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Implications for Tax Competition

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A Global Minimum Tax for Large Firms Only: Implications for Tax Competition*

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Abstract

The Global Minimum Tax (GMT) is applied only to firms above a certain size threshold. We set up a simple model of tax competition and profit shifting by heterogeneous multinational firms to evaluate the effects of this partial coverage of the GMT. A non-haven and a haven country are bound by the GMT rate for large multinationals, but can set tax rates for firms below the threshold non-cooperatively. We show that the introduction of the GMT with a moderate tax rate increases tax revenues in both the non-haven and the haven countries. Gradual increases in the GMT rate, however, trigger a sudden change in the tax competition equilibrium from a uniform to a split corporate tax rate, at which tax revenues in the non-haven country decline. In contrast, gradual increases in the coverage of the GMT never harm the non-haven country. We also discuss the quantitative effects of introducing a 15% GMT rate in a calibrated version of our model.

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

JEL classification: F23, H25, H87

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1 Introduction

Profit shifting by multinational enterprises (MNEs) has long been a major problem for corporate taxation worldwide. According to estimates by Wier and Zucman (2022, Table 1), more than one third of all corporate profits of multinationals are shifted to tax havens.[1] 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, 2013a,b). A core development in this endeavor is the introduction of a global minimum tax (GMT), to be applied to large MNEs (OECD, 2020b,c). The GMT with a tax rate of 15% has been agreed upon by a group of more than 130 countries in 2021 (among them several tax havens), and most of these countries are expected to have the GMT enacted by 2026.[2] The global revenue gains from a 15% GMT are estimated to be in the range of 155-192 billion USD, or 6.5 to 8.1% of global corporate tax revenues (Hugger et al., 2024).[3]

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.[4] Figure 1 shows that, according to the Orbis database of Bureau van Dijk, about 30% of all multinational enterprises (MNEs), which are responsible for about 90% of all MNE profits, have consolidated accounts above this threshold and are therefore covered by the GMT.[5] Nevertheless, a substantial amount of MNE profits exceeding 300 billion EUR remains 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 is probably an upper bound of the

[1] Using macroeconomic data, Tørsløv et al. (2023) estimate the magnitude of profit shifting by MNEs in OECD countries, several developing non-OECD countries, and tax haven countries/territories in 2015. Wier and Zucman (2022) report updated estimates of Tørsløv et al. (2023).

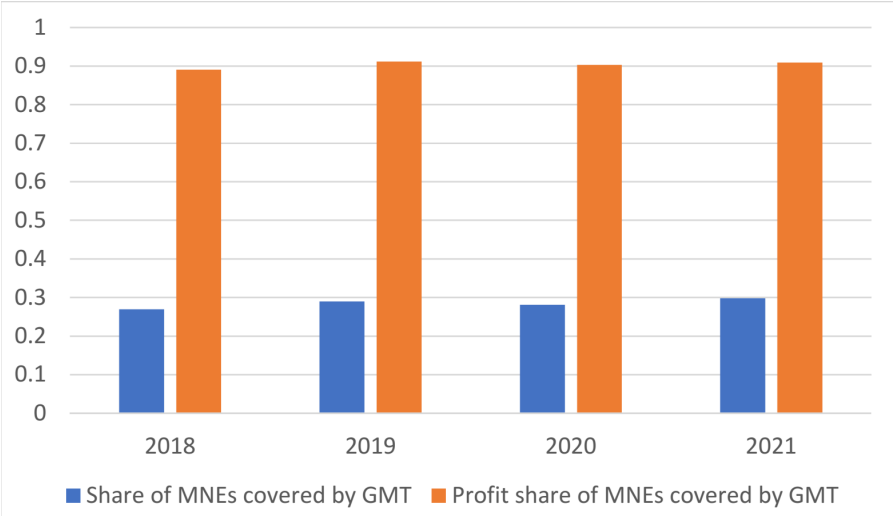
[2] The United States has already enacted, in its 2017 Tax Cuts and Jobs Act, a tax on Global Intangible Low-Tax Income (GILTI) that works in many respects like a GMT. See Clausing (2020).

[3] 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 50-60 billion EUR for the United States, and gains 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.

[4] 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*).

[5] 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, 2020b, # 505, p. 233). In practice, non-EUR countries express the 750 million EUR threshold value in their domestic currency using the average foreign exchange rate for the December month of the previous fiscal year (OECD, 2020a, p. 9).

Figure 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 exceeds 750 million EUR in at least two of the last four years out of all MNEs. See Data Appendix for details.

true profit share covered by the global minimum tax.

One implication of this incomplete coverage is that low-tax countries might respond to the introduction of the GMT by using a split (or "bifurcated") corporate tax system, where a lower tax rate applies to firms below the GMT threshold (Deloitte, 2021). 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.[6] Tax havens are fully aware of this option. Ireland, for example, has already decided to keep its general tax rate at 12.5%, but top up the tax rate to 15% for Irish affiliates of foreign-based MNEs (Department of Finance, 2023).

Against this background, this paper asks the following three questions. First, under which conditions will tax competition lead to discriminatory tax policies in either the non-haven or the haven countries? Second, is the introduction of the GMT revenue-increasing for non-haven and haven countries? And third, are small reforms of the GMT, given by either an increase in the tax rate or an increase in the coverage rate of the GMT, revenue-increasing for each of the countries involved, and for the world? To answer these, we build a simple two-country model where a non-haven country and a haven country compete for the profits of a heterogeneous set of multinational firms, which have agreed to implement the GMT with incomplete coverage. Both countries can decide to commit, in the first stage, to set the GMT rate for *all* its multinationals, or not. In the second

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

stage, if a country does not commit, it can either set a uniform tax rate above the GMT level, or split its tax rate and choose a lower rate for firms below the GMT threshold. In the third stage, multinationals take their profit-shifting choices.

Our analysis shows that the introduction of a partial GMT leads to a sequence of tax competition regimes between the haven and the non-haven. We show that if the GMT rate is binding for the tax haven, but still low enough, the tax haven 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, it is first the haven country and then also the non-haven country that do indeed split their tax rates in the non-cooperative tax equilibrium. At this regime-switching GMT rate, the non-haven country discretely loses tax revenues. Except at this rate, the non-haven always gains from gradual increases in the GMT rate, whereas the haven gains only for sufficiently low levels of the GMT, and loses revenue otherwise. Gradual increases in the coverage of the GMT have similar effects, with the important difference that they never reduce tax revenues in the non-haven country and in the world. These results suggest that even if both countries benefit from the introduction of a moderate GMT rate, conflicts of interest will arise once the GMT rate, or the GMT coverage, is increased.

In a final step, we calibrate our model using corporate tax rates and the estimates of profit shifting in a worldwide sample of countries (Tørsløv et al., 2023). In our calibrated economy, upon the introduction of the GMT, both the haven and the non-haven countries increase their single tax rate for all MNEs and gain more tax revenues. Any further increase in the GMT rate causes the haven country to lose tax revenues, however. Moreover, starting from a GMT rate of 18-19%, the haven country will start splitting its tax rate and impose a discretely lower tax rate on small multinationals not covered by the GMT. This in turn leads to a large loss for the non-haven country, equal to around 4% of its tax revenues from multinationals.

Our model contributes to the recent theoretical literature on the effects of introducing a GMT in tax competition. In a model with many non-haven and haven countries, Johannesen (2022) shows that the effects of introducing a GMT on welfare, i.e., the sum of tax revenues and capital income of residents, are fundamentally ambiguous for non-haven countries. This is because the increase in havens' tax rates due to the GMT raises tax revenues in the non-havens but lowers the profits of MNEs, and thus capital income, by limiting the scope of profit shifting. 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 17-20% 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. 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 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 they 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, in 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 mobile, multinational firms – increases 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 Nash equilibria that result in different tax regimes. Section 3 then turns to the revenue 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 tax-haven country, indexed by h. There are a large number of heterogeneous, multinational enterprises (MNEs), each having an affiliate both in the non-haven and in the haven. The

[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).

affiliate 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 country, and this is where the "true" profits accrue in its entirety. MNEs can shift a share $\theta \in [0, 1]$ of their non-haven affiliate's profits to their haven affiliate, in order to maximize their post-tax profits.[8]

We assume that both countries' objective is to maximize tax revenues. This is a standard assumption in models of corporate tax competition, and it is motivated by the specific focus on tax revenue increases in non-haven countries that underlies the GMT proposal (see footnote 3). We assume that both countries have signed the GMT agreement, and are therefore bound to set a tax rate no smaller than 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."

