. At the two regime-switching points t_M^1 and t_M^3, however, where one of the countries starts splitting its tax rate and discretely lowers the tax rate on small MNEs, tax competition is tightened and world welfare falls at the margin.

Next we examine the welfare effects of another likely reform option: a marginal increase in the GMT coverage rate ϕ, while keeping the GMT rate t_M fixed. As shown in (8), this is achieved by *reducing* the threshold profit level π_M above which the GMT rate must be charged. The results are summarized in:

Proposition 4 (Gradual reform: increasing GMT coverage rate ϕ)

Consider the tax-competition equilibrium with GMT, as summarized in Proposition 1. Except for special cases where a regime switch occurs, a marginal increase in the GMT coverage rate of $\phi \in (0,1)$ has the following effects:

(i) welfare in the non-haven is unaffected in Regime 1 and increases in Regimes 2 to 4.

(ii) welfare in the haven is unaffected in Regime 1 and decreases in Regimes 2 to 4.

(iii) world welfare is unaffected in Regime 1 and increases in Regimes 2 to 4.

Proof: See Appendix A.5.

In Regime 1, an increase in ϕ has no effect on welfare in any country, because all countries levy uniform tax rates. Changing ϕ does have effects, however, in the other regimes, where one or both countries split their tax rates. Since the equilibrium tax differential is always greater for small MNEs than for large MNEs, a higher ϕ, which implies fewer small MNEs, reduces aggregate profit shifting. This unambiguously hurts the haven and benefits the non-haven. From the global perspective, a higher GMT coverage is always desirable, as it reduces pressure on tax competition for the profits of small MNEs.

There are two exceptional cases where increasing ϕ causes a regime switch. The first is at $t_M = t_M^1 + \epsilon$ with ϵ being a small positive number, where a rise in ϕ pushes Regime 2 back to Regime 1 by weakening the havens' incentive to split their tax rate. This regime switch benefits the non-haven and the world, while it has no effect on the havens. The other is at $t_M = t_M^2 + \epsilon$, where a higher ϕ triggers a switch from Regime 3 to Regime 2, inducing the non-haven to set a tax rate above the GMT. This latter regime switch, however, leaves welfare in all countries and the world unaffected.

In summary, the welfare effects of an increase in the GMT coverage rate ϕ are similar to those of an increase in the GMT rate t_M (Proposition 3). A higher ϕ has opposing welfare effects in non-haven and haven countries in Regimes 2 to 4, but not in Regime 1. One notable difference from the effects of a higher t_M is that a higher ϕ can never harm the non-haven country and the world, even if it induces a regime switch.

4 Quantitative implications

We now examine which regime can be expected under the currently imposed GMT rate. For this purpose, we use a calibrated version of our model and explore its quantitative effects. We calibrate our unconstrained model without GMT (Regime 0) to match basic data on international profit shifting. The results are summarized in Table 2. The coverage rate of the GMT is set at $\phi = 0.9$, in line with OECD (2020a) and our own calculations from the ORBIS database (see Figure 1 and Appendix B). The marginal valuation of public funds (MVPF) is set at $\lambda = 1.5$ in our calibration benchmark, corresponding to the benchmark value used in Hebous and Keen (2023). The figures for total pre-tax profits of MNEs, Π, and the number of tax havens, H, are taken from Tørsløv et al. (2023) and the Country-by-Country Report Statistics (CbCR); see the notes to Table 2 for details. We then calculate the cost parameter of profit shifting, δ, to exactly match the GDP-weighted average of effective tax rates in non-haven countries of 18.6%, as reported in Tørsløv et al. (2023). Among the non-targeted moments, our model somewhat underestimates the havens' tax rate in the data, as well as the total profits shifted by MNEs and –accordingly– the non-havens' loss of tax revenues. Overall, however, our simple model explains the data reasonably well.

Table 2
Calibration of the model.

Parameter		Source
$\Pi = 4,623$bUSD	Total pre-tax profits of MNEs	Tørsløv et al. (2023), CbCR
$\phi = 0.9$	Profit share of MNEs covered by GMT	OECD (2020a), Orbis
$H = 40$	Number of tax havens	Tørsløv et al. (2023)
$\lambda = 1.5$	Marginal valuation of public funds	Hebous and Keen (2023)
$\delta = 27.4$	Cost of profit shifting	Calibrated

Targeted moment	Model	Data	Source
Corp. tax rate of non-haven (Regime 0): $t_n^0 = \frac{2\delta(\lambda-1)}{H(3\lambda-1)}$	18.6%	18.6%	Tørsløv et al. (2023)

Non-targeted moment	Model	Data	Source
Corp. tax rate of haven (Regime 0): $t_h^0 = \frac{\delta(\lambda-1)}{H(3\lambda-1)}$	9.3%	13.7%	Tørsløv et al. (2023)
MNE's shifted profits: $\sum_h \theta_h^0 \Pi$	660bUSD	969bUSD	Tørsløv et al. (2023)
Non-haven's revenue loss: $t_n^0 \sum_h \theta_h^0 \Pi$	129bUSD	247bUSD	Tørsløv et al. (2023)

Notes: Data are from 2019. The definitions of non-haven and haven countries follow Tørsløv et al. (2023) and the data is from the authors' website: `https://missingprofits.world` (corresponding figures in the spreadsheets of "Table1" and "Table U1" in the excel file "1975-2019 updated estimates: Tables"). The non-haven countries are 30 OECD countries, 7 major developing countries and the rest of the world. There are 40 haven countries across the world. The corporate tax rates for the representative non-haven and haven countries are calculated as the GDP-weighted averages of their respective effective tax rates. Tørsløv et al. (2023) report the pre-tax profits of foreign-owned MNEs only, which do not include those of domestically-owned MNEs (see their Section 3.1.2 on p.7). Using the CbCR Statistics of the EU Tax Observatory (`https://www.taxobservatory.eu/repository/the-cbcr-explorer/`), we compute the pre-tax profit ratio of domestically-owned MNEs to foreign-owned MNEs. With this ratio (0.785) and the pre-tax profits of foreign-owned MNEs (2,590 billion USD), we obtain the total pre-tax profits of foreign- and domestically-owned MNEs as $(1 + 0.785) \times 2,590 = 4,623$ billion USD.

For this calibrated version of our model, the effects of introducing a GMT at varying tax rates t_M on equilibrium tax schedules are shown in Figures 2, which we already discussed in Section 2.4. Figure 3 illustrates the effects on welfare in both non-haven and haven countries, and those on aggregate shifted profits, as compared to their counterparts in the unconstrained equilibrium (Regime 0). To make numbers comparable with tax revenues, the levels of welfare are normalized by the MVPF, λ.

