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Tax competition with parasitic tax havens

Joel Slemrod [a,*], John D. Wilson [b]

[a] University of Michigan, United States
[b] Michigan State University, United States

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ABSTRACT

We develop a tax competition framework in which some jurisdictions, called tax havens, are parasitic on the revenues of other countries, and these countries use resources in an attempt to limit the transfer of tax revenue from capital taxation to the havens. We demonstrate that the full or partial elimination of tax havens would improve welfare in non-haven countries. We also demonstrate that the smaller countries choose to become tax havens, and we show that the abolition of a sufficiently small number of the relatively large havens leaves all countries better off, including the remaining havens. We argue that these results extend to the case where there are also taxes on wage income that involve administrative and compliance costs.

1. Introduction

According to the .OECD (1998)., a tax haven is a jurisdiction that imposes no or only nominal taxes and offers itself as a place to be used by non-residents to escape Elitzur tax in their country of residence. Part of its attractiveness is that it enacts laws or administrative practices that prevent the effective exchange of information on taxpayers benefiting from the low-tax jurisdiction.[1] Although a previous literature has modeled tax havens as a benign phenomenon that helps high-tax countries reduce the negative impact of their own suboptimal domestic tax policies, there is considerable concern that the havens are "parasitic" on the tax revenues of the non-haven countries, inducing them to expend real resources in defending their revenue base and in the process reducing the welfare of their residents. This paper develops an equilibrium model of tax havens and tax competition that provides a rigorous framework within which to address why countries are, and should be, concerned about the detrimental effects of havens on their citizens' welfare.

Policy actions by OECD countries certainly reflect this concern. Before an OECD report issued in 1998, action against tax havens was predominantly unilateral, as exemplified by the introduction in 1962 of the U.S. Subpart F provisions that addressed so-called passive income earned in tax haven countries and not distributed to the United States.[2] Subsequently many other OECD countries enacted domestic tax rules designed to lessen the attractiveness of tax reductions achieved through the use of tax havens.

The 1998 OECD report concluded that "governments cannot stand back while their tax bases are eroded through the actions of countries which offer taxpayers ways to exploit tax havens [and preferential regimes] to reduce the tax that would otherwise be payable to them" (p. 37). It lists several recommendations concerning domestic legislation, tax treaties, and international cooperation. In the last category is a recommendation to produce a list of tax haven countries that would enable non-haven countries to coordinate their responses to the problems created by the havens and to "encourage these jurisdictions to reexamine their policies" (p. 57). In 2000, the OECD followed up by publishing the names of 35 countries called "non-cooperating tax havens," which were given one year to enact fundamental reform of their tax systems and broaden the exchange of information with tax authorities or face economic sanctions. By 2005, almost all of the blacklisted tax havens had signed the OECD's Memorandum of Understanding agreeing to transparency and exchange of information.[3]

Notably, the 35 designated tax havens are invariably small. Their average population is 284,000, and is 116,000 if one excludes the only two designated countries (Liberia and Panama) whose population exceeds one million. Although the 35 tax havens represent over 15% of the world's countries, their total population comprises just 0.150% of

* Corresponding author. Stephen M. Ross School of Business, University of Michigan, 701 Tappan Street, Rm. R5396, Ann Arbor, MI 48109-1234, United States. Tel.: +734 936 3914; fax: +734 936 8716.
E-mail address: jslemrod@umich.edu (J. Slemrod).

[1] The OECD report distinguished tax havens from cases of countries that raise significant revenues from the income tax but have preferential tax regimes for certain kinds of income, generally restricted to non-residents; see footnote 4. This paper is about the kind of tax haven covered by the OECD's definition.

[2] This history is recounted in Eden and Kudrle (2005).

[3] Public U.S. support for the OECD initiative flagged after 2000, as exemplified by statements by the Secretary of the Treasury suggesting that the U.S. government was no longer committed to fighting the tax havens. The financial crisis of 2008 prompted renewed interest in tax havens, as part of multilateral efforts to strengthen the financial system. The proclamation of the G20 summit issued on April 2, 2009 called for "action against non-cooperative jurisdictions, including tax havens," and continued that the G20 countries "stand ready to deploy sanctions to protect our public finances and financial systems."

