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Abstract

The OECD's proposal for a global minimum tax (GMT) of 15% aims for a reversal of a decades-long race to the bottom of corporate tax rates driven by competition over real investments and profit shifting to low-tax jurisdictions. We study the revenue effects of the GMT by focusing on the induced strategic tax setting effects. The direct effect of the GMT is a reduction in profit shifting, which has a positive effect on revenues in high-tax countries as their tax base grows, and makes higher taxes attractive. A secondary effect, however, is that the value of attracting real foreign investments increases, which intensifies tax competition. We argue that the revenue effects of the GMT depend on the instruments governments use to attract firms. With endogenous corporate tax rates, revenues in non-havens increase if initially tax competition among non-havens is fierce. By contrast, when governments compete via lump sum subsidies, the revenue gains from less profit shifting are exactly offset by higher subsidies.

JEL-Codes: F230, F550, H250, H730.

Keywords: global minimum tax, tax competition, OECD BEPS, Pillar II.

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1 Introduction

In October 2021, 136 countries and jurisdictions agreed on a global minimum tax (GMT) of 15% for corporations. The deal falls under the OECD's two-pillar package and seeks to put a floor on competition over corporate income tax rates. The hope among governments is that the agreement will reverse a decades-long race to the bottom of corporate tax rates driven by competition over real investments and profit shifting to low-tax jurisdictions.[1] The OECD estimates worldwide tax revenue gains of 150 billion US dollars annually.[2]

The OECD's global minimum tax agreement involves paying a 'top-up tax' at the level of the parent company if income made further down the ownership chain has been taxed below the global minimum rate. If everything goes according to plan and most countries implement the global minimum tax, high-tax countries stand to gain because most multinational companies are headquartered in high-income, high-tax countries. Barake, Neef, Chouc, and Zucman (2021) estimate that the European Union would increase its corporate income tax revenue by a quarter of current corporate tax revenue, and that the United States would gain about €57 billion a year. Revenue gains would be smaller in developing countries. These estimates are short run estimates in the sense that the calculations are based on the assumptions that there are no exemptions of income from the application of the minimum tax (so called carve-outs) and that neither low-tax jurisdictions nor non-haven countries change their tax rates.[3]

In this paper, we study theoretically the revenue effects of the global minimum tax for non-haven countries by focusing on the strategic tax setting effects induced by the GMT. We assume a best-case scenario where all (non-haven) countries implement a minimum corporate tax rate. In such a scenario, the global minimum tax will make profit shifting to tax havens less attractive because for given corporate tax rates the actual tax differential between haven and non-haven countries declines. At the same time, the GMT provides strong incentives for those countries who

[1] The global average statutory corporate tax rate has fallen from 49 percent in 1985 to 23 percent in 2019. See OECD Corporate Tax Statistics: Third Edition, 2021; Statutory corporate income tax rates, weighted by GDP.

[2] See OECD Newsletter on tax: https://www.oecd.org/tax/international-community-strikes-a-ground-breaking-tax-deal-for-the-digital-age.htm

[3] Under Pillar 2 of the OECD proposal, substance-based carve-outs consist of a reduction in the tax base on which the GMT will be applied. This reduction is determined based on two factors: employee compensation and tangible assets. For details see OECD (2021), Statement on a Two-Pillar Solution to Address the Tax Challenges Arising from the Digitalisation of the Economy – 8 October 2021, OECD, Paris.

have headline tax rates below the global minimum tax to increase their domestic rates, especially since not doing so will effectively export tax revenues to the non-haven countries.[4]

To the best of our knowledge, this study is the first to analyze theoretically the adjustment of tax rates in haven and non-haven countries as a result of a universal introduction of a global minimum tax when firm location decisions are endogenous. We share with Johannesen (2022) and Hebous and Keen (2021), discussed in more detail below, the interest in endogenous tax adjustment. Our work goes beyond those works, however, by incorporating a location decision of firms, and thus a real response to taxation, not only in terms of profit shifting. Our approach, therefore, adds realism and in addition addresses the concern that actual corporate tax rates have been on a decline not only because of profit shifting, but also because of competition for real investment and firm location.