The most important result is that the introduction of a 15% GMT rate leads to a tax equilibrium in Regime 2. In this regime, the havens find it profitable to split their tax rate and to set a lower tax rate for small MNEs as compared to large MNEs (Proposi-

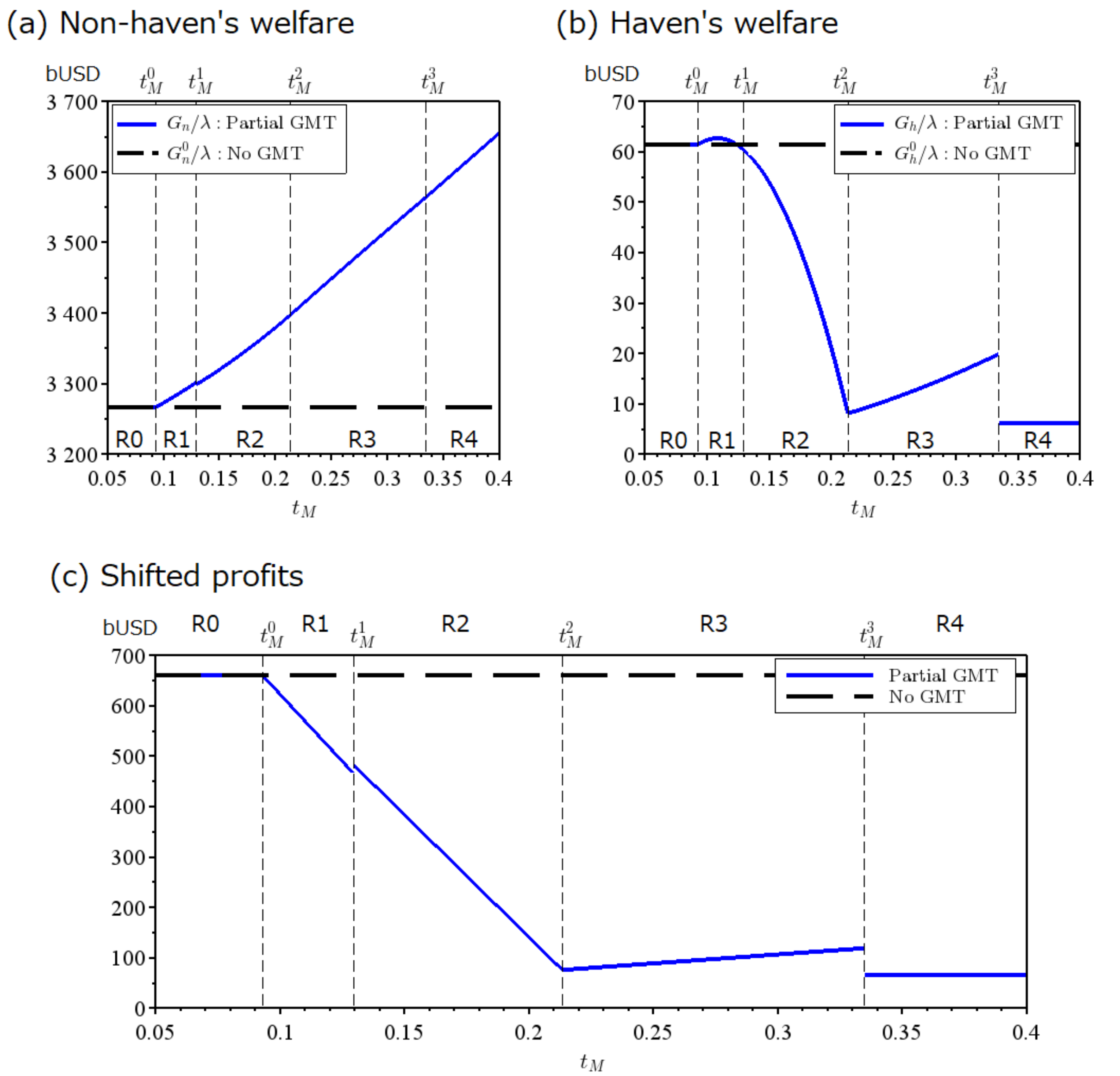


Fig. 3. Equilibrium welfare and shifted profits.

Notes: The figure shows the equilibrium levels of welfare normalized by the MVPF, λ, in the non-haven (a) and the sum of the $H = 40$ haven countries (b), and the aggregate shifted profits (c), for different rates of GMT. Parameter values are given in Table 2. The solid curves in each panel are the equilibrium values under the partial GMT ($\phi = 0.9$); the dashed horizontal lines are those in the unconstrained equilibrium (Regime 0).

tion 1(ii)).[25] This corresponds to the observations mentioned in the Introduction that several tax havens have announced to maintain their low statutory tax rate while topping up the taxation of large MNEs to comply with the GMT, known as the QDMTT (see

[25]This result also holds if we assume that the first stage decision of whether to split tax rates or not is made by each tax haven individually (see Appendix A.2). In this case the range of GMT rates that support Regime 1 will be smaller than in our benchmark model, while the range of t_M that supports an equilibrium in Regime 2 rises accordingly.

footnote 5). The GMT introduction reduces the total amount of profits shifted, thereby increasing the non-haven's welfare while reducing the havens' welfare (tax revenues).

Panel (a) of Table 3 further quantifies the welfare and revenue effects of a 15% GMT rate for our calibrated model, with the benchmark MVPF of $\lambda = 1.5$. Welfare and tax revenue increases in the non-haven country clearly outweigh the revenue losses in the havens, leading to an increase in global welfare and tax revenues. Our calibrated gain in tax revenue in the non-haven (107 billion USD) is close to the summed revenue gains for Europe and the U.S. in Baraké et al. (2022) and worldwide tax revenue gains are in the same range as in Hugger et al. (2024) (see footnote 2).[26] The welfare gain for the non-haven is smaller than its revenue gain, because the private income in the non-haven (the post-tax profits of MNEs net of profit-shifting costs) falls after the introduction of GMT.

One may argue that the MVPF is indeed higher than our benchmark value of $\lambda = 1.5$, as evidenced by the very substantial efforts, discussed in the introduction, that non-haven countries take to increase their corporate tax revenues. Panels (b) and (c) of Table 3 therefore present the results of two robustness checks with high values of the MVPF: $\lambda = 3$ and $\lambda = 10$. The latter value, given in Panel (c) approaches a Leviathan government objective of tax revenue maximization. With these increased values of λ, the introduction of a 15% GMT rate leads to a tax equilibrium in Regime 1, in which both countries employ a uniform tax rate on all MNEs. With the higher valuation of tax revenues in the non-haven country, the tax havens will find it profitable to commit to a uniform GMT rate for all MNEs, which in turn leads the non-haven to choose a higher uniform tax rate above the GMT, as compared to the benchmark in Panel (a). The GMT rate of 15% therefore acts as a coordination device between the non-haven and the havens, benefitting both countries.[27] Although observations at the time of writing somewhat favor the GMT resulting in split tax rates in the havens, corresponding to Regime 2, we leave open the question of which regime will eventually emerge.

Finally, Table 4 provides a quantitative assessment of two gradual reforms that are likely to follow the newly introduced GMT rate of 15% with incomplete coverage. The first reform is to increase the GMT rate from 15% to 18% while maintaining the coverage rate at $\phi = 90\%$ (Panel (a)). The second is to broaden the GMT coverage from 90%

[26]The percentage increases in corporate tax revenue in our model are not comparable to those in Baraké et al. (2022) and Hugger et al. (2024), as we do not model purely domestic firms.

[27]These results depend on the assumption that tax havens make their first stage choice collectively. With decentralized first stage decisions of tax havens (cf. Appendix A.2), the upper boundary for a Regime 1 equilibrium, $t_M = t_M^a$, is calculated to be 9.37%, 9.42%, and 9.45% for respective values of the marginal valuation of public funds, $\lambda = 1.5$, 3, and 10. This implies that the introduction of a 15% GMT rate leads to a Regime 2 equilibrium regardless of the level of λ. For $\lambda = 1.5$, the quantitative effects under decentralized decision making of havens are the same as those in Panel (a) of Table 3. For $\lambda = 3$ and $\lambda = 10$, the effects differ from those in Panels (b) and (c) of Table 3, however, and yield a conflict of interests between the non-haven and the havens that is analogous to the one in Panel (a).