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the world's population (0.058% excluding Liberia and Panama). Of the 35 designated tax havens, 27 are island nations.[4]

In sharp contrast to the longstanding concern among policy makers about the deleterious effects of havens, some recent literature has focused on a potentially beneficial role for tax havens.[5] The starting point is the well-known result that, under certain conditions, a small, open economy should levy no distorting tax on mobile factors such as capital.[6] Countries do, however, levy distorting taxes on mobile capital, and much of the recent theoretical literature conceives of tax havens as a device to save these countries from themselves, by providing them with a way to move toward the non-distorting tax regime they should, but for some reason cannot, explicitly enact.[7] For example, in Hong and Smart (2005), citizens of high-tax countries can benefit from haven-related tax planning because it allows them to tax domestic entrepreneurs (in a lump-sum way) without driving away mobile multinational capital. The presence of the haven reduces the (distorting) effective marginal tax rate for any given statutory tax rate.

Some empirical support for the "tax havens are good" argument is offered by Desai et al. (2006a), who argue that the scale of U.S. multinational corporations in foreign non-haven countries drives the establishment of affiliates in haven countries.[8] Desai et al. (2006b) explain these findings with a model in which there are complementarities between investment in havens and investment in neighboring non-haven countries, so that the presence of a tax haven enables tax planning that lowers the cost of investing, and thus stimulates investment, in these countries.

The idea that countries should welcome tax havens as a way to overcome their inability to explicitly differentiate the effective tax rate on mobile and immobile capital must be reconciled with the fact that governments of non-haven countries often expend considerable resources to limit the effect of haven transactions on their own tax revenue.[9] It suggests that these countries do not view havens as a way to overcome exogenous, perhaps politically motivated, constraints on their tax policy.

This paper develops a model of tax competition in the presence of parasitic tax havens that explains and justifies existing initiatives to limit haven activities. In the model, tax havens lead to a wasteful expenditure of resources, both by firms in their participation in havens and by governments in their attempts to enforce their tax codes. In addition, tax havens worsen tax competition problems by causing countries to reduce their tax rates further below levels that are efficient from the viewpoint of all countries combined. Either full or partial elimination of havens is found to be welfare-improving. Indeed, initiatives to limit some, but not all, havens can be designed to raise welfare both in the non-haven countries and in the remaining havens. To demonstrate this last possibility, we model the decision to become a haven and, in so doing, demonstrate that small countries have a greater incentive to become havens.

Our model is designed to capture the role in the world economy of the small, mostly island economies that act as tax havens. For this reason we do not develop a model of symmetric, identical countries, but rather a model in which some countries act as havens and other countries do not—the former are parasitic on the revenues of the latter, in a way we make explicit. Second, we model the real resources that are used up as companies shift taxable income to tax havens and home country governments attempt to limit this shifting. To address this issue, we model tax havens as juridical entrepreneurs that sell protection from national taxation, resulting in what Palan (2002) calls the "commercialization of state sovereignty."[10] The equilibrium price for this service depends on the demand for such protection, which in turn depends on the tax system, including the resources devoted to tax enforcement by the non-haven countries, and on the technology available to the parasitic havens. Our analysis allows this "price" to take the form of cash or various "in-kind benefits" provided to the tax haven. The activities undertaken by havens facilitate what may be viewed as forms of legal tax avoidance or illegal tax evasion. We do not prejudge their legality and recognize that the dividing line between legal and illegal activities is often blurry. For brevity, however, the term "avoidance" is sometimes used in this paper to cover both types of haven activities.

In addition to examining restrictions on the number of havens, we explicitly model the decentralized use of enforcement activities. The notion that tax enforcement policy is a separate instrument of tax policy that can play a role in tax competition has been recognized in the work of Cremer and Gahvari (1997, 2000). An important insight from this work is that each country has an incentive to enforce its tax base suboptimally, because the resulting reduction in the effective tax rate causes more of the mobile tax base to locate within its borders. Whereas this result may also hold in the current model, we explicitly examine the mix of statutory rates and enforcement levels used to finance a given public good level. Our conclusion is that countries would be better off if they agreed to increase their tax rates and lower enforcement. Doing so would raise the demand for the services provided by tax havens, which would raise the effective price of these services and thereby discourage their use. Countries fail to take into account this "cost externality" when choosing how vigorously to enforce their tax codes.