Since the GMT is prescribed as a minimum tax for large firms, it becomes a reference point for countries' tax-setting. Specifically, it allows both countries to commit to the tax rate set by the GMT, and doing so for *all* MNEs, not only for the large ones.[10] Thus, the tax competition game in our model has three stages. In the first stage, the non-haven and haven countries simultaneously choose whether to commit to the GMT rate for *all* MNEs, or not. In the second stage, the country that commits to the GMT in the prior stage sets the GMT rate, whereas the country that does not commit either sets a single non-GMT rate for all MNEs (which has to be no smaller than the GMT rate to be permitted), or it sets different tax rates for large and small MNEs. In the final stage, MNEs engage in profit shifting, given the tax rates in the two countries. 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.

[8]This is the simplest possible setting for profit shifting, and sufficient for our purposes. See e.g., 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 individual 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.

[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).

2.2 Profit shifting by multinationals

MNEs shift a share θ of their profits π from their non-haven affiliate to the haven affiliate, while bearing transaction costs. The latter 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 profit-shifting costs C are convex and, for analytical simplicity, quadratic in the level of profit-shifting, $\theta\pi$. Higher total profits make it easier, however, to hide a given amount of profit-shifting.[11] Therefore, the total shifting costs for a firm with profits π are $C(\pi) = (\theta\pi)^2/\pi = \theta^2\pi$. A MNE that maximizes its global after-tax profits given the tax rates t_n and t_h in the non-haven and the haven country respectively, then faces the following problem:

$$\max_{\theta} (1 - t_n)(1 - \theta)\pi + (1 - t_h)\theta\pi - \frac{\delta\theta^2\pi}{2}, \tag{1}$$

where $\delta > 0$ is an exogenous cost parameter that captures the ease with which profits can be shifted across countries. This parameter incorporates, in particular, any efforts that countries take to prevent profit-shifting, such as the newly enacted country-by-country documentation requirements.[12] The MNEs' optimal choice of θ is then:

$$\theta = \frac{t_n - t_h}{\delta}, \tag{2}$$

which is independent of π and therefore holds for all MNEs simultaneously.[13]

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) in (1), the tax base of a MNE with profits π in the non-haven country is $TB = [1-(t_n-t_h)/\delta]\pi$. This yields a tax base elasticity of an individual MNE in the non-haven country such that $\varepsilon_n = -\frac{dTB_n/TB_n}{dt_n/t_n} = \frac{t_n}{\delta-(t_n-t_h)}$, which is independent of π.

It seems safe to say that the relationship between the size of firms and their responsiveness to tax is inconclusive. Media coverage of tax avoidance by gigantic 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, e.g., Devereux et al., 2014; Coles et al., 2022; Auliffe et al., 2023). Therefore, assuming that the tax base elasticity is independent of firm size may

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

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

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

be considered a useful and not unrealistic benchmark. The assumption that the tax base elasticity is independent of the size of MNEs implies that there is no reason *per-se* for countries to 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* maximization problem of the two countries in the absence of a GMT. In this case, the non-haven country n maximizes

$$\max_{t_n} \; G_n = \int_{\underline{\pi}}^{\infty} t_n(1-\theta)\pi dF = t_n(1-\theta)\Pi,$$

where $\Pi \equiv \int_{\underline{\pi}}^{\infty} \pi dF$ are the total profits (before shifting) earned by all MNEs in country n. Analogously, the tax-haven country h maximizes

$$\max_{t_h} \; G_h = \int_{\underline{\pi}}^{\infty} t_h\theta\pi dF = t_h\theta\Pi,$$

where the assumption of equal tax base elasticities for all MNEs implies that tax revenues depend only on the aggregate before-shifting profits of MNEs, but not on the profit distribution across firms.

Using the profit-shifting choices of MNEs in (2), we obtain the first-order conditions of the two countries as follows:

$$\frac{\partial G_n}{\partial t_n} = \left(1 - \frac{t_n - t_h}{\delta}\right)\Pi - \frac{t_n}{\delta}\,\Pi = 0, \qquad \frac{\partial G_h}{\partial t_h} = \left(\frac{t_n - t_h}{\delta}\right)\Pi - \frac{t_h}{\delta}\,\Pi = 0,$$

where the first term in each FOC is the mechanical effect of increasing the tax rate on a given tax base, whereas the second term is the behavioral effect due to changes in the tax base that arise from the MNEs profit-shifting choices.

Solving the first-order conditions of the two countries yields best response functions:[14]

$$t_n = \frac{t_h + \delta}{2} \;\text{ for } \pi \in [\underline{\pi}, \infty), \qquad t_h = \frac{t_n}{2} \;\text{ for } \pi \in [\underline{\pi}, \infty). \tag{3}$$

Equilibrium taxes are then

$$t_n^0 = \frac{2\delta}{3} \;\text{ for } \pi \in [\underline{\pi}, \infty), \qquad t_h^0 = \frac{\delta}{3} \;\text{ for } \pi \in [\underline{\pi}, \infty), \tag{4}$$

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

and equilibrium tax revenues are

$$G_n^0 = \frac{4\delta}{9}\,\Pi, \qquad G_h^0 = \frac{\delta}{9}\,\Pi. \tag{5}$$

The superscript 0 represents the unconstrained equilibrium, which we call Regime 0. Regime 0 also emerges as an equilibrium in a world with a GMT, if the GMT rate is lower than *both* tax rates given in (4), and hence non-binding.

This benchmark equilibrium has the usual properties. A tax haven without an independent tax base will choose one-half of the tax rate of the large country, and both tax rates are rising in the cost parameter of profit shifting, δ. To ensure that the non-haven's unconstrained tax rate is below unity, we need to restrict the cost parameter for profit shifting. Hence we assume $\delta < 3/4$ in the following.[15] Finally, substituting the equilibrium tax rates in (4) back into the multinationals' first-order condition (2) gives

$$\theta^0 = \frac{t_n^0 - t_h^0}{\delta} = \frac{1}{3}.$$

The property of our model that, in the unconstrained tax equilibrium, all multinationals shift one-third of their profits to the tax haven makes our model particularly simple to work with. At the same time, this share of shifted profits is quite close to empirical estimates of profit shifting, as we will see in Section 4.

Our results for the benchmark equilibrium are summarized as follows.

Proposition 1 (Regime 0: Unconstrained tax equilibrium without GMT)

Consider a tax-competition game between the non-haven and haven country in the absence of a GMT and assume $\delta < 3/4$. In the tax-competition equilibrium, each country sets a single unconstrained maximizing tax rate for all MNEs with $\pi \in [\underline{\pi}, \infty)$ given by (4).

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 GMT rate, labelled t_M, for all MNEs. This gives rise to four possible combinations of commitment choices, which are shown in Table 1. For example, $G_i(C, N)$ stands for the total tax revenues of country $i \in \{n, h\}$ when the non-haven country n chooses to commit and the haven country h does not. One can immediately see that the combination (C, C) (both countries commit) can never occur in equilibrium.

[15] From (4) the condition for $t_n^0 < 1$ is $\delta < 3/2$. In the course of our analysis, we need the stricter condition $\delta < 3/4$, however, to ensure that all possible equilibrium regimes can emerge. See the discussion of Proposition 2 below.

This is because these first-stage choices would lead to a zero tax difference between the two countries and zero tax revenues for the haven. Therefore, the haven always has an incentive to deviate from (C, C). Finally, we assume that countries choose to commit, if the commitment choice does not make any difference to their revenues.

Table 1: Payoff matrix of the commitment game

Non-haven	**Haven**	
	Not commit	Commit to GMT
Not commit	$G_n(N,N), \quad G_h(N,N)$	$G_n(N,C), \quad G_h(N,C)$
Commit to GMT	$G_n(C,N), \quad G_h(C,N)$	—

The two countries choose their tax rates in the second stage. If they do not commit to a single GMT in the first stage, they may either set a single non-GMT rate for all MNEs, or set different rates for MNEs of different size. 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 rate* of the GMT:

$$\phi \equiv \frac{\int_{\pi_M}^{\infty} \pi dF}{\int_{\underline{\pi}}^{\infty} \pi dF} = \frac{\int_{\pi_M}^{\infty} \pi dF}{\Pi}, \tag{6}$$

which is exogenously given. Once the tax rates in both countries $i \in \{n, h\}$ are determined, the MNEs choose their levels of profit shifting from (2).