Table 3
Quantitative effects of introducing a 15% GMT.

(a) MVPF: $\lambda = 1.5$. Regime 0 to 2	Non-haven	Haven	World
Tax rate before GMT introduction	18.6% for all	9.3% for all	—
Tax rate after GMT introduction	19.9% for all	9.9% for small; 15.0% for large	—
Welfare change in bUSD (% change)	53 (1.6%)	−7 (−12.1%)	46 (1.4%)
Revenue change in bUSD (% change)	107 (14.5%)	−7 (−12.1%)	99 (12.4%)
Shifted-profits change in bUSD (% change)	267 (41.9%)	−267 (−41.9%)	0 (0%)

(b) MVPF: $\lambda = 3$. Regime 0 to 1	Non-haven	Haven	World
Tax rate before GMT introduction	18.6% for all	9.3% for all	—
Tax rate after GMT introduction	20.9% for all	15.0% for all	—
Welfare change in bUSD (% change)	122 (6.4%)	2 (2.0%)	124 (6.1%)
Revenue change in bUSD (% change)	168 (26.0%)	2 (2.0%)	170 (22.6%)
Shifting-profits change in bUSD (% change)	425 (36.8%)	−425 (−36.8%)	0 (0%)

(c) MVPF: $\lambda = 10$. Regime 0 to 1	Non-haven	Haven	World
Tax rate before GMT introduction	18.6% for all	9.3% for all	—
Tax rate after GMT introduction	21.3% for all	15.0% for all	—
Welfare change in bUSD (% change)	169 (17.3%)	12.4 (9.3%)	181 (16.3%)
Revenue change in bUSD (% change)	185 (31.1%)	12.4 (9.3%)	197 (27.1%)
Shifting-profits change in bUSD (% change)	463 (32.2%)	−463 (−32.2%)	0 (0%)

Notes: Each of panels (a) to (c) show the effects of a 15% GMT introduction for different values of the MVPF, $\lambda \in \{1.5, 3, 10\}$. Results are based on the calibrated parameter values described in Table 2; the GMT coverage rate is 90% ($\phi = 0.9$) in particular. The welfare levels are normalized by the MVPF, λ. With $\lambda = 1.5$, the 15% GMT introduction leads the economy from Regime 0 to 2; with $\lambda \in \{3, 10\}$, it leads instead to Regime 1. The haven refers to the sum of the $H = 40$ haven-countries. Due to rounding numbers, the sum of the welfare/revenue change of the non-haven and the haven in billion USD is not necessarily equal to that of the world.

to 100% while keeping the GMT rate at 15% (Panel (b)). In both scenarios, we assume our benchmark MVPF of $\lambda = 1.5$ and thus, the equilibrium remains in Regime 2 after the reforms. The results indicate that the non-haven gains more from the 18% GMT rate (+1.0% in welfare; +7.0% in revenues) than from the full GMT coverage (+0.2% in welfare; +1.3% in revenues). The greater gains for the non-haven from the 18% GMT rate are driven by the stronger reduction in profit shifting to the havens (−37.9%), as compared to a full GMT coverage (−7.0%). Hence the increase in the GMT rate creates

Table 4
Quantitative effects of gradual reforms.

(a) Gains from $t_M = 0.15$ to $t_M = 0.18$	Non-haven	Haven	World
Welfare change in bUSD (% change)	34 (1.0%)	−17 (−31.0%)	18 (0.5%)
Revenue change in bUSD (% change)	59 (7.0%)	−17 (−31.0%)	42 (4.7%)
Shifting-profits change in bUSD (% change)	146 (37.9%)	−146 (−37.9%)	0 (0%)

(b) Gains from $\phi = 0.9$ to $\phi = 1.0$	Non-haven	Haven	World
Welfare change in bUSD (% change)	5.4 (0.2%)	−0.5 (−0.9%)	4.9 (0.1%)
Revenue change in bUSD (% change)	10.7 (1.3%)	−0.5 (−0.9%)	10.3 (1.1%)
Shifting-profits change in bUSD (% change)	27 (7.0%)	−27 (−7.0%)	0 (0%)

Notes: Panel (a) shows gains/losses from an increase in the GMT rate from $t_M = 0.15$ to 0.2; panel (b) shows gains/losses from an increase in the GMT coverage rate from $\phi = 0.9$ to 1.0. Results are based on the calibrated parameter values described in Table 2; the MVPF is $\lambda = 1.5$ in particular. The welfare levels are normalized by the MVPF, λ. The haven refers to the sum of the $H = 40$ haven-countries. Due to rounding numbers, the sum of the welfare/revenue change of the non-haven and the haven in billion USD is not necessarily equal to that of the world.

a much sharper conflict of interest with the tax havens, as compared to the extension of GMT coverage. In this sense, covering more MNEs under the GMT may be a politically more feasible option than increasing the GMT rate. However, even a full coverage of the GMT will likely bring only moderate gains to the non-haven and to the world, while entailing higher administrative and compliance costs.

5 Conclusion

This paper has analyzed the effects of a global minimum tax (GMT) that is confined to large multinational enterprises (MNEs), thus leaving at least 10% of the global multinational tax base outside its scope. Using a simple model with profit shifting by heterogeneous MNEs, we have shown that this partial coverage of the GMT gives rise to a sequence of tax competition equilibria between a non-haven and a set of symmetric tax haven countries. In particular, introducing a low GMT rate that still binds the tax havens induces them to commit to a single GMT rate for all MNEs and thus results in higher welfare and tax revenues in both sets of countries. However, a further increase in the GMT rate leads first the tax havens, and then the non-haven, to split their tax rate for large and small MNEs, creating a conflict of interest between the two groups of countries. A similar conflict also arises from broadening the coverage of MNEs subject to the GMT.

The calibrated version of our model suggests that, upon the introduction of the current

GMT rate of 15%, the most likely regime is one where the non-haven sets a uniform tax rate above the GMT for all MNEs, whereas the haven countries split their tax rate and undercut the GMT for small MNEs (Regime 2). This finding corresponds to the observation that tax havens such as Ireland, Liechtenstein, Bermuda, or Bulgaria maintain their regular corporate tax rates below the level of 15%, but top up the taxation of large multinationals to the level of the GMT. In terms of welfare and tax revenues, our calibrated model predicts that the non-haven gains while the tax havens lose, resulting in a positive net gain globally.

Our main objective in this paper has been to understand the implications of an incomplete coverage of the GMT. We have done so in a highly stylized model, in order to develop some sharp intuitions. With the insights gained, it would be fruitful to extend our basic model to incorporate further important aspects of the global minimum tax and the responses of multinational firms. A first extension would allow MNEs to adjust their real pre-tax profits in response to changes in tax rates, for example, by modifying their investment decision. A second extension would incorporate a splitting response of *multinationals* seeking to benefit from potentially lower tax rates on small MNEs. A third extension would consider the substance-based income exclusion, i.e., additional tax deductions for MNEs that increase investment and employment. We leave these extensions for further research.

Appendix A: Proof of Propositions

A.1. Proof of Proposition 1

Regime 0 can be an equilibrium as long as the haven's unconstrained rate is greater than the GMT rate, $t_M < t_h^0 = t_M^0 \equiv \delta(\lambda - 1)/[H(3\lambda - 1)]$. A new equilibrium regime emerges when $t_M \geq t_M^0$. Since haven countries are all symmetric, we are concerned with the representative haven country h in what follows.