[4] Some countries that levy low corporate tax rates do so in part to attract real investment, knowing that once multinational companies have made such an investment, it is in their interest to use transfer pricing and other strategies to shift taxable income into the low-tax host country and away from other high-tax jurisdictions in which they operate. For example, the analysis of havens in Hines (2005) covers a different set of countries than the OECD list, including some countries, most notably Ireland and Switzerland, that have the kind of dual motivation discussed in this footnote.

[5] Dharmapala (2008) critically surveys what he calls the "positive" and "negative" views of tax havens.

[6] The intuition behind this result is straightforward. All taxes levied in this economy will ultimately be borne by the immobile factors. Given that, it is better to levy taxes directly on the immobile factors; attempting to tax the mobile factors will not change the incidence but will, unlike taxes levied directly on the immobile factors, drive away the mobile capital, thus reducing the productivity and therefore the pre-tax return to the immobile factors. See Gordon (1986) and Bucovetsky and Wilson (1991) for demonstrations that small open economies should not levy distorting source-based taxes.

[7] A separate literature examines the issue of whether countries would benefit from international agreements that potentially lessen tax competition by restricting the degree to which countries can provide preferential tax treatment to relatively mobile factors. The results are mixed. See Janeba and Peters (1999), Keen (2001), Janeba and Smart (2003), Wilson (2005), and Bucovetsky and Haufler (2008). Marceau et al. (forthcoming) demonstrate that rules against preferential treatment enable small countries to compete away mobile capital from larger countries, but that non-preferential regimes are still preferable. Yet another literature models information sharing between governments as a strategic variable in tax competition; see, for example, Bacchetta and Espinosa (1995). Peralta et al. (2006) assume that countries cannot directly discriminate in the rates of profit taxation of mobile and immobile firms, but a government may optimally decide not to enforce the arm's length principle of transfer pricing in order to host a multinational firm while setting high profit taxes on domestic firms. Similarly, Becker and Fuest (2005) demonstrate that if immobile and mobile firms must be taxed at the same rate, then the government may wish to alter other aspects of the tax code to reduce the effective taxation of the mobile firms, including the use of a pure profits tax and the degree to which capital costs are tax deductible.

[8] To establish causality, they use foreign countries' economic growth rates as instruments for the scale of a multinational corporation's operations in foreign non-haven countries.

[9] One path of reconciliation might be that a country would want to spend resources to limit which companies can take advantage of tax havens (to, presumably, the more mobile ones).

[10] We do not consider other outlets for such commercialization, although Slemrod (2008) analyzes country decisions to engage in three such outlets: tax havens, issuing "pandering" postage stamps, and money laundering. The data analysis provides support for the idea that commercialization of state sovereignty is more likely in countries where it is more difficult to raise revenue in alternative ways. Examples of commercialization that are more likely to directly raise revenue (stamp pandering and tax havens) are more attractive to poorer countries.

The plan of this paper is as follows. We develop the model in the next section, and then devote Section 3 to deriving the rule for equilibrium public good provision in the presence of tax havens. Section 4 demonstrates that eliminating tax havens raises public good levels and improves welfare. The partial elimination of havens is addressed in Section 5, and Section 6 analyzes inefficiencies in tax enforcement activities. In Section 7, the model is extended to include the endogenous determination of the number of tax havens, along with the welfare effects of restrictions on this number. Section 8 concludes.

2. The model

We extend a standard model of tax competition to include tax havens.[11] The economy contains a large number of countries, each containing a fixed number of identical residents, L_i for country i. Each resident possesses one unit of labor and k^* units of capital. The utility function is denoted $u(x, g)$, where x is private consumption and g is consumption of a publicly provided private good, both of which are normal goods. For brevity, we refer to the latter good as the "public good."

The capital employed by country i is K_i, with $K_i - k^*L_i$ representing imports of capital. Competitive firms use a constant-returns technology to transform these inputs into a single output. This output is sold to consumers in the form of the private consumption good, and to the government for use as the sole input in the production of the public good. Although countries differ in size, we will specify a constant-returns technology for collecting and evading taxes that yields equilibrium tax policies that are independent of (non-haven) country size.

Following the standard models of tax competition, the public good is financed by a tax on mobile capital. We later argue that the main results of this paper extend to the case where countries can tax both capital and immobile labor, provided taxing labor also involves administrative and compliance costs. These costs imply that a country's optimal tax system includes both capital and labor taxes.