Let us first state the full characterization of the sub-game perfect Nash equilibrium of the three-stage tax competition game, before commenting on each regime. It is immediate to see that if t_M is lower than the haven's unconstrained rate $t_h^0 = \delta/3$, the GMT has no effect on either country's decision and Regime 0 emerges. Thus Proposition 2 below starts from $t_M \geq t_M^0 \equiv t_h^0 = \delta/3$. As t_M is continuously increased from t_h^0 to unity, the tax competition equilibrium passes through four different regimes.

Proposition 2 (Equilibrium regimes with binding GMT)

Consider a GMT rate such that $t_M \geq t_M^0 \equiv \delta/3$ with $\delta < 3/4$. As t_M is continuously increased, the tax-competition equilibrium is characterized by the following four regimes:

(i) Regime 1: $t_M \in [t_M^0, t_M^1 \equiv 2\delta/3)$. The non-haven sets a single unconstrained revenue-maximizing tax rate and the haven commits to a single GMT rate:

$$t_n^1 = \frac{t_M + \delta}{2} \quad \text{for } \pi \in [\underline{\pi}, \infty), \qquad t_h^1 = t_M \quad \text{for } \pi \in [\underline{\pi}, \infty).$$

(ii) Regime 2: $t_M \in \left(t_M^1, t_M^2 \equiv \delta\left[1 - \frac{1}{3}\sqrt{\frac{2(1-\phi)}{2-\phi}}\right]\right)$. *Both the non-haven and the haven split their tax rates and the non-haven chooses a tax rate in excess of* t_M *for large MNEs:*

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

(iii) Regime 3: $t_M \in [t_M^2, t_M^3 \equiv 4\delta/3]$. *The non-haven commits to a single GMT and the haven splits its tax rate:*

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

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

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

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*.

In Regime 1, where t_M is rising above t_M^0, the haven's unconstrained maximizing rate $t_h^0 = t_M^0$ falls short of t_M and the haven is forced to set t_M for large MNEs. By contrast, the non-haven's unconstrained rate is still above the GMT, so that the non-haven is not bound by the GMT. Therefore, the non-haven will choose not to commit to the GMT in this regime, and the first-stage equilibrium is determined only by the haven's commitment choice. The latter affects only tax revenues from small MNEs, since the haven must set t_M for large MNEs, regardless of whether it commits. Given the non-haven's non-commitment, the haven's total revenues when it commits and those when it does not are respectively,

$$\begin{aligned} G_h(N, C) &= t_M \left(\frac{(t_M + \delta)/2 - t_M}{\delta}\right)(1 - \phi)\Pi \quad + t_M \left(\frac{(t_M + \delta)/2 - t_M}{\delta}\right)\phi\Pi, \\ G_h(N, N) &= \frac{\delta}{3}\left(\frac{2\delta/3 - \delta/3}{\delta}\right)(1 - \phi)\Pi \qquad\quad + t_M \left(\frac{(t_M + \delta)/2 - t_M}{\delta}\right)\phi\Pi, \end{aligned} \tag{7}$$

where we have substituted the non-haven's tax rate on small MNEs in the second stage

from its best response function (3).

The second term in each function $G_h(N,\cdot)$ are tax revenues from large MNEs, which are independent of the haven's commitment choice. What matters for the haven is therefore the first term, i.e., tax revenues from small MNEs. In Regime 1, we see from (7) that $G_h(N,C) - G_h(N,N) \geq 0$ and the haven will obtain more revenues, if it commits. The reason is that this induces the non-haven to set a higher tax rate for small MNEs, $(t_M + \delta)/2 > 2\delta/3$. In response to the haven's commitment, the non-haven will in turn also choose a uniform tax rate that exceeds its unconstrained level.

In Regime 2, where $t_M > t_M^1 \equiv 2\delta/3$, the GMT becomes binding for the non-haven country as well. In contrast to Regime 1, the level of the GMT in this regime is high enough that commitment by the haven would reduce the tax differential between the two countries and thus shifted profits to the haven significantly. Thus, non-commitment becomes the dominant strategy for the haven country, i.e., $G_h(N,C) - G_h(N,N) < 0$, and the haven undercuts the GMT for small MNEs. For the non-haven, the trade-off is then to either commit and set t_M for all MNEs, or not to commit and set a tax rate in excess of the GMT, $t_n = (t_M + \delta)/2 > t_M$, for large MNEs, but a tax rate below the GMT, $t_n = 2\delta/3 < t_M$, for small MNEs. At the moderate level of the GMT in this regime, the non-haven can gain more revenues by exceeding the GMT for large MNEs, and thus chooses not to commit, $G_n(N,N) > G_n(C,N)$. The upper boundary of Regime 2, t_M^2, is rising in the GMT coverage rate, ϕ, and thus Regime 2 holds for a wider range of t_M, as a higher coverage rate makes revenue gains from large MNEs more important.

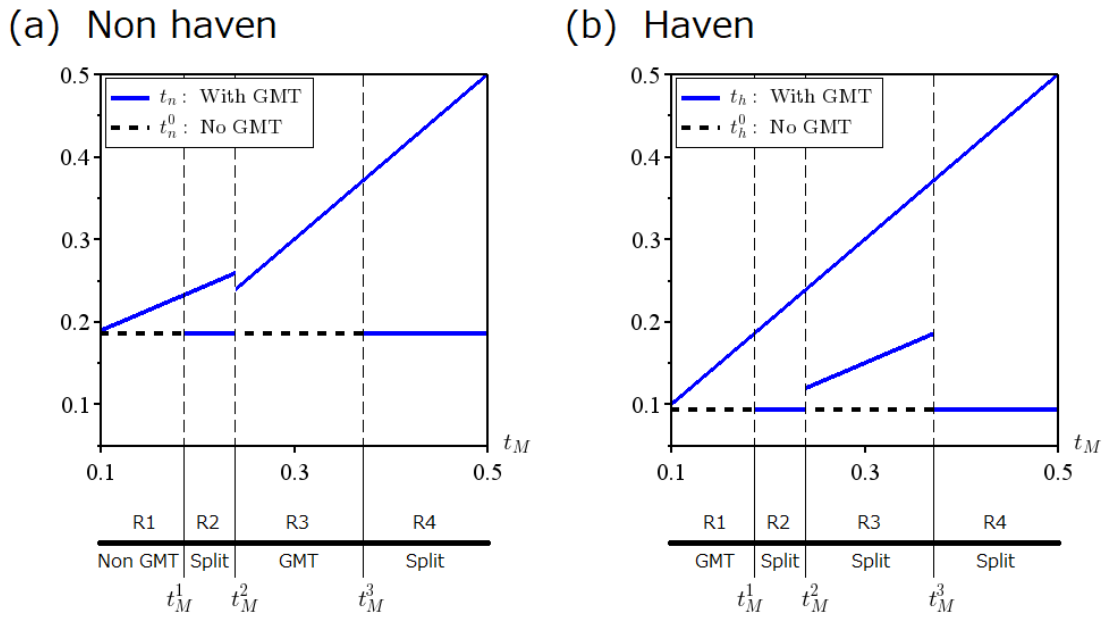
In Regime 3, where $t_M > t_M^2 \equiv \delta\left[1 - \frac{1}{3}\sqrt{\frac{2(1-\phi)}{2-\phi}}\right]$, the haven continues to undercut the GMT for small MNEs. For the non-haven, however, the GMT is now so close to its tax rate for large MNEs under non-commitment, $t_n = (t_M + \delta)/2$, that committing to the GMT causes few revenue losses for large MNEs. The non-haven will therefore benefit from committing, and $G_n(C,N) \geq G_n(N,N)$, as this induces the haven to set a higher tax rate for small MNEs. Hence commitment serves the same purpose for the non-haven in this regime, as it does for the haven in Regime 1.

Finally, in Regime 4, where $t_M > t_M^3 \equiv 4\delta/3$, the international tax differential for small MNEs becomes very large, if the non-haven keeps its commitment to the GMT.[16] To avoid large tax base losses from small MNEs, the non-haven therefore abandons its commitment and undercuts the GMT for small MNEs, $G_n(N,N) > G_n(C,N)$. Again, this argument is analogous to the argument for the haven to end its commitment in Regime 2. In equilibrium, both countries split their tax rates and set their unconstrained tax rates for small MNEs, while adhering to the GMT for large MNEs.