Regime 1: $t_M \in [t_M^0, t_M^1]$, where $t_M^0 = \frac{\delta(\lambda-1)}{H(3\lambda-1)}$ and $t_M^1 \equiv \frac{\delta(\lambda-1)(2\lambda-1)}{H[\lambda(3\lambda-1)-\phi(\lambda-1)^2]}$.

When the non-haven sets a single non-GMT rate and the haven sets a single GMT rate, the equilibrium tax rates and payoffs are

$$t_n^1 = \frac{(\lambda - 1)(Ht_M + \delta)}{H(2\lambda - 1)}, \qquad t_h^1 = t_M. \tag{A.1}$$

$$G_n^1 \equiv G_n(t_n = t_n^1, t_h = t_h^1), \qquad G_h^1 \equiv G_h(t_n = t_n^1, t_h = t_h^1).$$

When the non-haven sets a single non-GMT rate and the haven splits its tax rates, the equilibrium tax rates are

$$t_n^2 = \frac{2(\lambda - 1)(\phi Ht_M + \delta)}{H[\lambda(3 + \phi) - (1 + \phi)]}, \qquad t_h^2 = \begin{cases} \frac{(\lambda-1)(\phi Ht_M+\delta)}{H[\lambda(3+\phi)-(1+\phi)]} & \text{for } \pi \in [\underline{\pi}, \pi_M) \\ t_M & \text{for } \pi \in [\pi_M, \infty) \end{cases}. \tag{A.2}$$

$$G_n^2 \equiv G_n(t_n = t_n^2, t_h = t_h^2), \qquad G_h^2 \equiv G_h(t_n = t_n^2, t_h = t_h^2).$$

Given the non-haven's single non-GMT rate, the haven prefers to set a single GMT rate, if

$$G_h^1 - G_h^2 = \tag{A.3}$$
$$\frac{\lambda \overbrace{[Ht_M(3\lambda - 1) - \delta(\lambda - 1)]}^{\geq 0} \overbrace{\left[\delta(\lambda - 1)(2\lambda - 1) - Ht_M \left\{\lambda(3\lambda - 1) - \phi(\lambda - 1)^2\right\}\right]}^{\geq 0}}{\delta H^2(2\lambda - 1)[\lambda(3 + \phi) - (1 + \phi)]^2}(1 - \phi)\Pi \geq 0,$$

where the strict equality holds at $t_M \in \{t_M^0, t_M^1\}$. Therefore, the tax-competition equilibrium is that the non-haven sets a single non-GMT rate, and the haven sets a single GMT rate, given by (A.1). Table A1 shows the relevant payoffs in Regimes 1 and 2, where the GMT rate is not binding for the non-haven.

Regime 2: $t_M \in (t_M^1, t_M^2]$, where $t_M^1 = \frac{\delta(\lambda-1)(2\lambda-1)}{H[\lambda(3\lambda-1)-\phi(\lambda-1)^2]}$ and $t_M^2 \equiv \frac{2\delta(\lambda-1)}{H[3\lambda-1-\phi(\lambda-1)]}$.

Since (A.3) becomes negative for $t_M \in (t_M^1, t_M^2]$, the haven splits its tax rates in response to a non-haven's single non-GMT rate. The non-haven is still not bound by the GMT and continues to chooses its optimal unconstrained tax rate. Therefore, the tax-competition equilibrium is that the non-haven sets a single non-GMT rate and the haven splits its tax rates, with tax rates given by (A.2).

Table A1
Payoff matrix for Regimes 1 ($t_M \in [t_M^1, t_M^2]$) and 2 ($t_M \in (t_M^1, t_M^2]$).

Non-haven	**Haven**	
	single GMT rate	split tax rate
single non-GMT rate	$G_n^1, \quad G_h^1$	$G_n^2, \quad G_h^2$
single GMT rate	—	—
split tax rate	—	—

Notes: In Regimes 1 and 2, the GMT is binding only for the haven. The potential regimes where the non-haven does choose a single GMT rate or split tax rates are irrelevant because, whenever possible, it always chooses a single non-GMT rate that solves the unconstrained maximization problem.

Regime 3: $t_M \in (t_M^2, t_M^3]$, where $t_M^2 \equiv \frac{2\delta(\lambda-1)}{H[3\lambda-1-\phi(\lambda-1)]}$ and $t_M^3 = \frac{2\delta(\lambda-1)(8\lambda-3)}{H(3\lambda-1)(4\lambda-1)}$.

For $t_M > t_M^2$, the non-haven's single-non GMT rate, given by (A.2), is bound by the GMT and it cannot choose the unconstrained maximizing rate in response to the haven's splitting rates. The non-haven thus chooses either a single GMT rate or a splitting tax schedule. In response, the haven must always split its tax rate; otherwise it cannot obtain positive tax revenues.

When the non-haven sets a single GMT rate and the haven splits its tax rates, the equilibrium tax rates and payoffs are

$$t_n^3 = t_M \quad \text{for } \pi \in [\underline{\pi}, \infty), \qquad t_h^3 = \begin{cases} t_M/2 & \text{for } \pi \in [\underline{\pi}, \pi_M) \\ t_M & \text{for } \pi \in [\pi_M, \infty) \end{cases}. \tag{A.4}$$

$$G_n^3 \equiv G_n(t_n = t_n^3, t_h = t_h^3), \qquad G_h^3 \equiv G_h(t_n = t_n^3, t_h = t_h^3).$$

When both the non-haven and the haven split their tax rates, the equilibrium tax rates are

$$t_n^4 = \begin{cases} \frac{2\delta(\lambda-1)}{H(3\lambda-1)} & \text{for } \pi \in [\underline{\pi}, \pi_M) \\ t_M & \text{for } \pi \in [\pi_M, \infty) \end{cases}, \qquad t_h^4 = \begin{cases} \frac{\delta(\lambda-1)}{H(3\lambda-1)} & \text{for } \pi \in [\underline{\pi}, \pi_M) \\ t_M & \text{for } \pi \in [\pi_M, \infty) \end{cases}. \tag{A.5}$$

$$G_n^4 \equiv G_n(t_n = t_n^4, t_h = t_h^4), \qquad G_h^4 \equiv G_h(t_n = t_n^4, t_h = t_h^4).$$

Given the haven's splitting rates, the non-haven prefers to set a single GMT rate, if

$$G_n^3 - G_n^4 = \frac{\overbrace{[Ht_M(3\lambda-1) - 2\delta(\lambda-1)]}^{>0}\overbrace{[2\delta(\lambda-1)(8\lambda-3) - Ht_M(3\lambda-1)(4\lambda-1)]}^{\geq 0}}{8\delta H(3\lambda-2)^2}(1-\phi)\Pi \geq 0, \tag{A.6}$$

which is always fulfilled in Regime 3. The strict equality holds at $t_M = t_M^3$ and it holds that $t_M > t_M^2 > \frac{2\delta(\lambda-1)}{H(3\lambda-1)}$ for any $\lambda > 1/3$. Therefore, the tax-competition equilibrium is that the non-haven sets a single GMT rate, and the haven splits its tax rates, as given in (A.4).

Regime 4: $t_M \in (t_M^3, 1]$, where $t_M^3 = \frac{2\delta(\lambda-1)(8\lambda-3)}{H(3\lambda-1)(4\lambda-1)}$.