We capture the global minimum tax through an exogenous increase in the haven's corporate tax rate. As pointed out by Devereux, Simmler, Vella, Wardell-Burrus, et al. (2021), the design of the substance-based carve-out defines the effective rate of tax under the GMT and is instrumental in how low-tax countries respond. According to Devereux et al. (2021), there are two prime candidates for the design of the carve-out labelled model A and B.[5] Our analysis is in line with Model A, under which low-tax countries have a strong incentive to increase their tax rates to the level where the 'top-up tax' is zero, since a rise to this level does not affect the tax liabaility of the multinational firm. With endogenous tax rates in non-havens the effect on tax revenues following an increase in the haven's corporate tax rate is a priori not clear. The direct effect of the GMT is a reduction in profit shifting, which has a first order positive effect on revenues in high-tax countries because their tax base grows. This makes higher taxes attractive at the margin. A secondary effect, however, is that for non-havens the value of attracting real foreign direct investments increases due to less profit shifting, which in turn may intensify competition for real capital/firms among non-haven countries. This tends to push tax rates down. Moreover, to the extent that tax competition is

[4]The consultancy firm KPMG argues that low-tax countries have an incentive to increase their corporate tax rate to capture some tax revenue that would otherwise be subject to tax elsewhere. See: https://home.kpmg/xx/en/home/insights/2021/05/global-minimum-tax-an-easy-fix.html

[5]Under model A the denominator in the effective rate of tax (ERT) is taxes paid and the numerator is accounting income less carve-out. Model B, in contrast, defines the ERT as taxes paid divided by accounting income. Both models calculate the top up rate as accounting income less carve-out times the top up tax rate. The latter is given by max (0, 15% - ERT).

indeed reduced by the GMT and corporate tax rates in non-haven countries increase, this in itself offsets in part the revenue gain from less profit shifting.

There are two main findings from our analysis: First, the revenue effect of the global minimum tax depends crucially on whether competition is over tax rates or over other incentive instruments. When governments compete by using lump sum subsidies, while corporate tax rates are constant, the revenue gains for non-havens from less profit shifting are always exactly offset by higher subsidies, and thus leave overall net revenues unchanged. Corporate tax rates might be hard to change, perhaps because of political economy considerations. By contrast, when governments compete via corporate tax rates, revenues and corporate tax rates in havens may go up or down. Our second finding is to shed light on this. Tax revenues in non-havens increase if initially tax competition among non-havens is fierce, but the opposite may hold when competition is rather weak. A sufficient condition for revenues to increase is that the equilibrium corporate tax rate in non-haven countries rises with the haven's tax rate, which is akin to strategic complementarity.[6] In further characterization, we can relate the change in non-haven tax rates to the cost of profit shifting. If profit shifting is almost costless (very costly), tax competition is fierce (lax) and thus non-haven tax rates are likely to increase (decrease).

The danger of offsetting incentives is real. Switzerland, for example, considers subsidies that counter the effect of the minimum tax. Among the measures considered are research grants, social security deductions and tax credits to offset any changes to headline tax rates.[7] If the Swiss policy response were to spill over to other countries, the global miminum tax agreement should be complemented with a restriction to limit competition with other instruments in order to generate the envisioned revenue gains for non-havens. Such a complementary policy exists in the European Union in form of state aid regulations, albeit with a somewhat different intention, namely to limit in the EU's common market a government's ability to favor particular firms through subsidies at the expense of their competitors. One may doubt whether at the worldwide level such complementary policies can be agreed upon and enforced. If not, however, revenue gains from the GMT may not be as large as hoped for.

[6]Since the haven's tax rate is exogenous, our model is different from the standard modeling of strategic complemetarity, where all players have reaction functions.

[7]See: https://www.swissinfo.ch/eng/switzerland-plans-subsidies-to-offset-g7-corporate-tax-plan/46696800

Our paper is related to different literatures. The starting point for policies aimed at curbing competition over mobile capital and profit shifting is the canonical tax competition model: benevolent governments set tax rates without taking into account the effect national tax policy has on other countries' tax bases. As a result, a fiscal externality arises that makes competition harmful in the sense that tax rates are set too low and public goods are underprovided in equilibrium.[8] The tax competition literature has given rise to a large literature on coordination of tax rates when countries compete to attract real investment. Konrad and Schjelderup (1999) come closest to the setting of the GMT in that they study whether a group of countries can gain from harmonizing their capital income taxes if the rest of the world does not follow suit. They show that cooperation among the subgroup of countries is beneficial if tax rates in the initial fully noncooperative Nash equilibrium are strategic complements.[9] The tax coordination literature is surveyed in Keen and Konrad (2013) who conclude that ".. the agreement of minimum tax rates at levels somewhat above the lowest in the observed outcome is likely to be a fruitful path to coordinating away from inefficient outcomes than is agreeing on common rates."[10] Their concluison, then, is in line with the intention of the GMT. Johannesen (2010) considers a setting with N identical countries and a single multinational firm that has affilates in all N countries. He shows that under certain circumstances tax havens make it less attractive to compete for profits and thus induce low-tax countries to become high-tax countries.

Our paper also contributes to an emerging literature that analyzes theoretically the effects of the GMT. Johannesen (2021) assumes that profits by multinationals are fixed and only the location of reporting profits is endogenous. He shows that the global minimum tax causes a coordinated tax rate increase in tax havens to the level of the GMT, which affects welfare in non-haven countries through two channels. First, a higher equilibrium tax rate in havens increases the total tax liabilities of multinational firms and represents a loss of private consumption for the owners of the firms located in non-haven countries. This lowers welfare in non-haven countries. Second, a higher tax rate in tax havens has a positive effect on welfare in non-haven countries as it reduces profit

[8] See e.g., Zodrow and Mieszkowski (1986) and Wilson (1986); Wilson (1999) surveys the literature.