The sequence of regime-specific equilibria for different values of t_M is shown graphically

[16] Excluding tax rates above unity, Regime 4 can only occur when $\delta < 3/4$. This is the reason for imposing this constraint from the start of our analysis (see footnote 15).

Figure 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). Parameter values are $(\phi, \delta) = (0.9, 0.279)$ given in Table 2, but they do not affect the qualitative behavior. The horizontal axis is the exogenous GMT rate starting from $t_M = 0.1$ above $t_M^0 = \delta/3 = 0.093$. The solid curve in each panel is the equilibrium rate in the corresponding equilibrium regimes; the dotted horizontal line is the unconstrained equilibrium rate in Regime 0.

in Figure 2, where the solid curves give the tax rate(s) in the tax-competition equilibrium, and the dotted curve gives the unconstrained equilibrium tax rate t_i^0. Tax rates in both countries generally tend to rise as the GMT increases, but there are distinct patterns in the different regimes. At the switch from Regime 1 to Regime 2, the non-haven country splits its tax rate and its tax rate for small MNEs drops discontinuously. At the switch from Regime 2 to Regime 3, the non-haven returns to a single tax rate, but this implies that its tax rate for large MNEs falls discontinuously. Finally, in Regime 4, the non-haven once again splits its tax rate, leading to a discontinuous fall in the tax rate for small MNEs. In contrast, the haven country adheres to the GMT in taxing large MNEs in all regimes. From Regime 2 onward, however, the haven splits its tax rate and charges a lower tax for small MNEs. In Regimes 2 and 4, this tax rate corresponds to the unconstrained tax rate $t_h^0 = \delta/3$, whereas in Regime 3 it is above t_h^0, in response to the non-haven's commitment.

3 Revenue effects of the GMT

3.1 Introduction of the GMT

Having fully described the tax-competition equilibrium in each regime, we can now turn to the effects that introducing the GMT has on tax revenues in the two countries. We first compare revenues in the tax-competition equilibrium to those in the unconstrained equilibrium, Regime 0. This is summarized in:

Proposition 3 (GMT introduction)

Consider the tax-competition equilibrium with GMT, as summarized in Proposition 2, 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 tax revenues in the non-haven country for all Regimes 1 to 4.

(ii) a rise in tax revenues in the haven country for Regime 1, but a fall in tax revenues for Regimes 2 to 4.

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

Proof: See Appendix A.2.

The intuition for Proposition 3 is straightforward for the non-haven country. Since the GMT is first binding for the haven and pushes this country's tax rate upward in Regime 1, the non-haven will necessarily gain from a GMT that affects only the other country. In Regimes 2 to 4, the haven splits its tax rate, but it is still bound by the GMT for large MNEs. Therefore the non-haven always has an option to set t_M for large MNEs, and the unconstrained tax rate, $t_n^0 = 2\delta/3$, for small MNEs. This clearly benefits the non-haven because it cannot lose tax base through the profit shifting of its large MNEs, whereas the competition for small MNEs is the same as in Regime 0. This is indeed the outcome in Regime 4. In Regimes 2 and 3 the non-haven deviates from this policy by choosing a tax rate above the GMT for large MNEs in Regime 2, or by committing to set the GMT also for small MNEs in Regime 3. However, the non-haven will only do so if these deviations offer additional tax revenue, relative to the "default policy" chosen in Regime 4. Therefore, the non-haven must gain from introducing a GMT in all of Regimes 1 to 4, relative to Regime 0, and for all levels of $\phi \in (0, 1)$.

Matters are different for the haven country. In Regime 1, the haven is forced to increase the tax rate for large MNEs and, by the haven's own commitment, also for small MNEs. This commitment by the haven raises in turn the uniform tax rate levied by

the non-haven. Effectively, the GMT works as a coordination device in Regime 1 and it increases tax rates in both countries from their inefficiently low levels in the benchmark of Regime 0. Therefore, the haven will also gain from the introduction of the GMT in Regime 1.

For higher levels of the GMT, however, the haven will lose revenues. This is most obvious in Regime 4, where both countries set the GMT for large MNEs, and choose their unconstrained tax rate for small MNEs. In this regime, the haven still secures positive tax revenues from underbidding the non-haven for small MNEs, but these revenues must be strictly less than those in Regime 0 because only a fraction $(1-\phi)$ of the total aggregate profits is subject to this tax competition. In Regimes 2 and 3, the haven loses revenues for a different reason. In both regimes, the international tax differential for large MNEs is smaller than in Regime 0, implying that less profits are shifted to the haven. When the GMT coverage rate is sufficiently large, so that $\phi \in (3/4, 1)$, this revenue loss from large MNEs is the dominant effect for the tax haven.

Finally, the gains to the non-haven exceed the losses to the haven country in all regimes where the effects are counteracting. Therefore, the GMT introduction results in higher aggregate (worldwide) tax revenues in all regimes, and for all coverage rates ϕ.

Overall, our results in Proposition 3 show that the interests of haven and non-haven countries are aligned only in Regime 1, where t_M is only slightly above t_h^0. In the remaining Regimes 2 to 4, there is a conflict of interests between the two countries, in the sense that the non-haven benefits from the introduction of a higher GMT, whereas the haven country loses.[17] To evaluate the revenue effects of the GMT, and the incentives that havens have to agree to its introduction, it is therefore critical to determine which regime is induced by the current GMT rate of 15%. We will analyze this issue for a calibrated economy in Section 4. Before doing so, however, it is also relevant to analyze the effects of two more gradual reforms, increases in the GMT rate t_M, and in the GMT coverage rate ϕ. Both are likely reform options after the GMT has been introduced.

3.2 Gradual reform I: increasing the GMT rate

The effects of a marginal increase in the GMT rate can be summarized as follows:

Proposition 4 (Gradual reform: increasing GMT rate t_M)

Consider the tax-competition equilibrium with GMT, as summarized in Proposition 2, and assume the GMT coverage rate is not too low such that $\phi \in (1/4, 1)$. A marginal increase

[17] This conflict of interest does not exist 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. The reason is that Johannesen (2022) models many identical tax havens that are in Bertrand competition with each other. 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.

in the GMT rate has the following effects:

(i) tax revenues in the non-haven country strictly increase in all regimes, except at the first regime-switching point, t_M^1, where they discretely fall.

(ii) tax revenues in the haven country increase in Regime 1 as long as $t_M < \delta/2$, then decrease in the remainder of Regime 1 and in Regime 2, then rise in Regime 3, and are zero in Regime 4. Marginal revenues in the haven discretely fall at the last two regime-switching points, t_M^2 and t_M^3.

(iii) tax revenues in the world strictly increase within all regimes, but fall at the three regime-switching points, t_M^1, t_M^2 and t_M^3.

Proof: See Appendix A.3.

As is true for the introduction of the GMT (Proposition 3), the non-haven generally gains from a gradual increase in the GMT rate t_M. In Regimes 1 and 2, this is because the non-haven's equilibrium tax rate is rising in t_M while the international tax differential for large MNEs simultaneously narrow, so that fewer profits are shifted to the tax haven. In Regimes 3 and 4, where the tax differential for large MNEs is zero, raising t_M without inducing large MNEs to shift profits to the haven must benefit the non-haven.[18]

An interesting discrete drop in the non-haven's revenue occurs, however, at the first regime-switching point t_M^1. At this point, the haven country changes its behavior from committing to the GMT for all MNEs to splitting its tax rate for large vs. small MNEs. This intensifies competition for small MNEs and thus discontinuously reduces both the tax base and the tax rate for small MNEs in the non-haven country.

For the haven country, the marginal effects of t_M display several non-monotonicities. In Regimes 1 and 2, there are two fundamentally counteracting effects as a higher t_M raises the tax rate levied by the haven on large MNEs, but at the same time fewer profits are shifted to the tax haven. In the first part of Regime 1, for $t_M \in [t_M^1, \delta/2)$, the positive first effect dominates and the haven benefits from an increased level of t_M. This pattern is reversed, however, in the remaining part of Regime 1, where $t_M \in [\delta/2, t_M^2]$, and also in Regime 2. In Regime 3, where the non-haven commits, a higher t_M widens the tax differential for small MNEs, leading to increased tax revenues in the haven country. Finally, in Regime 4, the haven's revenues are independent of t_M, as the haven's tax base is zero for large MNEs, whereas tax rates on small MNEs are unaffected by t_M.