Since (A.6) becomes negative for $t_M \in (t_M^3, 1]$, the non-haven splits its tax rates in response to the havens' split rates. Therefore, the tax-competition equilibrium is that both the non-haven and the haven split their tax rates, as given in (A.5).

Table A2
Payoff matrix for Regimes 3 ($t_M \in (t_M^2, t_M^3]$) and 4 ($t_M \in (t_M^3, 1]$).

Non-haven	**Haven**	
	single GMT rate	split tax rate
single non-GMT rate	—	—
single GMT rate	—	$G_n^3, \quad G_h^3$
split tax rate	—	$G_n^4, \quad G_h^4$

Notes: In Regimes 3 and 4, the GMT is binding for both the non-haven and the haven. Therefore, the regimes where the non-haven chooses a single-non GMT rate are irrelevant. The regimes where the haven sets a single GMT are also irrelevant because, by doing so, the haven would obtain non-positive welfare/tax revenues.

A.2. Decentralized decision of tax havens

In our main model, we have assumed that tax havens collectively decide on whether to set a single GMT rate, or to split their tax rate. We here examine an alternative, decentralized decision process in the first stage of our game where each single tax haven decides whether to split or not, given the other havens' decisions. To simplify this analysis, we assume that countries can split their tax rate only if they are bound by the GMT. This reflects the fact that preferential tax regimes for specific tax bases are not allowed under the OECD's action plan to fight base erosion.

Suppose then that $t_M \in [t_M^0, t_M^2]$. Out of the total of H tax havens, there are H_M havens that commit to a single GMT rate while the remaining $H_S = H - H_M$ havens split their tax rate. When the non-haven sets a single non-GMT rate and a single haven h sets a uniform GMT rate, the equilibrium tax rates are

$$t_n(H_M) = \frac{2(\lambda-1)[\phi t_M(H-H_M) + H_M t_M + \delta]}{\phi(\lambda-1)(H-H_M) + \lambda(3H+H_M) - (H+H_M)}, \qquad t_h^1 = t_M, \tag{A.7}$$

which is the counterpart of (A.1). Let $G_h^1(H_M)$ be the haven's equilibrium payoff with commitment.

If the single haven h splits its tax rate instead, whereas the non-haven sets a uniform non-

GMT rate, the equilibrium tax rates are

$$t_n(H_M) = \frac{2(\lambda-1)[\phi t_M(H-H_M)+H_M t_M+\delta]}{\phi(\lambda-1)(H-H_M)+\lambda(3H+H_M)-(H+H_M)}, \qquad t_h^2 = \begin{cases} t_n(H_M)/2 & \text{for } \pi \in [\underline{\pi}, \pi_M) \\ t_M & \text{for } \pi \in [\pi_M, \infty) \end{cases}, \tag{A.8}$$

which is the counterpart of (A.2). Let $G_h^2(H_M)$ be the haven's equilibrium payoff under splitting.

We then ask if a single haven has an incentive to choose a uniform GMT rate given that all the other $H-1$ havens split their tax rates. A single haven h has a unilateral incentive to do so, if the following holds:

$$\begin{aligned}\Delta G_h^{12}(H_M=1) &\equiv G_h^1(H_M=1) - G_h^2(H_M=0) \\ &= \frac{(1-\phi)[Ht_M(3\lambda-1)-\delta(\lambda-1)]\Theta}{\delta H^2[\lambda(3+\phi)-(1+\phi)]^2[\phi(\lambda-1)(H-1)+\lambda(3H+1)-(H+1)]} \geq 0,\end{aligned} \tag{A.9}$$

where $\Theta \equiv A - Bt_M, \quad A \equiv \delta(\lambda-1)[\phi(\lambda-1)(H-1)+\lambda(3H+1)-(H+1)] > 0,$

$B \equiv H\phi(\lambda-1)[\lambda(3H-5)-(H-3)] + H(3\lambda-1)[\lambda(3H-1)-(H-1)] > 0,$

and $\quad Ht_M(3\lambda-1)-\delta(\lambda-1) \geq 0 \;$ or $\; t_M \geq \dfrac{\delta(\lambda-1)}{H(3\lambda-1)} \equiv t_M^0.$

It is straightforward to show that $\Theta > 0$ holds at t_M^0 and hence, by continuity, also for t_M marginally above t_M^0. Therefore, there must be a positive range of t_M, with $t_M^0 < t_M \leq t_M^a \equiv A/B$ for which the inequality (A.9) holds for a haven h. By symmetry, this argument applies to all havens.

For a Regime 1 equilibrium with commitment to occur, a further condition is that no single haven h must have an incentive to split, given that all the other $H_M - 1$ havens commit to a single GMT rate. A single haven h has no unilateral incentive to split its tax rate, if the following holds:

$$\begin{aligned}\Delta G_h^{12}(H_M=H) &\equiv G_h^1(H_M=H) - G_h^2(H_M=H-1) \\ &= \frac{(1-\phi)[Ht_M(3\lambda-1)-\delta(\lambda-1)]\Theta'}{\delta H(2\lambda-1)[\phi(\lambda-1)+\lambda(4H-1)-(2H-1)]^2} \geq 0,\end{aligned} \tag{A.10}$$

where $\Theta' \equiv C - Dt_M, \quad C \equiv \delta H(2\lambda-1)(\lambda-1) > 0,$

$D \equiv (6H^2-4H+1)\lambda^2 - (5H^2-6H+2)\lambda + (H-1)^2 - \phi(\lambda-1)^2 > 0.$

and $t_M \geq t_M^0$ holds again. The equivalent condition is $t_M \leq t_M^b \equiv C/D$. We can immediately see $\Delta G_h^{12}(H_M = H) < 0$ for $t_M \in (t_M^b, t_M^2]$ and check $t_M^a < t_M^b < t_M^1 < t_M^2$:

$$
\begin{aligned}
t_M^b - t_M^a &= \frac{\delta(H-1)(1-\phi)^2(\lambda-1)^4}{\Theta''[(6H^2-4H+1)\lambda^2-(5H^2-6H+2)\lambda+(H-1)^2-\phi(\lambda-1)^2]} > 0,\\
t_M^1 - t_M^b &= \frac{\delta(H-1)(2\lambda-1)(\lambda-1)^2}{\Theta''[\lambda(3\lambda-1)-\phi(\lambda-1)^2]} > 0,\\
\Theta'' &\equiv 3(3H-1)\lambda^2 - 2(3H-2)\lambda + H - 1 + \phi(\lambda-1)[\lambda(3H-5)-(H-3)] > 0.
\end{aligned}
$$

We can conclude that for $t_M \in [t_M^0, t_M^a]$, all the havens set a single GMT rate and the non-haven sets a single non-GMT rate; for $t_M \in (t_M^a, t_M^2]$, all the havens split their tax rate and the non-haven sets a single non-GMT rate. The former regime corresponds to Regime 1 and the latter one to Regime 2 in the text. The only difference is that the range of Regime 1 is smaller when havens make their first stage decision in a decentralized way, implying that the havens' commitment is less likely. This is intuitive because the commitment of a single haven does not induce the non-haven to increase its tax rate by as much as the simultaneous commitment of many havens. Finally, in the remaining range of the GMT, $t_M \in (t_M^2, 1]$, the difference between collective vs. decentralized decisions of havens plays no role any more. In either setting, the tax havens always have an incentive to split their tax rate, whether the non-haven sets a single GMT rate (Regime 3), or splits its tax rate as well (Regime 4).