[9] Vrijburg and de Mooij (2016) analytically derive conditions under which the slope of the tax-reaction function is negative in a classical tax competition model.

[10] The idea of the GMT is not new. In the area of corporate taxation, the Ruding Committee (Ruding (1992)) proposed for the EU a common minimum tax rate of 30 percent in 1992.

shifting and bolsters tax revenue. The net welfare effect is ambiguous. Hebous and Keen (2021) also assume that firms profits are fixed, while the location of reported profits is endogenous, and show in a two-country framework that a haven country may benefit from an exogenous increase in its own tax rate under plausible assumptions about strategic complementarity of tax policies. Our analysis sets itself apart from the studies above in that we consider a three country set up and in addition to investigating the dynamic effect of the GMT we allow the use of lump sum subsidies as a policy tool.

Finally, our paper relates to the work by Slemrod and Wilson (2009), who model the endogenous pricing of concealment services by tax havens in a model of tax competition for capital between non-haven countries. The exogenous elimination of tax havens in their model is similar in spirit but qualitatively different to our introduction of a global minimum tax. Slemrod and Wilson (2009) find that the elimination of tax havens is welfare improving for non-havens, while a similar strong statement cannot be made in the context of the GMT.

The outline of the paper is as follows. In Section 2 we outline the model and present three versions of the model to study the impact of the GMT on tax revenue in high-income high-tax countries (interchangably referred to as non-haven countryes) . Section 3 sums up our results and discusses some issues related to policy and the GMT.

2 A Model of Profit Shifting and Tax Competition

We consider a framework with three countries: Countries 1 and 2 (indexed by $i, j = 1, 2$) are non-havens countries and compete for firms themselves. Country 3 is a tax haven to which profits are shifted from multinational firms operating in non-haven countries. Let corporate tax rates be denoted by t_1, t_2 for countries 1 and 2, respectively, and by t_h the rate for the tax haven. We assume that initially $t_h < t^{min} < (t_1, t_2)$, with t^{min} being the global minimum tax rate.

We capture the introduction of the global minimum tax t^{min} by an exogenous increase in t_h (regardless of whether the haven's tax rate was optimally chosen or takes some given starting value).[11] The revenue from the GMT goes by assumption to the tax haven, as argued in the

[11] If the revenue effect of the marginal increase is positive and independent of the initial level of t_h, the conclusion

introduction, because otherwise the haven would leave tax money on the table. We focus on the induced effects of the GMT via endogenous changes in tax policy of non-haven countries, and their effects on firm location. Formally, we consider a noncooperative game between countries 1 and 2, which set their policies simultaneously, in anticipation of firms making their location decision, as well as their profit shifting choices.

The question is whether tax revenues increase: in non-haven countries, the haven country and at the worldwide level. Government revenues come from taxing corporate profits net of any subsidies. To simplify the analysis, we assume that non-haven governments maximize revenues net of any subsidies. This reflects the desire to increase tax payments from multinationals. As long as the underprovision of public goods is severe, we expect that welfare maximization would give qualitatively similar results as long as the objective includes the provision of public goods.[12] Our assumption is also plausible if the owners of multinational firms are mostly non-residents and thus not directly relevant for domestic welfare purposes.

2.1 Endogenous Corporate Tax Rates

A multinational firm, out of continuum (desribed below), operates its real activity either in country 1 *or* 2, while shifting profits to the tax haven, country 3. There are many multinational firms operating in different industries (hence no interaction in sales/pricing). Each firm earns gross profit s (i.e., sales) regardless of location .[13] The firm's local profit from operating in country $i = 1, 2$ is

$$\pi_i = (1 - t_i)[s - g_i] - C(g_i), \tag{1}$$

where g_i is a transfer price to be paid for one unit of an intermediate good/intangible sold by the subsidiary of the firm located in country 3, the tax haven. As is standard in the literature on profit shifting, the true price of the intermediate is normalized to zero and deviations from the true price

about the revenue effect goes beyond the marginal increase and would hold if t_h is raised to t^{min}.

[12]For example, this property has been shown to hold in Janeba and Smart (2003).

[13]The value s could be the result of an optimal capital stock decision. For example, assume that $s = pf(k) - rk$, and capital cost are fully tax deductible. In this case, the multinational's capital choice, say k^*, is independent of location and hence $s(k^*)$ is a fixed term.

are costly.[14] For tractibility, we assume a quadratic cost function $C(g) = \delta g^2/2$, which is common in the literature.