The taxation of capital takes the form of a territorial tax on "taxable business income," defined below. In particular, each government taxes only the capital income earned within its borders.[12] This assumption is standard in the tax competition literature, and reflects the difficulties that home countries face in effectively taxing foreign-source income.

In standard models that feature perfect competition and constant returns to scale in production, the number of competitive firms is typically indeterminate and irrelevant. For the present case, however, we wish to model tax avoidance at the firm level. Consequently, we assume that investors create firms using one unit of capital per firm, and then these firms hire labor and decide whether to shift income to tax havens.[13] Each firm has access to the same production technology and therefore employs the same labor and produces the same output. Firms differ, however, in the cost of participating in tax havens, as described by a parameter, θ. This parameter can be interpreted as the legal and accounting fees needed to research the relevant tax laws, research the available tax havens, and implement the chosen income-shifting strategy.

To obtain the "concealment services" that havens provide, firms must also incur a variable cost. In particular, we posit a unit price of concealment services, p, which in equilibrium is a function of the worldwide purchases of these services, C. In other words, there is a well-defined inverse supply function for concealment services, $p = p(C)$, which is assumed to be upward-sloping. An interpretation is that there are many "competitive" havens, each of which prices its services at marginal cost.[14] As previously noted, havens may be paid in cash or in indirect forms of compensation, such as investments made at favorable terms that facilitate economic growth. Section 7 describes some approaches to modeling the concealment supply function in more detail, including a model in which a higher concealment price causes more countries to become tax havens. But for now, we treat the number of countries that are tax havens as exogenously fixed. If a country is not a tax haven, then it is often simply referred to as a "country."

For the present analysis, we assume that the total size of havens is sufficiently small to imply that any net imports or exports of capital between havens and countries are unimportant *relative to the aggregate size of the non-haven countries*. This assumption is consistent with our previous observations that havens tend to be very small jurisdictions. It allows us to follow standard tax competition models by treating the capital employed per worker as fixed for the system of non-haven countries as a whole. Note that the investment flows associated with haven activities may still be important to havens even while they are unimportant to non-haven countries.

The timing of events is as follows. First, each country's government chooses its tax rate and expenditures on tax enforcement. Next, firms are formed, with capital moving across countries to ensure that a firm's expected income, calculated net of taxes, labor expenditures, and expenditures on the concealment of taxable income, are the same everywhere. This expected income is denoted r, which may be interpreted as the expected after-tax return on capital. The realized return is random because investors do not yet know the value of θ. However, when making their investment decisions, investors correctly anticipate wages in each country and the opportunities for concealing income. In the next stage, θ is revealed, output is produced and sold, taxes are paid, and the public good is provided.

Output produced in a country may then be written $Kf(L/K)$, where the production function f relates a firm's output per unit of capital to the labor–capital ratio that it employs, and country subscripts are dropped where doing so would cause no confusion. The income earned by a firm's investors before taxes are paid (or avoided) is given by the before-tax return on capital, $R = f(L/K) - W(L/K)(L/K)$, where $W(L/K)$ is the country's equilibrium wage, which is declining in the labor–capital ratio. Note that R is an increasing function of L/K. Inverting this function yields the capital demand function, $k(R)$, expressed per unit of labor. With R and W both related to L/K, we can also define a factor–price frontier, $W(R)$, which satisfies the requirement that equilibrium profits (output minus labor and capital costs) equal zero.

Capital income is taxed at the statutory rate t, but a firm can lower the tax base, and therefore the average effective tax rate, by first incurring the "setup cost," θR, which we take to be a fixed fraction of firm size as measured by income, R.[15] For each dollar of income, $s(c, b)$ can be shielded from taxes by making use of c units of concealment services at the cost pc, where b represents the government's enforcement expenditures per unit of capital.[16] This function is increasing and strictly concave

[11] See Wilson (1999) for a review of the tax competition literature.

[12] This assumption allows us to sidestep the question of whether havens can benefit capital-exporting countries by reducing the tax collected by host countries, letting the home country collect more revenue for any given excess burden. See Hines and Rice (1994) for an elaboration of this argument.

[13] By limiting the income shifting opportunities to tax havens, the model does not address the possibility that the non-haven countries might compete for capital by not only lowering their tax rates, but also by offering the types of avoidance services provided by havens. In this case, restrictions on tax havens may increase the attractiveness of low-tax, but non-haven, alternatives.