A.3. Proofs of Propositions 3 and 4

Regime 1: $t_M \in (t_M^0, t_M^1]$, where $t_M^0 = \frac{\delta(\lambda-1)}{H(3\lambda-1)}$ and $t_M^1 = \frac{\delta(\lambda-1)(2\lambda-1)}{H[\lambda(3\lambda-1)-\phi(\lambda-1)^2]}$.

Comparing the welfare levels of countries in Regime 1 with those in Regime 0 gives

$$
\begin{aligned}
G_n^1 - G_n^0 &= \frac{[Ht_M(3\lambda-1)-\delta(\lambda-1)]\left[Ht_M\lambda^2(3\lambda-1)+\delta(\lambda-1)(7\lambda^2-8\lambda+2)\right]}{2\delta H(2\lambda-1)(3\lambda-1)^2}\Pi > 0,\\
G_h^1 - G_h^0 &= \frac{\lambda\,[Ht_M(3\lambda-1)-\delta(\lambda-1)]\,[\delta(\lambda-1)(2\lambda-1)-Ht_M\lambda(3\lambda-1)]}{\delta H(2\lambda-1)(3\lambda-1)^2}\Pi \equiv \Delta\\
\Delta &\begin{cases} \geq 0 & \text{if } t_M \leq \frac{\delta(\lambda-1)(2\lambda-1)}{H\lambda(3\lambda-1)} \\ < 0 & \text{if } t_M > \frac{\delta(\lambda-1)(2\lambda-1)}{H\lambda(3\lambda-1)} \end{cases},\\
G_W^1 - G_W^0 &= \frac{[Ht_M(3\lambda-1)-\delta(\lambda-1)]\left[\delta(\lambda-1)(11\lambda^2-10\lambda+2)-Ht_M\lambda^2(3\lambda-1)\right]}{2\delta H(2\lambda-1)(3\lambda-1)^2}\Pi > 0,
\end{aligned}
$$

where the last inequality holds from

$$
t_M \leq t_M^1 < \frac{\delta(\lambda-1)(11\lambda^2-10\lambda+2)}{H\lambda^2(3\lambda-1)}.
$$

The marginal effect of the GMT is

$$\frac{\partial G_n^1}{\partial t_M} = \frac{H\lambda^2 t_M + \delta(\lambda-1)^2}{\delta(2\lambda-1)}\Pi > 0, \qquad \frac{\partial G_h^1}{\partial t_M} = \frac{\lambda[\delta(\lambda-1) - 2H\lambda t_M]}{\delta(2\lambda-1)}\Pi \begin{cases} \geq 0 & \text{if } t_M \leq \frac{\delta(\lambda-1)}{2H\lambda} \\ < 0 & \text{if } t_M > \frac{\delta(\lambda-1)}{2H\lambda} \end{cases},$$

$$\frac{\partial G_W^1}{\partial t_M} = \frac{\delta(\lambda-1)(2\lambda-1) - H\lambda^2 t_M}{\delta(2\lambda-1)}\Pi > 0,$$

where the last inequality holds because of

$$t_M \leq t_M^1 < \frac{\delta(\lambda-1)(2\lambda-1)}{2H\lambda}.$$

In Regime 1, the welfare levels of the non-haven and the world rise after the GMT introduction and they increase along with a gradual increase in the GMT rate. On the other hand, the welfare level of the haven rises if $t_M < \frac{\delta(\lambda-1)(2\lambda-1)}{H\lambda(3\lambda-1)}$ after the GMT introduction and it falls if $t_M > \frac{\delta(\lambda-1)(2\lambda-1)}{H\lambda(3\lambda-1)}$.

Regime 2: $t_M \in (t_M^1, t_M^2]$, where $t_M^1 = \frac{\delta(\lambda-1)(2\lambda-1)}{H[\lambda(3\lambda-1)-\phi(\lambda-1)^2]}$ and $t_M^2 = \frac{2\delta(\lambda-1)(2\lambda-1)}{H[\lambda(3\lambda-1)-\phi(\lambda-1)^2]}$.

For the non-haven country, we see

$$\left.\frac{\partial G_n^2}{\partial t_M}\right|_{t_M=t_M^1} = \frac{(\lambda-1)[8\lambda^3 - 5\lambda^2 - 2\lambda + 1 + \phi(\lambda-1)^2]}{[3\lambda-1+\phi(\lambda-1)][\lambda(3\lambda-1)-\phi(\lambda-1)^2]}\phi\Pi > 0,$$

$$\left.\frac{\partial G_n^2}{\partial t_M}\right|_{t_M=t_M^2} = \frac{(\lambda-1)[8\lambda^2 - 5\lambda + 1 + \phi(\lambda-1)]}{[3\lambda-1+\phi(\lambda-1)][3\lambda-1-\phi(\lambda-1)]}\phi\Pi > 0.$$

From these results and the fact that G_n^2 is a quadratic function of t_M, it follows that G_n^2 increases with t_M for $t_M \in (t_M^1, t_M^2]$. To prove $G_n^2 - G_n^0 > 0$, it is sufficient to show

$$G_n^2 - G_n^0\big|_{t_M=t_M^1} = \frac{\delta(\lambda-1)^3[(3\lambda-1)(16\lambda^3 - 13\lambda^2 + 1) - \phi(\lambda-1)^3(8\lambda-3)]}{2H(3\lambda-1)^2[\lambda(3\lambda-1)-\phi(\lambda-1)^2]^2}\phi\Pi > 0,$$

which holds for any $\lambda > 1$ and $\phi \in (0,1)$.

For the haven country, we get

$$\left.\frac{\partial G_h^2}{\partial t_M}\right|_{t_M=t_M^1} = -\frac{2\lambda(2\lambda-1)(\lambda-1)^2}{[3\lambda-1+\phi(\lambda-1)][\lambda(3\lambda-1)-\phi(\lambda-1)^2]}\phi\Pi < 0,$$

$$\left.\frac{\partial G_h^2}{\partial t_M}\right|_{t_M=t_M^2} = -\frac{4\lambda^2(\lambda-1)}{[3\lambda-1+\phi(\lambda-1)][3\lambda-1-\phi(\lambda-1)]}\phi\Pi < 0.$$

From these results and the fact that G_h^2 is a quadratic function of t_M, G_h^2 must be decreasing in t_M for $t_M \in (t_M^1, t_M^2]$. To prove $G_h^2 - G_h^0 > 0$, it is sufficient to show

$$G_h^2 - G_h^0\big|_{t_M=t_M^1} = -\frac{\delta\lambda(\lambda-1)^5[3\lambda-1+\phi(\lambda-1)]}{H(3\lambda-1)^2(3\lambda-1)^2[\lambda(3\lambda-1)-\phi(\lambda-1)^2]^2}\phi\Pi < 0,$$

which holds for all $\lambda > 1$ and $\phi \in (0,1)$.