The firm shifts profits out of its non-haven company into the tax haven, where no real activity takes place. The subsidiary's profit in the tax haven is

$$\pi_h^i = (1 - t_h)g_i, \tag{2}$$

where the superscript on the profit term indicates that the parent company is located in non-haven country i. The optimal profit shifting price is characterized by (3) and has the standard form

$$g_i^* = \frac{t_i - t_h}{\delta}, \ i = 1, 2. \tag{3}$$

When the haven's tax rate is below the non-haven's one, as we assume, profits are shifted into the haven. Condition (3) reveals that for given t_i an increase in the haven's tax rate reduces profit shifting and thus raises the firm's tax base in non-havens (see (1)). The latter effect features prominently when we consider the effects of a global minimum tax.

Firms differ in their preference for country 1 relative to country 2, perhaps because different industries find different aspects of a country's characteristics relevant . Let F be the additional fixed cost of operating in country 1 relative to operating in country 2, which are not taxable. Let F be uniformly distributed on $[-\underline{F}, \overline{F}]$. The mass of firms is normalized to one, and $M(\hat{F}) = \frac{\hat{F}-\underline{F}}{\overline{F}-\underline{F}}$. Denote by $M_i(\hat{F})$ the mass of firms located in country i if the indifferent firm has fixed cost $\hat{F}$, and $m = 1/(\overline{F} - \underline{F})$ its constant density. We have $M_1 = M(\hat{F}), \quad M_2 = 1 - M(\hat{F})$ for countries 1 and 2, respectively, and furthermore $\frac{dM_1}{d\hat{F}} = \frac{dM}{d\hat{F}} = -\frac{dM_2}{d\hat{F}} = m$. F is not observable to the government, although it knows the distribution.

Inserting (3) into the profit functions (1) and (2), and now taking fixed location cost into account, the local profit of operating in country i, $i = 1, 2$, is given by

$$\pi_i = (1 - t_i)\left(s + \frac{t_h - t_i}{\delta}\right) - \frac{(t_i - t_h)^2}{2\delta} - \lambda F, \tag{4}$$

[14] See e.g., Kant (1988) and Haufler and Schjelderup (2000); Göx and Schiller (2006) surveys the literature.

where λ is a dummy that takes the value of 1 if the firm operates in country 1, and 0 when it operates in country 2. We define the tax bases $B_i := s + \frac{t_h - t_i}{\delta},\ i = 1, 2$. We assume that corporate taxes in non-havens are not too large so that profit (4) is non-negative.

The marginal firm that is indifferent between non-haven locations is obtained from solving

$$\pi_1 + \pi_h^1 - F = \pi_2 + \pi_h^2,$$

and has fixed cost

$$\hat{F} = (t_2 - t_1)\left(s + \frac{t_h}{\delta}\right) + \frac{t_1^2 - t_2^2}{2\delta}. \tag{5}$$

Firms with fixed cost below the critical value operate in country 1, while those with fixed cost above it operate in country 2. Note that (5) depends on the haven's tax rate only when corporate tax rates differ, that is, $\frac{d\hat{F}}{dt_h} = t_2 - t_1$. An increase in the haven's tax rate has not only direct tax base effects via profit shifting, as seen in (3), but also shifts firms to the country with the lower tax rate. This gives rise to strategic tax setting effects. To see this more clearly, note that changes in corporate tax rates affect the marginal firm as follows:

$$\frac{d\hat{F}}{dt_1} = -(s + \frac{t_h}{\delta}) + \frac{t_1}{\delta} = -B_1$$

and $\frac{d\hat{F}}{dt_2} = B_2$. Increases in corporate tax rates drive some firms out of the country, as is standard in the literature on tax competition, and the size of the effect depends on the haven's tax rate.

We now turn to the analysis of tax revenues. Tax revenues in non-haven countries $i = 1, 2$ are given by

$$R_i = M_i(\hat{F}) t_i B_i, \tag{6}$$

while in the haven country these are

$$R_h = t_h[M_1(\hat{F}) g_1^* + M_2(\hat{F}) g_2^*]. \tag{7}$$

The endogenous instruments of the non-havens are the corporate tax rates t_1, t_2. We consider a Nash equilibrium such that countries 1 and 2 simultaneously maximize their tax revenues given

the tax rate of the other country, and given the haven's tax rate: $t_1^*(t_h), t_2^*(t_h)$.