Moreover, the haven country discretely loses tax revenues at the regime-switching points t_M^2 and t_M^3, where its opponent changes its behavior. At t_M^2, the non-haven starts

[18] In Regime 3, the international tax differential for small MNEs widens and the non-haven may earn less revenues from them as t_M rises. For revenue gains from large MNEs to dominate, the coverage share of the GMT, ϕ, must exceed 1/4. This condition is clearly fulfilled for the existing GMT, as we see in Figure 1.

committing to t_M for all MNEs and therefore shuts down the profit shifting of large MNEs. At t_M^3 the non-haven stops committing to the GMT rate, fueling competition for small MNEs.

Taking the results of the two countries together, the effect of marginal increases in t_M on worldwide tax revenues are dominated by the effects on the non-haven country, and are therefore positive. The negative, discontinuous effects at the regime-switching points are caused by the non-haven at t_M^1, and by the haven country at t_M^2 and t_M^3. We will illustrate these results in our quantitative analysis in Section 4.

3.3 Gradual reform II: increasing GMT coverage

Finally, we analyze the marginal effect of the GMT coverage rate ϕ while keeping the GMT rate t_M fixed. As shown in (6), 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 5 (Gradual reform: increasing GMT coverage rate ϕ)

Consider the tax-competition equilibrium with GMT, as summarized in Proposition 2. A marginal increase in the GMT coverage rate of $\phi \in (0,1)$ has the following effects:

(i) tax revenues in the non-haven country are unaffected in Regime 1 and strictly increase in Regimes 2 to 4;

(ii) tax revenues in the haven country are unaffected in Regime 1 and strictly decrease in Regimes 2 to 4, except at the regime-switching point t_M^2, where they discretely rise.

(iii) world tax revenues are unaffected in Regime 1 and strictly increase in Regimes 2 to 4.

Proof: See Appendix A.4.

In Regime 1, an increase in ϕ has no effect on revenues in either country, because both 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, meaning less presence of small MNEs, reduces aggregate profit shifting. This unambiguously hurts the haven and benefits the non-haven. From the global perspective, more GMT coverage is always desirable, as it reduces pressure on tax competition for the profits of small MNEs.

There is one situation, however, in which the haven can gain from a higher ϕ. Suppose that t_M is slightly above $t_M^2 = \delta\left[1 - \frac{1}{3}\sqrt{\frac{2(1-\phi)}{2-\phi}}\right]$ and the equilibrium is in Regime 3. The

non-haven reacts to an increase in ϕ by stopping to commit to a single GMT, leading to an equilibrium switch to Regime 2 (as $dt_M^2/d\phi > 0$). In Regime 2, the non-haven's optimal tax rate for large MNEs rises above the GMT and this in turn increases profit shifting to the haven.

In summary, Proposition 5 shows that changes in the GMT coverage rate ϕ have opposing revenue effects in non-haven and haven countries in Regimes 2 to 4, but not in Regime 1. This underscores our findings from Propositions 3 and 4 that mutual gains both from the introduction of the GMT and from gradual increases in the GMT rate can only arise in Regime 1. However, one notable difference between the two gradual reforms is that a higher ϕ never harms the non-haven country and the world. We now turn to the issue of which regime we can expect for the currently imposed GMT rate.

4 Quantitative implications

In this section we analyze a calibrated version of our model, and explore its quantitative revenue effects. We calibrate our benchmark model without GMT to match basic data on international profit shifting. We set the total pre-tax profits of MNEs (Π) to $2,590$ billion USD, as reported in Tørsløv et al. (2023). The coverage rate of the GMT is set at $\phi = 0.9$, in accordance with OECD (2020b) and our own calculations from the ORBIS database (see Table B.1 in the appendix). 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). Table 2 reports calibration results. Among the non-targeted moments, our calibration arrives at a share of shifted profits of 33.3%, which closely matches the share of shifted profits in the data (37.4%), as reported in Tørsløv et al. (2023). Our model somewhat underestimates the haven tax rate and the aggregate revenue loss in the non-haven countries, as compared to their corresponding values in the data.

Figure 3 shows the effects of introducing a GMT at various tax rates t_M for this calibrated version of our model. The figure shows both the resulting tax regimes and the equilibrium tax revenues for both non-haven and haven countries, as compared to the level of tax revenues in the unconstrained tax-competition equilibrium (G_i^0). The most important result is that the introduction of the GMT with a tax rate of 15% leads to a tax equilibrium in Regime 1. In this regime, the tax haven finds it profitable to commit to the GMT rate for *all* MNEs; see Proposition 2(i). Also, both countries will gain from the introduction of the GMT, as stated in Proposition 3. In fact, panel (b) in Figure 3 shows that a 15% GMT rate is very close to the haven country's global (i.e., regime-independent) revenue maximum in our calibrated model.

The calibrated revenue gain of a 15% GMT rate is around 106 billion USD for the non-

Table 2: Calibration of the model

Parameter		Source
$\Pi = 2,590$bUSD	Total pre-tax profits of MNEs	Tørsløv et al. (2023)
$\phi = 0.9$	Profit share of MNEs covered by GMT	OECD (2020b) / Orbis
$\delta = 0.279$	Cost of profit shifting	Calibrated

Targeted moment	Model	Data	Source
Corp. tax rate of non-haven: $t_n = 2\delta/3$	18.6%	18.6%	Tørsløv et al. (2023)

Non-targeted moment	Model	Data	Source
Corp. tax rate of haven: $t_h = \delta/3$	9.3%	13.7%	Tørsløv et al. (2023)
Share of MNE's shifted profits: θ	33.3%	37.4%	Tørsløv et al. (2023)
Non-haven's revenue loss: $t_n\theta\Pi$	161bUSD	247bUSD	Tørsløv et al. (2023)

Notes: Data are from 2019. Definition of non-haven and haven countries follow Tørsløv et al. (2023). The non-haven countries are 30 OECD and 7 major developing countries. There are 40 haven countries across the world. The corporate tax rate of the non-haven and haven countries is a GDP-weighted average of effective tax rates.

haven and 10 billion USD for the haven country. These values do not depend on specific values of the coverage rate ϕ, since both countries optimally set a uniform tax rate across all MNEs in Regime 1. This implies that worldwide tax revenues, $G_W \equiv G_n + G_h$, increase by 116 billion USD.[19] The quantitative revenue estimates of introducing a 15% GMT are summarized in Table 3.

Table 3: Quantitative effects of introducing a 15% GMT

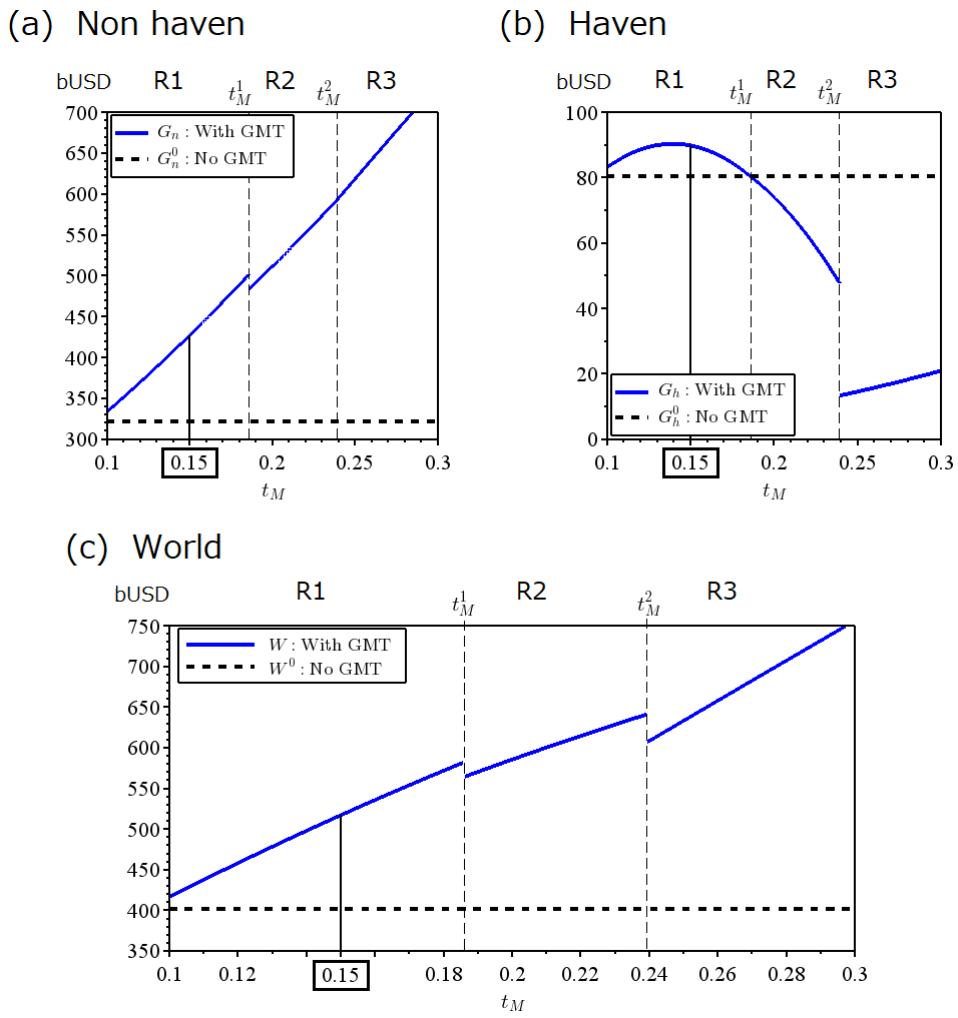
	Non-haven	Haven	World
Tax rate before GMT introduction	18.6%	9.3%	—
Tax rate after GMT introduction	21.4%	15%	—
Revenue change in bUSD (% change)	106 (33.0%)	10 (11.8%)	116 (28.7%)