For the world, we see

$$\left.\frac{\partial G_W^2}{\partial t_M}\right|_{t_M=t_M^1} = \frac{(\lambda-1)[4\lambda^3+\lambda^2-4\lambda+1+\phi(\lambda-1)^2]}{[3\lambda-1+\phi(\lambda-1)][\lambda(3\lambda-1)-\phi(\lambda-1)^2]}\phi\Pi > 0,$$
$$\left.\frac{\partial G_W^2}{\partial t_M}\right|_{t_M=t_M^2} = \frac{(\lambda-1)^2(4\lambda-1+\phi)}{[3\lambda-1+\phi(\lambda-1)][3\lambda-1-\phi(\lambda-1)]}\phi\Pi > 0.$$

Hence G_W^2 must be increasing in t_M for $t_M \in (t_M^1, t_M^2]$. To prove $G_W^2 - G_W^0 > 0$, we must show

$$G_W^2 - G_W^0\big|_{t_M=t_M^1} = \frac{\delta(\lambda-1)^3[(3\lambda-1)(14\lambda^3-9\lambda^2-2\lambda+1)-\phi(\lambda-1)^3(10\lambda-3)]}{2H(3\lambda-1)^2[\lambda(3\lambda-1)-\phi(\lambda-1)^2]^2}\phi\Pi > 0,$$

which holds for all $\lambda > 1$ and $\phi \in (0,1)$.

In Regime 2, the welfare levels of the non-haven and the world therefore rise after the GMT introduction and they increase along with a gradual increase in the GMT rate. On the other hand, the welfare level of the haven declines after the GMT introduction and it is independent of t_M.

Regime 3: $t_M \in (t_M^2, t_M^3]$, where $t_M^2 = \frac{2\delta(\lambda-1)(2\lambda-1)}{H[\lambda(3\lambda-1)-\phi(\lambda-1)^2]}$ and $t_M^3 = \frac{2\delta(\lambda-1)(8\lambda-3)}{H(3\lambda-1)(4\lambda-1)}$.

For the non-haven country, we have

$$\left.\frac{\partial G_n^3}{\partial t_M}\right|_{t_M=t_M^2} = \frac{(\lambda-1)[2\lambda-1+\phi(2\lambda+1)]}{2[3\lambda-1-\phi(\lambda-1)]}\Pi > 0,$$
$$\left.\frac{\partial G_n^3}{\partial t_M}\right|_{t_M=t_M^3} = \frac{(\lambda-1)[\phi(8\lambda-3)-(2\lambda-1)]}{2(3\lambda-1)}\Pi > 0,$$

so that G_n^3 must increase with t_M for $t_M \in (t_M^2, t_M^3]$. To prove $G_n^3 - G_n^0 > 0$, we show that the following must hold for all levels of $\lambda > 1$ and $\phi \in (0,1)$:

$$G_n^3 - G_n^0\big|_{t_M=t_M^2} = \frac{\delta(\lambda-1)^2[(3\lambda-1)(16\lambda^3-13\lambda^2+3)-\phi(\lambda-1)^2(8\lambda-3)]}{2H(3\lambda-1)^2[3\lambda-1-\phi(\lambda-1)]^2}\phi\Pi > 0.$$

For the haven country, we see

$$\left.\frac{\partial G_h^3}{\partial t_M}\right|_{t_M=t_M^2} = \frac{\lambda(\lambda-1)}{3\lambda-1-\phi(\lambda-1)}(1-\phi)\Pi > 0,$$
$$\left.\frac{\partial G_h^3}{\partial t_M}\right|_{t_M=t_M^3} = \frac{\lambda(\lambda-1)(8\lambda-3)}{(3\lambda-1)(4\lambda-1)}(1-\phi)\Pi > 0,$$

which implies that G_h^3 decreases with t_M for $t_M \in (t_M^2, t_M^3]$. To prove $G_h^3 - G_h^0 < 0$, we must show that

$$G_h^3 - G_h^0\big|_{t_M=t_M^3} = \frac{\delta\lambda(\lambda-1)^2[8(2\lambda-1)(3\lambda-1)-\phi(8\lambda-3)^2]}{H(3\lambda-1)^2(4\lambda-1)^2}\Pi < 0.$$

This inequality holds under our assumptions of $\lambda > 1$ and $\phi \in (3/4, 1)$, noting that $\phi > \frac{3}{4} >$

$\frac{8(2\lambda-1)(3\lambda-1)}{(8\lambda-3)^2}$.

Considering that both the non-haven and the haven increases their welfare along with a gradual increase in t_M, world welfare must also increase as t_M rises. To prove $G_W^3 - G_W^0 > 0$, we show that, for all $\lambda > 1$ and $\phi \in (0,1)$, it holds that

$$G_W^3 - G_W^0\big|_{t_M=t_M^2} = \frac{\delta(\lambda-1)^2[(3\lambda-1)(14\lambda^2-15\lambda+3)-\phi(\lambda-1)^2(10\lambda-3)]}{2H(3\lambda-1)^2[3\lambda-1-\phi(\lambda-1)]^2}\phi\Pi > 0.$$

In Regime 3, the welfare levels of the non-haven, the haven, and the world all rise after the GMT introduction and they increase along with a gradual increase in the GMT rate.

Regime 4: $t_M \in (t_M^3, 1]$, where $t_M^3 = \frac{2\delta(\lambda-1)(8\lambda-3)}{H(3\lambda-1)(4\lambda-1)}$.

For the non-haven country, we see

$$G_n^4 - G_n^0\big|_{t_M=t_M^3} = \frac{\delta(\lambda-1)^2(8\lambda-3)^2}{2H(3\lambda-1)^2(4\lambda-1)}\phi\Pi > 0,$$

for $\lambda > 1$ and $\phi \in (0,1)$. Moreover, the marginal effect of the GMT is always positive: $\partial G_n^4/\partial t_M = (\lambda-1)\phi\Pi > 0$. With these observations and the fact that $G_n^4 - G_n^0$ is linear in t_M, we conclude that $G_n^4 - G_n^0 > 0$ for $t_M \in (t_M^3, 1]$.

For the haven country, we have

$$G_h^4 - G_h^0 = -\frac{\delta\lambda(\lambda-1)^2}{H(3\lambda-1)^2}\phi\Pi > 0,$$

which holds for $\lambda > 1$ and $\phi \in (0,1)$. The marginal effect of the GMT is zero: $\partial G_h^4/\partial t_M = 0$ for $t_M \in (t_M^3, 1]$. Combining these results leads to $G_W^4 - G_W^0 > 0$ and $\partial G_W^4/\partial t_M > 0$.

In Regime 4, the welfare levels of the non-haven and the world rise after the GMT introduction and they increase along with a gradual increase in the GMT rate. On the other hand, the welfare level of the haven declines after the GMT introduction and it is independent of t_M.

This proves Proposition 3 and a part of Proposition 4. The proof of the results on the regime-switching points is given in Appendix 3.

A.4. Regime-switching points

At the three regime switching GMT rates, t_M^1, t_M^2 and t_M^3, welfare in the non-haven, the haven, and the world changes as follows.

Change from Regime 1 to 2 at t_M^1

$$\begin{aligned} &G_n^2 - G_n^1\big|_{t_M=t_M^1} = G_W^2 - G_W^1\big|_{t_M=t_M^1} \\ &= -\frac{\delta(\lambda-1)^3[\lambda(3\lambda-1)(3\lambda-2)-\phi(\lambda-1)^2]}{2H(\lambda-1)[\lambda(3\lambda-1)-\phi(\lambda-1)^2]}(1-\phi)\Pi < 0, \\ &G_h^2 - G_h^1\big|_{t_M=t_M^1} = 0. \end{aligned}$$

Change from Regime 2 to 3 at t_M^2

$$G_n^3 - G_n^2\big|_{t_M=t_M^2} = G_h^3 - G_h^2\big|_{t_M=t_M^2} = G_W^3 - G_W^2\big|_{t_M=t_M^2} = 0.$$

Change from Regime 3 to 4 at t_M^3

$$G_n^4 - G_n^3\big|_{t_M=t_M^3} = 0,$$
$$G_h^4 - G_h^3\big|_{t_M=t_M^3} = G_W^4 - G_W^3\big|_{t_M=t_M^3} = -\frac{8\delta\lambda(\lambda-1)^2(2\lambda-1)}{2H(\lambda-1)[H(3\lambda-1)(4\lambda-1)^2]}(1-\phi)\Pi < 0.$$

This completes the proof of Proposition 4.