Before we analyze the Nash equilibrium in detail, it is useful to generate the general comparative static effects of an increase in the haven's tax rate as result of a global minimum tax. Consider first world tax revenues

$$R = R_1 + R_2 + R_h = M_1(\hat{F}) \left[t_1 s - \frac{(t_1 - t_h)^2}{\delta} \right] + M_2(\hat{F}) \left[t_2 s - \frac{(t_2 - t_h)^2}{\delta} \right]. \tag{8}$$

Condition (8) makes clear that in a symmetric tax situation ($t_1 = t_2$) world tax revenues depend on the level of corporate taxation and its difference to the haven's tax rate. Total revenues go up if the level rises and the difference to the haven's rate declines. To be more precise, assume an increase in t_h in case of a symmetric Nash equilibrium, $t_1^*(t_h) = t_2^*(t_h) = t^*$, so that $M_1(\hat{F}) = M_2(\hat{F}) = 0.5$. In this case, $R = \left[t^* s - \frac{(t^* - t_h)^2}{\delta} \right]$ and we obtain

$$\frac{dR}{dt_h} = s \frac{dt^*}{dt_h} - \frac{2(t^* - t_h)}{\delta} \left[\frac{dt^*}{dt_h} - 1 \right] = B \frac{dt^*}{dt_h} + \frac{(t^* - t_h)}{\delta} \left[2 - \frac{dt^*}{dt_h} \right]. \tag{9}$$

This expression is positive if the non-haven's tax rate increases, but less than twice as the haven's tax rate (sufficient, not necessary).

In general, the revenue effects on the tax haven come from a mechanical and behavioral effect. The former reflects a higher tax rate on given transfer prices, while the second captures the change in transfer pricing by the firms. Formally, the effect of the GMT on the haven, assuming it collects the revenue rather than the non-haven, is as follows

$$\frac{dR_h}{dt_h} = \frac{t^* - 2t_h + \frac{dt^*}{dt_h}}{\delta}, \tag{10}$$

which is positive if i) the initial tax rate difference between non-haven and haven is sufficiently large and ii) the non-haven tax rate is rising. The former term is exactly zero if we were to assume that the haven is tax revenue maximizing, which would imply $t_h = t^*/2$.

Conditions (9) and (10) reveal that the sign and magnitude of induced tax change in the non-haven's tax rate is key for the evaluation of the GMT. We now turn to the analysis of this issue

by considering the non-haven country's tax choice. Maximizing revenues with respect to t_i, we get the first order condition

$$\frac{dR_i}{dt_i} = \frac{dM_i}{d\hat{F}}\frac{d\hat{F}}{dt_i}t_i B_i + M_i(\hat{F})\left(B_i + t_i\frac{dB_i}{dt_i}\right) = -mt_i B_i^2 + M_i(\hat{F})\left(B_i - \frac{t_i}{\delta}\right) = 0. \tag{11}$$

The first term represents the loss in revenues from firms leaving the country due to a marginally higher tax. The second captures the effect on the tax base of a firm (for a given mass of firms). Conditions (11) for $i = 1, 2$ characterize implicitly the Nash equilibrium tax rates (t_1^*, t_2^*), as function of the haven's tax rate t_h.[15]

The effect of t_h on net revenues in country i is (using envelope condition via 11)

$$\frac{dR_i}{dt_h} = \frac{dR_i}{dt_j}\frac{dt_j^*}{dt_h} + \frac{dR_i}{dt_h} = \frac{dM_i}{d\hat{F}}\left(\frac{d\hat{F}}{dt_j}\frac{dt_j^*}{dt_h} + \frac{d\hat{F}}{dt_h}\right)t_i^* B_i + M_i(\hat{F})t_i^*\frac{dB_i}{dt_h} = m\left(B_j\frac{dt_j^*}{dt_h} + \frac{t_j^* - t_i^*}{\delta}\right)t_i^* B_i + \frac{t_i^* M_i(\hat{F})}{\delta}. \tag{12}$$

The last term is a *mechanical effect* from the global minimum tax: a higher haven tax reduces the profit shifting price g, which in turn raises government i's revenues by t_i/δ per firm. The first term (in round brackets) stands for the strategic effect via the tax of the other country. The second term in brackets is zero in a symmetric equilibrium $t_1^* = t_2^*$.

The key issue for the sign of (12) is again whether t_j^* rises or falls with t_h. If it rises, then revenues increase by more than the mechanical effect (in a symmetric equilibrium) because the first term is positive. However, if t_j^* falls with t_h, revenues go up by less than the mechanical effect.

To shed light on the sign of the derivative we totally differentiate the first order conditions for revenue maximization. To simplify notation, let $V^i := dR_i/dt_i = 0$ and $V_j^i = d^2R_i/dt_i dt_j$ for $i = 1, 2$, where $j = 1, 2, h$. Hence $V_i^i < 0$ is the second order condition for revenue maximization. Solving for the system of two equations results in

$$\frac{dt_j^*}{dt_h} = \frac{V_i^i V_h^j - V_i^j V_h^i}{V_j^i V_i^j - V_i^i V_j^j}. \tag{13}$$

The expression can be simplified if one assumes a symmetric equilibrium with $t_1^* = t_2^* = t^*$. In this

[15] The second order condition reads $-2mB_i^2 + 3mt_i B_i\delta^{-1} - 2M_i(\hat{F})\delta^{-1}$, which is negative if $\delta s > 5/2$ (the first two terms are negative).