[14] Note that this specification may be interpreted more generally by assuming that the production of concealment services requires the use of not just a tax haven, but also the aid of "accountant services" located in a firm's country of residence. More formally, one could posit a production process whereby accountant and haven services serve as intermediate inputs in the production of concealment services. If there were constant costs in the provision of accountant services (to abstract from issues related to country size, which do not seem important in this context), then all countries would face the same world supply curve for concealment services.

[15] Making the setup cost proportional to revenue R simplifies the algebra, because the subsequent purchases of concealment services are also proportional to R; however, our results are not sensitive to this particular specification.

[16] Equivalently, we could specify a cost function $c(s, b)$. Whereas firms are assumed to directly choose c in the current paper, a previous draft assumed that they chose s, given a nonlinear price function, $p(s)$, designed by tax havens to induce firms to choose s efficiently. The two specifications are effectively equivalent.

in c, and declining and convex in b, with $s(0,b)=0$ and $1>s(c,b)>0$ for all positive c. In particular, some taxes are paid even when $b=0$, although the amount may be small (costless "moral suasion").[17] Finally, we assume that $\partial^2 s/\partial c\partial b<0$, implying that an increase in b reduces the marginal productivity of c in income-shifting activities, thereby reducing a firm's optimal purchases of concealment services. Unless specifically indicated, we will consider only interior solutions for both taxpayers and the government, i.e., where b and c are positive.

For a firm that takes advantage of this income-shifting opportunity, after-tax profits are

$$\tilde{r} = R[1-(pc+\theta)-t(1-s)], \tag{1}$$

where the tilde distinguishes this return from its expected value, r, calculated prior to the realization of θ. For ease of notation only, we assume that the costs of participating in tax havens are not deductible from taxable income. Also without loss of generality, we assume that the income shifted to a tax haven is not taxed at all by the haven.

The firm chooses s to maximize $\tilde{r}$, yielding the first-order condition,

$$t\frac{\partial s}{\partial c} = p. \tag{2}$$

As an example, suppose that $s=c^{\gamma}$,$\gamma<1$, for a given b and a value of c in some neighborhood of zero. In this case, Eq. (2) implies that dc/dt is increasing in t, with $dc/dt=0$ at $t=0$. Alternatively, let $s=\int_0^c \frac{1}{\psi+x}dx$, $\psi>0$, again for a given b and small values of c. For small values of t, we then have a corner solution, where $c=0$. But for any given t, no matter how small, we may choose ψ sufficiently small to ensure that the chosen c is positive, in which case Eq. (2) implies that $dc/dt=1/p$.[18] This last example suggests that the marginal deadweight loss from an increase in t can be substantial even at low values of t, measured in terms of the resources "wasted" on tax avoidance. As we next see, however, few firms will choose to evade taxes at small values of t.

The benefit that a firm receives from participating in a haven, calculated per dollar of income and not counting the setup cost θ, is the tax saving

$$\Theta = ts - pc. \tag{3}$$

This benefit determines the number of firms that participate in a haven. In particular, all firms with $\theta<\Theta$ choose to participate, whereas those with $\theta>\Theta$ do not. Letting $G(\theta)$ denote the continuous distribution function for θ, the number of firms participating in a tax haven, summed over all countries, is $G(\Theta)k^*\sum_{i\in N} L_i$, where N is the set of countries. With each of these firms purchasing cR units of concealment services, aggregate purchases are $C = cRG(\Theta)k^*\sum_{i\in N} L_i$.

Letting $\alpha=G(\Theta)$ denote the share of firms that shift income to havens, we may rearrange Eq. (1) and take its expected value to obtain the pre-tax return, R, as the sum of the expected after-tax return, r, the effective tax rate, T, and the social costs associated with capital income tax shifting, D:

$$R = r + T + D, \tag{4}$$

where

$$T = tR(1-\alpha s) - b, \tag{5}$$

and

$$D = R[\alpha\{pc + E(\theta|\theta<\Theta)\}] + b, \tag{6}$$

where $E(\theta|\theta<\Theta)$ is the expected value of θ, conditional on participation in a tax haven. The social cost of capital taxation per unit of capital, D, consists of government expenditures on enforcement, b, plus the expected costs incurred by a firm to evade taxes. Using Eqs. (3)–(6), together with the optimizing behavior of taxpayers, we may define the functions, $T=T(R, t, b, p)$ and $D=D(R, t, b, p)$. The costs included in D are deadweight losses not only from the given country's viewpoint, but also from the viewpoint of all countries combined, because they represent expenditures on real resources.