A.5. Proof of Proposition 5

The effects of an increase in the GMT coverage rate, ϕ, on welfare in the non-haven, the haven, and the world are given as follows.
Regime 1: $t_M \in (t_M^0, t_M^1]$, where $t_M^0 = \frac{\delta(\lambda-1)}{H(3\lambda-1)}$ and $t_M^1 = \frac{\delta(\lambda-1)(2\lambda-1)}{H[\lambda(3\lambda-1)-\phi(\lambda-1)^2]}$.

We see

$$\frac{\partial G_n^1}{\partial \phi} = 0, \quad \frac{\partial G_h^1}{\partial \phi} = 0, \quad \frac{\partial G_W^1}{\partial \phi} = 0.$$

Regime 2: $t_M \in (t_M^1, t_M^2]$, where $t_M^1 = \frac{\delta(\lambda-1)(2\lambda-1)}{H[\lambda(3\lambda-1)-\phi(\lambda-1)^2]}$ and $t_M^2 = \frac{2\delta(\lambda-1)(2\lambda-1)}{H[\lambda(3\lambda-1)-\phi(\lambda-1)^2]}$.

For the non-haven country, we see

$$\frac{\partial G_h^2}{\partial \phi} = \frac{\Theta_n[Ht_M(3\lambda-1)-\delta(\lambda-1)]}{2\delta H[3\lambda-1+\phi(\lambda-1)]^3}\Pi,$$
$$\Theta_n \equiv \phi[Ht_M(\lambda-1)(16\lambda^2-13\lambda+3)-\delta(\lambda-1)^2] + Ht_M(3\lambda-1)^2 + \delta(\lambda-1)(16\lambda^2-19\lambda+5).$$

The sign of the derivative is determined by that of Θ_n. From $\Theta_n(t_M = t_M^1) > 0$, $\Theta_n(t_M = t_M^1) > 0$, and the fact that $\Theta_n(t_M)$ is linear in t_M, it follows that $\Theta_n > 0$.

For the haven country, we see

$$\frac{\partial G_h^2}{\partial \phi} = \frac{\lambda\Theta_h[Ht_M(3\lambda-1)-\delta(\lambda-1)]}{\delta H[3\lambda-1+\phi(\lambda-1)]^3}\Pi,$$
$$\Theta_h \equiv \phi[Ht_M(\lambda-1)(5\lambda-3)-\delta(\lambda-1)^2] - Ht_M(3\lambda-1)^2 + \delta(\lambda-1)(5\lambda-3).$$

The sign of the derivative is determined by that of Θ_h. From $\Theta_h(t_M = t_M^1) < 0$, $\Theta_h(t_M = t_M^1) < 0$, and the linearity of $\Theta_h(t_M)$ in t_M, it follows that $\Theta_h < 0$.

For the world, we get

$$\frac{\partial G_W^2}{\partial \phi} = \frac{\Theta_W[Ht_M(3\lambda-1)-\delta(\lambda-1)]}{2\delta H[3\lambda-1+\phi(\lambda-1)]^3}\Pi,$$

$$\Theta_W \equiv \phi[Ht_M(\lambda-1)(2\lambda-1)(13\lambda-3)-\delta(\lambda-1)^2(2\lambda+1)] - Ht_M(3\lambda-1)^2(2\lambda-1) + \delta(\lambda-1)(26\lambda^2-25\lambda+5).$$

The sign of the derivative is determined by that of Θ_W. From $\Theta_W(t_M = t_M^1) > 0$, $\Theta_W(t_M = t_M^1) > 0$, and the linearity of $\Theta_W(t_M)$ in t_M, it follows that $\Theta_W > 0$.

Regime 3: $t_M \in (t_M^2, t_M^3]$, where $t_M^2 \equiv \frac{2\delta(\lambda-1)}{H[3\lambda-1-\phi(\lambda-1)]}$ and $t_M^3 = \frac{2\delta(\lambda-1)(8\lambda-3)}{H(3\lambda-1)(4\lambda-1)}$. We see

$$\frac{\partial G_n^3}{\partial \phi} = \frac{H(4\lambda-1)t_M^2}{8\delta}\Pi > 0, \quad \frac{\partial G_h^3}{\partial \phi} = -\frac{H\lambda t_M^2}{8\delta}\Pi < 0, \quad \frac{\partial G_W^3}{\partial \phi} = \frac{H(2\lambda-1)t_M^2}{4\delta}\Pi > 0,$$

Regime 4: $t_M \in (t_M^3, 1]$, where $t_M^3 = \frac{2\delta(\lambda-1)(8\lambda-3)}{H(3\lambda-1)(4\lambda-1)}$.

We get

$$\frac{\partial G_n^4}{\partial \phi} = \frac{(\lambda-1)[2Ht_M(3\lambda-1)^2-\delta(\lambda-1)(8\lambda-3)]}{2H(3\lambda-1)^2}\Pi > 0,$$

$$\frac{\partial G_h^4}{\partial \phi} = -\frac{\delta\lambda(\lambda-1)^2}{H(3\lambda-1)^2}\Pi < 0,$$

$$\frac{\partial G_W^4}{\partial \phi} = \frac{(\lambda-1)[2Ht_M(3\lambda-1)^2-\delta(\lambda-1)(10\lambda-3)]}{2H(3\lambda-1)^2}\Pi > 0,$$

noting that $t_M > t_M^3 > \frac{\delta(\lambda-1)(10\lambda-3)}{2H(3\lambda-1)^2} > \frac{\delta(\lambda-1)(8\lambda-3)}{2H(3\lambda-1)^2}$.

This completes the proof of Proposition 5.

Appendix B: Data for Figure 1

We select MNEs from the Orbis based on the following criteria.

- Global Ultimate Owner with foreign subsidiaries. The threshold ownership is 50.01%.
- C1: MNEs report only consolidated accounts, not unconsolidated accounts.

The numbers on which Figure 1 is based are given in Table B1. In column A, to calculate the pre-tax profits of all MNEs in a given year, we exclude those with missing revenues ("Operating revenue (Turnover)") and pre-tax profits ("P/L before tax"). In column B, MNEs subject to the GMT are those with annual revenues of no less than 750 million EUR in at least two years of the last four years. Using column A and B, column C reports the share of MNEs subject to the GMT in terms of pre-tax profits and numbers.

Table B1
MNEs in the Orbis database.

	A: All MNEs		B: MNEs $\geq$ 750mEUR		C: Share = B/A	
Year	Pre-tax profits	Number	Pre-tax profits	Number	Pre-tax profits	Number
2018	2320	8656	2066	2333	0.89	0.27
2019	2430	8416	2216	2437	0.91	0.29
2020	1985	7920	1793	2228	0.90	0.28
2021	3564	8803	3239	2627	0.91	0.30

Source: Orbis database, own calculations.

Note: Pre-tax profits are in billion EUR.

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