case, $V_j^i = V_i^j$, $V_i^i = V_j^j$ for $i, j = 1, 2, i \neq j$,and $V_h^1 = V_h^2 = V_h$. Equation (13) can thus be written as

$$\frac{dt^*}{dt_h} = -\frac{V_h}{V_1^2 + V_2^2} = -\frac{V_h}{V_2^1 + V_1^1} \tag{14}$$

The denominator is negative in a symmetric equilibrium $V_1^2 + V_2^2 < 0$, where $B_1 = B_2 = B$, that is, the direct effect of an own tax increase is in absolute value larger than the cross effect of the other country's tax increase. Hence, under symmetry the sign of (14) is equal to the sign of V_h, which represents the partial effect of the haven's tax rate on the first order condition for revenue maximization, i.e., the effect of the tax haven's tax on the marginal benefit and marginal cost of raising country i's tax. We obtain after some algebra

$$V_h = \frac{1}{\delta}\left[M(\hat{F} = 0) - 2mt^*B\right] = \frac{1 - 4mt^*B}{2\delta} \tag{15}$$

which is negative if in equilibrium the initial tax revenue is relatively large ($t^*B > 1/4$), but positive if it is relatively small ($t^*B < 1/4$). The condition is difficult to interpret in so far as it contains endogenous variables. To shed more light on the condition, we solve the first order condition (11) in the symmetric equilibrium for the tax rate to obtain

$$t = \frac{2\delta B}{1 + 4\delta m B^2} \tag{16}$$

and then insert into (15), which results in an expression without the explicit tax rate (of course the tax rate is part of the tax base B)

$$V_h = \frac{1}{2\delta}\frac{(1 - 4\delta m B^2)}{(1 + 4\delta m B^2)}. \tag{17}$$

The sign of the numerator can be related to the cost of profit shifting. If δ becomes very small (but positive), and hence profit shifting is almost costless, the tax base goes to either zero (if $g \leq s$ is imposed) or becomes even negative. In either case the numerator is positive and hence the non-haven tax rate increases in that case. On the other hand, if δ becomes very large, thus making profit shifting too costly ($g = 0$), the tax base is positive and finite ($B = s$) and the numerator

becomes negative for sufficiently large values of δ and s.[16] In that case the tax rate in non-havens tend to fall when the tax haven's rate increases.

Proposition 1. *Assume that non-haven countries compete via corporate tax rates for a continuum of multinational firms, which locate in one non-haven country. Then starting from a symmetric Nash equilibrium in non-havens corporate tax rates, the introduction of a global minimum tax;*

a) raises the non-haven tax rate if initial tax competition is suffciently fierce (weak), which is the case when the cost of profit shifting δ are sufficiently low (high)

b) increases world tax revenues when the non-haven's tax rate increases (but less than twice as much as the haven's one)

c) raises tax revenues in the haven country if the non-haven tax rate increases (and the initial tax spread is large enough)

d) raises tax revenues in non-haven countries if it raises non-haven tax rates.

Initial tax revenues are small when tax competition is intense, and high when competition is relatively low. Hence, the intensity of tax competition before the introduction of the global minimum tax is crucial for the revenue prospects of the global minimum tax .

Proposition 1 has immediate implications for the effect of the global minimum tax on firms. If worldwide tax revenues rise, these are paid by firm owners, and hence profits decline. At the same time, wasteful profit shifting may be reduced. The net effect can be derived formally: Conditional on a firm's location, and taking optimal profit shifting into account, the effect of the global minimum tax on world profits of a multinational firms $\pi = \pi_i + \pi_h^i$ is given by

$$\frac{d\pi}{dt_h} = -B\frac{dt^*}{dt_h} - g, \tag{18}$$

which is negative if the tax in non-haven countries tax rate does not fall. While this is a sufficient condition, it is not necessary. Together with Proposition 1 it becomes clear that a rise in non-haven tax rates implies opposite welfare effects on firms on the one hand and non-haven and haven

[16] For infinite profit shifting cost, the symmetric Nash tax rate of the non-haven countries becomes $t^* = 1/(2ms)$. Inserting this into (15) makes $V_h < 0$.

countries on the other hand. This appears intuitive and desirable from the perspective of taxing countries, but hinges on the effect of the GMT on non-haven countries tax rates, which we have shown to be less straightforward.

Moreover, we note that spending on profit shifting $C(g)$ declines when the tax rate of non-havens does not increase by more than the increase of the haven country through the GMT, that is, $dt^*/dt_h < 1$, because then the optimal profit shifting price (3) decreases.