Note: Results are based on the calibrated parameter values described in Table 2.

Further marginal increase in the GMT rate beyond 15% will, however, not benefit the haven country. As is shown in panel (b) of Figure 3, this fall in tax revenues for the haven country continues until $t_M = t_M^1 = 0.186$. When t_M exceeds this level, the tax equilibrium

[19]This compares with estimated revenue gains for the EU countries of 55 billion EUR by Baraké et al. (2022), and OECD estimates of global revenue gains in the range of 155-192 billion USD (Hugger et al., 2024). 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 there are no domestic firms in our model.

Figure 3: Quantitative effects of introducing the GMT



Notes: The figure shows tax revenues in the non-haven (a), the haven (b), and the world (c). Worldwide revenues are the sum of those in the two countries, $G_W \equiv G_n + G_h$. Parameter values are from Table 2. The horizontal axis is the exogenous GMT rate and the vertical axis is tax revenues in billion USD. The solid curve in each panel is tax revenues in the corresponding equilibrium regimes; the dotted horizontal line is tax revenues in Regime 0.

switches from Regime 1 to Regime 2. As stated in Proposition 3, this regime switch is associated with a discrete loss in tax revenues in the non-haven country and in the world. The reason is that at this regime-switching rate t_M^1, the haven country starts splitting its tax rate and discretely reduces the tax rate for small MNEs. Specifically, the haven country's tax rate for small MNEs falls from $t_M^1 = 18.6\%$ to $t_h^0 = 9.3\%$ (the unconstrained tax rate). As a result of the increased competition from the haven, the non-haven also reduces its tax rate on small MNEs from 23.2% to 18.6%.

The revenue implications of this discontinuous change from Regime 1 to Regime 2 are summarized in Table 4 for different levels of the GMT coverage rate ϕ. While ϕ does not

affect the regime-switching rate t_M^1, it affects the quantitative implications of the switch. In general, a lower ϕ puts more emphasis on competition for small MNEs in Regime 2, and thus leads to a greater revenue loss for the non-haven country and for the world.

Table 4: Quantitative effects of switch from Regime 1 to Regime 2

GMT coverage rate: ϕ	80%	85%	90%
GMT rate at regime switch: $t_M^1 = 2\delta/3$	18.6%	18.6%	18.6%
Revenue change in non-haven (bUSD, %)	−36 (−7.7%)	−27 (−5.7%)	−18 (−3.7%)
Revenue change in haven (bUSD)	0	0	0
Total revenue change (bUSD, %)	−36 (−6.2%)	−27 (−4.6%)	−18 (−3.1%)

Note: Results are based on the calibrated parameter values in Table 2 other than ϕ.

To summarize, the revenue effects of the current GMT at a rate of 15% turn out to be rather favorable in our calibrated model. This is because the GMT rate is low enough to lead to a Regime 1 equilibrium where the haven country chooses to commit to the GMT rate for all MNEs including small ones not covered by the GMT agreement. In response, the uniform tax rate levied by the non-haven country is also increased beyond its unconstrained tax rate. The introduction of the GMT therefore acts as a coordination device between the non-haven and the haven county and both gain substantial amounts of tax revenues in the resulting Regime 1 equilibrium. However, all further increases in the GMT rate will harm the haven country. Moreover, a moderate 3.6 percentage point increase in the GMT rate to a level of 18.6% would trigger a splitting tax schedule in the haven, resulting in non-negligible revenue losses in the non-haven country and in the world. These results are similar to the quantitative evaluation of the GMT by Hebous and Keen (2023), where GMT rates up to 17-20% generate Pareto improvements for both non-haven and haven countries. However, the abrupt switch to Regime 2, which causes revenue losses for the non-haven and the world, can arise only in a setting where countries have an incentive to choose split tax rates once the GMT rate exceeds a critical level.

5 Conclusion

In this paper we have analyzed the effects of a global minimum tax (GMT) that is confined to large 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 haven country. In particular, introducing a moderate GMT rate does not cause tax splitting by any of the two countries and leads to greater tax revenues in both countries. Following the introduction of the moderate GMT rate, gradual

increases in either the GMT rate or the GMT coverage create a conflict of interest between the two countries. One important difference between the two gradual reforms is that a higher GMT coverage rate never harms the non-haven and the world.

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 country sets the GMT rate for all MNEs. Both countries are likely to gain tax revenues. Therefore, worries that the introduction of a 15% GMT rate might lead to split tax regimes in haven countries are not confirmed by our model. While this finding seems to contradict the Irish example stated in the introduction, the majority of non-haven countries have yet to decide their new tax structures following the introduction of the GMT, and Ireland may still commit to a 15% tax rate on all MNEs in response. As the GMT rate is further increased from 15%, however, there will be incentives to split the tax rate and set a lower tax rate for small multinationals that are not covered by the GMT. This incentive will first arise for the haven country, but eventually also for the non-haven. At the switch of regimes where the haven country splits its tax rate, the non-haven country and the world experience a discrete, substantial revenue loss.

Our model can be extended in several directions. A first important assumption of our analysis has been that the pre-tax profits of MNEs are fixed. An extended version of our model would incorporate a real response to tax rates, lowering the pre-tax profits of all MNEs, in addition to inducing profit shifting. A second important assumption has been that the tax base elasticity is the same for all MNEs in our model. The empirical evidence on this issue is inconclusive, but it would be interesting to consider the case where the tax base elasticity is higher for large firms. In such a setting it is no longer clear that tax discrimination always leads to lower tax rates on small multinationals, but tax discrimination could also go in the opposite direction. Finally, a third extension would be to incorporate a splitting response of *multinationals*, in order to benefit from potentially lower tax rates on small MNEs. We leave these extensions to further research.

Appendix A: Proof of Propositions

A1. Proof of Proposition 2

Regime 1: $t_M \in [t_M^0, t_M^1]$, where $t_M^1 \equiv 2\delta/3$

If t_M is equal to or slightly higher than $t_M^0 = \delta/3$, the haven always has to set a GMT for large MNEs with $\pi \in [\pi_M, \infty)$, whether it chooses to commit or not in the first stage. In response to this, the non-haven chooses not to commit and sets the unconstrained maximizing rate for large MNEs as $t_n = (t_M + \delta)/2$. Non-commitment is the non-haven's dominant strategy since the unconstrained rate is higher than the GMT: $t_n = (t_M+\delta)/2 > t_M$. The tax-competition equilibrium is thus determined by whether the haven commits or not.