2.2 Endogenous Subsidies

We now turn to a different model in which corporate tax rates t_1, t_2 are exogenous, but governments compete for firms with a lump sum subsidy $z_i, i = 1, 2$. The reason for exogenous corporate tax rates could be that they are much more salient in the public and thus subject to strong political forces. By contrast, subsidies may come in different forms and thus are less transparent. Of course, subsidies are often tied to specific firm activities, such as R&D spending, sales or employment. To model this explicitly, would require an additional firm decision variable, which makes the analysis less tractable. By focusing instead on lump sum subsidies, we consider a polar case to the one in the previous section, which we hope give insights as to how distortionary subsidies tied to other firm activity may work.

The profit of firm i equals (1), but now adding the subsidy z_i, we obtain

$$\pi_i = (1 - t_i)(s - g_i) - \delta g_i^2/2 + z_i.$$

A firm is indifferent between countries 1 and 2 if its world profit from locating in 1 is equal to the world profit when locating in 2. The marginal firm for which this holds has fixed cost

$$\hat{F} = (t_2 - t_1)\left(s + \frac{t_h}{\delta}\right) + \frac{t_1^2 - t_2^2}{2\delta} + z_1 - z_2. \tag{19}$$

The difference between (19) and (5) is the subsidy differential $z_1 - z_2$. Firms with $F \leq \hat{F}$ locate in country 1 and firms with $F > \hat{F}$ locate in 2. Again, the fixed cost threshold of the marginal firm (19) is independent of t_h if corporate tax rates are the same. Furthermore, the effect of subsidies

on the marginal firm is particularly simple: $\frac{d\hat{F}}{dz_1} = 1 = -\frac{d\hat{F}}{dz_2}$, higher subsidies attract more firms. Moreover, when corporate tax rates and subsidies are the same, $\hat{F} = 0$ and half of all firms locate in 1 and the other half in 2.

Using $B_i = s - g_i$, net revenues of non-haven government i are

$$R_i = M_i(\hat{F}) \left[t_i B_i - z_i \right], \tag{20}$$

while revenues for the haven are still given by (7). World tax revenues, net of subsidies, correspond to (8), adjusted by the term $-(M_1 z_1 + M_2 z_2)$.

The revenue effects for non-havens and the haven country depend on the level of the initial tax rate differential and the adjustment of subsidies. To study the latter, we consider the comparative statics of the Nash equilibrium in subsidies z_1^*, z_2^*. These values are obtained by focusing on the tax revenue maximization with respect to z_i, which leads to the first order condition

$$\frac{dR_i}{dz_i} = \frac{dM}{d\hat{F}} \left(\frac{d\hat{F}}{dz_1} \right) \left[t_i B_i - z_i \right] - M_i(\hat{F}) = m \left[t_i B_i - z_i \right] - M_i(\hat{F}) = 0. \tag{21}$$

The first term is the gain in net revenues when at the margin m additional firms enter the country, while the second term represents the additional fiscal cost from raising the subsidy marginally. Second order conditions hold. Solving (21) for $z_i = t_i B_i - M_i/m$, then substituting back into (20), we get a simple characterization of net revenues:

$$R_i = \frac{(M_i(\hat{F}))^2}{m} \tag{22}$$

We are interested in how (22) is affected by the global minimum tax. For this, we analyze first the effect of t_h on optimal subsidies z_i, and totally differentiate (21) for both non-haven countries to obtain

$$\frac{dz_i}{dt_h} = \frac{t_i}{\delta}. \tag{23}$$

Thus, the global minimum tax raises subsidies to firms unambiguously, and in fact by the mechan-

ical effect per firm. Then, we obtain the effect of t_h on net revenues of non-havens as

$$\frac{dR_i}{dt_h} = 2M_i(\hat{F}) \left[\frac{d\hat{F}}{dz_i}\frac{dz_i}{dt_h} + \frac{d\hat{F}}{dz_j}\frac{dz_j}{dt_h} + \frac{d\hat{F}}{dt_h} \right] = 2M_i(\hat{F}) \left[\frac{t_i}{\delta} - \frac{t_j}{\delta} + \frac{t_j - t_i}{\delta} \right] = 0. \tag{24}$$

The global minimum tax leaves net revenues in non-havens unaffected, as the revenue effects from GMT induced direct and indirect changes in the firm allocation across countries offset each other.

Furthermore, if we assume symmetry in non-havens corporate tax rates ($t_1 = t_2 = t$) and a symmetric Nash equilibrium in subsidies ($z_1^* = z_2^* = z^*$), we obtain the effects on world tax revenues and those of the haven country to be

$$\frac{dR}{dt_h} = \frac{2(t - t_h)}{\delta} - \frac{dz^*}{dt_h} = \frac{t - 2t_h}{\delta} \tag{25}$$

and

$$\frac{dR_h}{dt_h} = \frac{t - 2t_h}{\delta}. \tag{26}$$

The expressions in and sign of (25) and (26) are the same. We conclude that the only beneficiary among governments is the haven country if the initial tax rate differential between haven and non-haven is sufficiently large. In fact, the condition is equivalent to stating that the haven country is on the upward sloping part of its revenue curve. It seems plausible to assume that this is the case.

Proposition 2. *Assume that non-haven countries compete via lump sum subsidies for a continuum of multinational firms, which locates in one non-haven country. The introduction of a global minimum tax leaves net tax revenues in non-haven countries unchanged, while increasing those of the haven country.*

It is also straightforward to calculate the effect on a firm's global profit, given its location and taking optimal profit shifting into account:

$$\frac{d\pi}{dt_h} = \frac{dz^*}{dt_h} - g = \frac{t_h}{\delta} > 0, \tag{27}$$

The firm benefits unambigously. While the higher tax in the haven reduces profits (i.e., the direct effect from the subsidiary's profit $\pi_h^i = (1 - t_h)g_i$), the induced effect via higher subsidies (23)

makes more than up for this reduction.

The latter result in conjunction with Proposition 2 appears paradoxical, as there are only winners (or more precisely no losers): the firms and the haven country gain, while non-havens are unaffected. It is explained by the efficiency gain in less wasteful profit shifting. Recall that the cost of profit shifting are $C(g) = \delta g^2/2$ and the optimal transfer price is $g^* = (t_i - t_h)/\delta$. An increase in t_h reduces spending on profit shifting by $(t_i - t_h)/\delta$, which equals exactly the joined gain in tax revenues of tax havens (26) and profit of firms (27).[17] If one considers spending on profit shifting is wasteful, as we do, then the global minimum tax has a positive effect, as it is reduced. At the same time, however, competition via lump sum subsidies enriches only haven governments, while non-haven governments are unaffected. It should be noted here that the latter needs to be intepreted with care, as we assumed a revenue maximizing non-haven government. The outcome of the subsidy game is problematic if the government revenues were used to provide public goods, which are underprovided, and the ownership of firms rests outside the non-haven countries. In that situation, the global minimum tax does not benefit non-haven countries.

Our result relates to the findings by Slemrod and Wilson (2009), who consider parasitic tax havens that influence tax competiton among non-havens. In their model, an exogenous elimination of tax havens improves welfare because wasteful income shifting is reduced and public good supply in non-havens expands.

3 Conclusion

We set up a three country model that allows us to study the revenue effects of the global minimum tax for non-haven and haven countries by focusing on the strategic tax setting effects induced by the GMT. Non-haven countries compete via corporate tax rates or other tax incentives, which drive the location decisions of a continuum of multinational firms and their profit shifting to a haven affiliate. We derive two main results. First, our analysis shows that the tax revenue effects of the GMT depend crucially on whether competition is over tax rates or over other incentive instruments. If corporate tax rates are exogenous, but governments compete for firms with a lump

[17] The mass of firms is assumed to be one, so that aggregate profit change is also given by (27).

sum subsidy, the GMT leaves net tax revenues in non-haven countries unchanged, while increasing those of the haven country. In this subsidy game, multinationals benefit unambigously. While this result goes hand in hand with a reduction in wasteful profit shifting, it does not generate the intended positive revenue effects for non-havens.

Second, if countries compete via corporate tax rates, the GMT may raise or lower non-haven tax rates and tax revenues. This result may be surprising at first glance, and demonstrates the importance of allowing tax rates to adjust endogenously. The condition for an increase in tax rates and revenues can be related to the intensity of initial tax competition, which in turn depends on the cost of profit shifting. If shifting profits is easy, initial tax competition for firms is intense. In this scenario, revenue in tax havens also rise, but multinational after-tax profits decline. However, tax rates and tax revenue in non-haven countries may fall if the opposite is true, that is, tax revenue is initally large and competition is lax, for example because profit shifting is costly. This result has interesting implications, as it suggests that previous attempts in reducing profit shifting, for example via the OECD's BEPS initiative, may have made the introduction of a global minimum tax less beneficial. Note, however, that both our formal results as well as the effect of BEPS are only qualitative statements, and would need to be calibrated in a more realistic model than the one we have examined here.

From a policy perspective, our paper highlights what may happen if the introduction of the GMT leads to competition over other incentives than tax. The danger of offsetting incentives is real. Incentives such as tax holidays, free trade zones, and land and infrastructure paid for by governments to attract firms will be come attractive to some countries in the wake of the GMT. An implication of our investigation is also that it matters how the tax base is calulated under the GMT scheme. If there are loopholes, competition will again be over other instruments than tax rates. The risk, then, is that the potential benefit from the GMT is counteracted by such incentives. Even if all non-tax incentives are eliminated, our analysis shows that a rise in tax revenue among high-income high-tax countries due to the GMT is by no means assured. And then there is the issue of who will will not be part of the GMT-deal. Failure to get the GMT bill through the US Congress, for example, will probably spell the end of the GMT.

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