If the haven commits in the first stage, the tax rates and tax revenues in the second-stage equilibrium are

$$t_n = (t_M + \delta)/2 \ \text{ for } \pi \in [\underline{\pi}, \infty), \qquad t_h = t_M \ \text{ for } \pi \in [\underline{\pi}, \infty), \tag{A.1}$$

$$G_n(N, C) = \frac{(t_M + \delta)^2}{4\delta}\Pi, \qquad G_h(N, C) = \frac{t_M(\delta - t_M)}{2\delta}\Pi, \tag{A.2}$$

where $G_n(N, C)$ and $G_h(N, C)$ are equilibrium revenues in country $i \in \{n, h\}$ when the non-haven does not commit (N) and the haven commits (C). If neither of the two countries commits, the equilibrium tax rates and tax revenues in the first stage are instead

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

$$G_n(N, N) = \left[\frac{(t_M + \delta)^2}{4\delta}\,\phi + \frac{4\delta}{9}(1 - \phi)\right]\Pi, \qquad G_h(N, N) = \left[\frac{t_M(\delta - t_M)}{2\delta}\,\phi + \frac{\delta}{9}\,(1 - \phi)\right]\Pi, \tag{A.4}$$

where both countries split their tax rate for small and large MNEs. Comparing the haven's revenues yields

$$G_h(N, C) - G_h(N, N) = -\frac{(1 - \phi)(t_M - \delta/3)(t_M - 2\delta/3)}{2\delta}. \tag{A.5}$$

If $t_M \in [t_M^0 = \delta/3, t_M^1]$, where $t_M^1 \equiv 2\delta/3$, this is non-negative; hence the haven chooses to commit in the first stage. The tax rates and the revenues in tax-competition equilibrium are respectively given by (A.1) and (A.2).

Regime 2: $t_M \in (t_M^1, t_M^2)$, where $t_M^2 \equiv \delta\left[1 - \frac{1}{3}\sqrt{\frac{2(1-\phi)}{2-\phi}}\right]$

If t_M exceeds $t_M^1 = 2\delta/3$, (A.5) becomes negative. Hence, given the non-haven's non-

commitment, the haven no longer chooses to commit. Also, if the non-haven commits to t_M for all MNEs, the haven's best response is non-commitment, $G_h(C,N)-G_h(C,C)>0$, since otherwise it would obtain zero revenues, $G_h(C,C)=0$. Therefore, the haven's dominant strategy is non-commitment and the tax-competition equilibrium is determined by whether the non-haven commits or not.

If neither of the two countries commits in the first stage, the tax rates and the revenues in equilibrium of the first stage are respectively given by (A.3) and (A.4). By contrast, if the non-haven chooses to commit and the haven chooses not to commit in the first stage, the equilibrium tax rates and revenues are respectively given by

$$t_n = t_M \quad \text{for } \pi \in [\underline{\pi}, \infty), \qquad t_h = \begin{cases} t_M/2 & \text{for } \pi \in [\underline{\pi}, \pi_M) \\ t_M & \text{for } \pi \in [\pi_M, \infty) \end{cases} \tag{A.6}$$

$$G_n(C,N) = \left[t_M \phi + \frac{t_M(2\delta - t_M)}{2\delta}(1-\phi) \right] \Pi, \qquad G_h(C,N) = \frac{t_M^2(1-\phi)}{4\delta}\Pi, \tag{A.7}$$

Comparing the non-haven's revenues yields

$$G_n(C,N) - G_n(N,N) = -\frac{9(2-\phi)t_M(t_M-2\delta) + \delta^2(16-7\phi)}{36\delta}\Pi. \tag{A.8}$$

This is negative if

$$t_M < t_M^2 \equiv \delta \left[1 - \frac{1}{3}\sqrt{\frac{2(1-\phi)}{2-\phi}} \right], \tag{A.9}$$

noting that $t_M^2 > t_M^1 = 2\delta/3$. Hence, for $t_M \in (t_M^1, t_M^2)$, the non-haven chooses not to commit in the first stage. Tax rates and revenues in the tax-competition equilibrium are then given by (A.3) and (A.4).

Regime 3: $t_M \in [t_M^2, t_M^3]$, where $t_M^3 \equiv 4\delta/3$

If t_M exceeds t_M^2, as defined in (A.9), the revenue difference in (A.8) becomes non-negative. This implies that, given the haven's non-commitment, the non-haven chooses to commit. When t_M increases further and reaches $t_M = \delta > t_M^2$, the non-haven is constrained by the GMT, $t_n = (t_M + \delta)/2 \leq t_M = \delta$. If neither of the two countries commits, their tax rates and revenues in the second-stage equilibrium are

$$t_n = \begin{cases} 2\delta/3 & \text{for } \pi \in [\underline{\pi}, \pi_M) \\ t_M & \text{for } \pi \in [\pi_M, \infty) \end{cases}, \qquad t_h = \begin{cases} \delta/3 & \text{for } \pi \in [\underline{\pi}, \pi_M) \\ t_M & \text{for } \pi \in [\pi_M, \infty) \end{cases}, \tag{A.10}$$

$$G_n(N,N) = \frac{9\phi t_M + 4\delta(1-\phi)}{9}\Pi, \qquad G_h(N,N) = \frac{\delta(1-\phi)}{9}\Pi. \tag{A.11}$$

Given the haven's non-commitment, the non-haven compares $G_N(C,N)$ in (A.7) with $G_n(N,N)$ in (A.11). This gives

$$G_n(C,N) - G_n(N,N) = \left[\frac{2\delta - t_M^2}{2\delta} - \frac{4\delta}{9}\right](1-\phi)\Pi, \tag{A.12}$$

which is non negative as long as $t_M \in [t_M^2, t_M^3]$ holds, where $t_M^3 \equiv 4\delta/3$. Intuitively, by committing to a single GMT for all MNEs, the non-haven induces a higher tax rate on small MNEs in the haven country, and therefore gains greater revenues from small MNEs. Combining this result with the fact that the haven's dominant strategy throughout Regime 3 is non-commitment, we get a tax-competition equilibrium in Regime 3 where the non-haven commits and the haven does not. The equilibrium tax rates and revenues in the two countries are respectively given by (A.6) and (A.7).

Regime 4: $t_M \in (t_M^3, 1]$

For $t_M \in (t_M^3, 1]$, (A.12) becomes negative, implying that the non-haven chooses not to commit, given the haven's non-commitment. Since the haven's dominant strategy remains non-commitment, the tax-competition equilibrium is such that neither of the two countries commits and the tax rates and revenues are respectively given by (A.10) and (A.11).

This completes the proof of Proposition 2. □

A2. Proof of Proposition 3

We denote regime-specific revenues for country $i \in \{n, h\}$ in regime $J \in \{1,2,3,4\}$ by G_i^J and aggregate (world) revenue by $G_W^J = G_n^J + G_h^J$. The revenue changes from introducing GMT for the non-haven, the haven, and the world are then calculated as follows.

Regime 1: $t_M \in [t_M^0, t_M^1]$, where $t_M^0 \equiv \delta/3$ and $t_M^1 \equiv 2\delta/3$.

We get from (A.2) and (5):

$$\begin{aligned}
G_n^1 - G_n^0 &= \frac{(t_M+\delta)^2}{4\delta}\Pi - \frac{4\delta}{9}\Pi = \frac{(t_M - \delta/3)(t_M + 7\delta/3)}{4\delta}\Pi > 0,\\
G_h^1 - G_h^0 &= \frac{t_M(\delta - t_M)}{2\delta}\Pi - \frac{\delta}{9}\Pi = -\frac{(t_M - \delta/3)(t_M - 2\delta/3)}{2\delta}\Pi > 0,\\
G_W^1 - G_W^0 &= -\frac{(t_M - \delta/3)(t_M - 11\delta/3)}{4\delta}\Pi > 0.
\end{aligned}$$

Regime 2: $t_M \in (t_M^1, t_M^2]$, where $t_M^2 \equiv \delta\left[1 - \frac{1}{3}\sqrt{\frac{2(1-\phi)}{2-\phi}}\right]$.

We get from (A.4) and (5):

$$G_n^2 - G_n^0 = \frac{9\phi t_M(t_M + 2\delta) + \delta^2(16 - 7\phi)}{36\delta}\Pi - \frac{4\delta}{9}\Pi = \frac{(t_M - \delta/3)(t_M + 7\delta/3)}{4\delta}\phi\Pi > 0,$$
$$G_h^2 - G_h^0 = \frac{\phi(9t_M\delta - 9(t_M)^2 - 2\delta^2}{18\delta}\Pi = -\frac{(t_M - \delta/3)(t_M - 2\delta/3)}{2\delta}\phi\Pi < 0,$$
$$G_W^2 - G_W^0 = -\frac{(t_M - \delta/3)(t_M - 11\delta/3)}{4\delta}\phi\Pi > 0.$$

Regime 3: $t_M \in [t_M^2, t_M^3]$, where $t_M^3 \equiv 4\delta/3$.

We get from (A.7) and (5):

$$G_n^3 - G_n^0 = \left[\frac{18\delta t_M - 9(t_M)^2 - 8\delta^2}{18\delta} + \frac{\phi(t_M)^2}{2\delta}\right]\Pi > 0,$$
$$G_h^3 - G_h^0 = \frac{(t_M)^2(1-\phi)}{4\delta}\Pi - \frac{\delta}{9}\Pi = \frac{9(t_M)^2(1-\phi) - 4\delta^2}{36\delta}\Pi < 0 \quad \text{for } \phi > 3/4,$$
$$G_W^3 - G_W^0 = \frac{9t_M[4\delta - t_M(1-\phi)] - 20\delta^2}{36\delta}\Pi > 0.$$

where the first term in the squared bracket of $G_n^3 - G_n^0$ is non-negative for $t_M \in [t_M^2, t_M^3]$. The expression $G_h^3 - G_h^0$ reaches a regime-specific maximum at $t_M = 4\delta/3$ and is non-positive at this level of t_M for $\phi \in (3/4, 1)$.

Regime 4: $t_M \in (t_M^3, 1]$.

We get from (A.11) and (5):

$$G_n^4 - G_n^0 = \frac{9\phi t_M + 4\delta(1-\phi)}{9}\Pi - \frac{4\delta}{9}\Pi = \frac{9t_M - 4\delta}{9}\phi\Pi > 0,$$
$$G_h^4 - G_h^0 = \frac{\delta(1-\phi)}{9}\Pi - \frac{\delta}{9}\Pi = -\frac{\delta}{9}\phi\Pi < 0,$$
$$G_W^4 - G_W^0 = \frac{9t_M - 5\delta}{9}\phi\Pi > 0.$$

This completes the proof of Proposition 3. □

A3. Proof of Proposition 4

The effects of an increase in t_M on tax revenues in the non-haven, the haven and the world in each regime are as follows.

Regime 1: $t_M \in [t_M^0, t_M^1]$, where $t_M^0 \equiv \delta/3$ and $t_M^1 \equiv 2\delta/3$. From (A.2), we get

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

where $\partial G_h^1/\partial t_M = 0$ holds at $t_M = \delta/2$.

Regime 2: $t_M \in (t_M^1, t_M^2)$, where $t_M^2 \equiv \delta\left[1 - \frac{1}{3}\sqrt{\frac{2(1-\phi)}{2-\phi}}\right]$. From (A.4), we get

$$\frac{\partial G_n^2}{\partial t_M} = \frac{t_M + \delta}{2\delta}\,\phi\Pi > 0, \quad \frac{\partial G_h^2}{\partial t_M} = -\frac{(t_M - \delta/2)}{\delta}\,\phi\Pi < 0, \quad \frac{\partial G_W^2}{\partial t_M} = -\frac{(t_M - 2\delta)}{2\delta}\,\phi\Pi > 0.$$

Regime 3: $t_M \in [t_M^2, t_M^3]$, where $t_M^3 \equiv 4\delta/3$. From (A.7), we get

$$\frac{\partial G_n^3}{\partial t_M} = \left[\phi + \frac{(\delta - t_M)}{\delta}\,(1-\phi)\right]\,\Pi$$
$$\frac{\partial G_h^3}{\partial t_M} = \frac{(1-\phi)\Pi}{2\delta} > 0, \qquad \frac{\partial G_W^3}{\partial t_M} = \frac{2\delta - t_M(1-\phi)}{2\delta}\Pi > 0.$$

where G_n^3 has a regime-specific minimum at $t_M^3 = 4\delta/3$. For this level of t_M, $\phi > 1/4$ guarantees $\partial G_n^3/\partial t_M > 0$.

Regime 4: $t_M \in (t_M^3, 1]$. From (A.11), we get

$$\frac{\partial G_n^4}{\partial t_M} = \phi\Pi > 0, \qquad \frac{\partial G_h^4}{\partial t_M} = 0, \qquad \frac{\partial G_W^4}{\partial t_M} = \phi\Pi > 0.$$

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

Change from Regime 1 to 2 at t_M^1

$$G_n^2 - G_n^1\big|_{t_M = t_M^1} = -\frac{\delta}{4}(1-\phi)\Pi < 0,$$
$$G_h^2 - G_h^1\big|_{t_M = t_M^1} = 0, \qquad G_W^2 - G_W^1\big|_{t_M = t_M^1} = -\frac{\delta}{4}(1-\phi)\Pi < 0.$$

Change from Regime 2 to 3 at t_M^2

$$G_n^3 - G_n^2\big|_{t_M = t_M^2} = 0,$$
$$G_h^3 - G_h^2\big|_{t_M = t_M^2} = G_W^3 - G_W^2\big|_{t_M = t_M^2} = \frac{9t_M^2[t_M^2(1+\phi) - 2\delta\phi] - 4\delta^2(1-\phi)}{36\delta}\,\Pi < 0.$$

Change from Regime 3 to 4 at t_M^3

$$G_n^4 - G_n^3\big|_{t_M=t_M^3} = 0, \qquad G_h^4 - G_h^3\big|_{t_M=t_M^3} = G_W^4 - G_W^3\big|_{t_M=t_M^3} = -\frac{\delta(1-\phi)}{3}\Pi < 0.$$

This completes the proof of Proposition 4. □

A4. Proof of Proposition 5

The effects of an increase in ϕ on tax revenues in the non-haven, the haven and the world in each regime are as follows.

Regime 1: $t_M \in [t_M^0, t_M^1]$, where $t_M^0 \equiv \delta/3$ and $t_M^1 \equiv 2\delta/3$. From (A.2) we get

$$\frac{\partial G_n^1}{\partial \phi} = 0, \qquad \frac{\partial G_h^1}{\partial \phi} = 0, \qquad \frac{\partial W^1}{\partial \phi} = 0.$$

Regime 2: $t_M \in (t_M^1, t_M^2]$, where $t_M^2 \equiv \delta\left[1 - \frac{1}{3}\sqrt{\frac{2(1-\phi)}{2-\phi}}\right]$. From (A.4) we get

$$\frac{\partial G_n^2}{\partial \phi} = \frac{(t_M - \delta/3)(t_M + 7\delta/3)}{4\delta}\Pi > 0, \qquad \frac{\partial G_h^2}{\partial \phi} = -\frac{(t_M - \delta/3)(t_M - 2\delta/3)}{2\delta}\phi\Pi < 0,$$
$$\frac{\partial W^2}{\partial \phi} = \frac{(t_M - \delta/3)(t_M + 11\delta/3)}{4\delta}\Pi > 0.$$

Regime 3: $t_M \in [t_M^2, t_M^3]$, where $t_M^3 \equiv 4\delta/3$. From (A.7) we get

$$\frac{\partial G_n^3}{\partial \phi} = \frac{(t_M)^2}{2\delta}\Pi > 0, \qquad \frac{\partial G_h^3}{\partial \phi} = -\frac{(t_M)^2}{4\delta}\Pi < 0, \qquad \frac{\partial W^3}{\partial \phi} = \frac{(t_M)^2}{4\delta}\Pi > 0.$$

Regime 4: $t_M \in (t_M^3, 1]$. From (A.11) we get

$$\frac{\partial G_n^4}{\partial \phi} = \left(t_M - \frac{4\delta}{9}\right)\Pi > 0, \qquad \frac{\partial G_h^4}{\partial \phi} = -\frac{\delta}{9}\Pi < 0, \qquad \frac{\partial W^4}{\partial \phi} = \left(t_M - \frac{5\delta}{9}\right)\Pi > 0.$$

Among the three regime-switching GMT rates, only t_M^2 depends on ϕ and it increases with ϕ. If $t_M = t_M^2$, and the equilibrium is in Regime 3 initially, an increase in ϕ triggers a regime switch to Regime 2. This switch has no effects on revenues in the non-haven country, $G_n^2 - G_n^3\big|_{t_M=t_M^2} = 0$, but it increases revenues in the haven and the world by

$$G_h^2 - G_h^3\big|_{t_M=t_M^2} = G_W^2 - G_W^3\big|_{t_M=t_M^2} = -\frac{9t_M^2[t_M^2(1+\phi) - 2\delta\phi] - 4\delta^2(1-\phi)}{36\delta}\Pi > 0.$$

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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