For future use it will be helpful to invert the function T to obtain $t=t(R, T, b, p)$. By substituting this function into $D(R, t, b, p)$ and using the determination of R given by Eq. (4), we may redefine the function D as $D(r, T, b, p)$. Except when indicated otherwise, this latter function is used for the remainder of this paper. The derivative, $D_T(r, T, b, p)$, is positive, because a rise in the effective rate T requires an increase in the statutory rate, which induces more firms to participate in havens, and existing participants to increase their concealment purchases. In addition, the higher statutory rate raises the before-tax return, R, which further increases $D(r, T, b, p)$, because more income is subject to avoidance. Note finally that a welfare-maximizing country will choose an enforcement level b to minimize $D(r, T, b, p)$. In other words, it will choose the combination of t and b that minimizes this deadweight loss, subject to the constraint that t and b yield the chosen effective rate T. In the case of an interior solution, we may use the first-order condition, $D_b(r, T, b, p)=0$, to define a relation between the optimal value of b and T, given the r and p faced by the country.

The government budget constraint requires that the cost of the public good be equal to tax revenue net of enforcement expenditures. Assuming constant returns to scale in the provision of the public good, this cost may be written gL, and the budget constraint may then be expressed in per-capita terms as follows:

$$g = Tk(R). \tag{7}$$

Finally, private consumption x is determined by the resident's budget constraint:

$$x = rk^* + W(R). \tag{8}$$

3. Equilibrium public good provision

This section derives the rule for equilibrium public good provision and shows how the activities of tax havens affect this rule. The optimization problem for a government consists of maximizing the utility of its residents, $u(x, g)$, subject to the government budget constraint [Eq. (7)], a resident's budget constraint [Eq. (8)], and the equation determining how taxation raises the gross return on capital above the net return [Eq. (4)], which we rewrite as follows:

$$R = r + T + D(r, T, b, p). \tag{9}$$

Consider now the optimal choice of the public good supply. Replacing g and x in $u(x, g)$ with the expressions given by Eqs. (7) and (8) and using (9), yields an unconstrained optimization problem with T and b as the control variables. The first-order condition for T is derived by differentiating Eqs. (7) and (8) with respect to T in order to obtain the marginal rate of transformation between x and g, $(dx/dT)/(dg/dT)$, and then equating this quantity to the marginal rate of substitution between x and g, yielding:

$$\frac{u_g}{u_x} = \frac{1+D_T}{1-\frac{T}{R}\varepsilon(1+D_T)} \equiv MC, \tag{10}$$

[17] This specification avoids discontinuities at $b=0$, where $s(c, b)$ goes to zero as c goes to zero for $b>0$, but $s(c, b)=1$ for $b=0$ and $c>0$. We assume that $s(c, b)$ is twice continuously differentiable.

[18] We cannot choose $\psi=0$, because then the integral defining the function s does not exist.

where $\varepsilon = -k'(R/k) > 0$, denoting the capital demand elasticity (measured positively), and use is made of the factor–price derivative, $W'(R) = -k$. Some of our results rely on a marginal cost function that increases with T, with t and b optimally set for each T, and decreasing in enforcement b, given T. The first property necessarily holds in the absence of havens, and it can be argued that both results hold for a wide variety of income-shifting functions.[19]

Recall that in the standard tax competition model (i.e., where tax evasion and avoidance are absent), the marginal cost of g, MC, exceeds the marginal resource cost (normalized to equal one) because each country treats as a cost the outflow of capital resulting from a rise in its tax rate on capital. This outflow represents a positive externality for other countries, in the form of capital inflows, suggesting that public good provision is inefficiently low (more on this below).

When tax havens exist, the standard tax competition story is incomplete because it ignores several relevant factors. First, increasing T through a higher statutory rate on capital income, t, makes concealment services more valuable to firms. As a result, they respond by increasing their purchases of concealment services: c and s rise. In addition, more firms participate in tax havens, so α rises. These responses cause the required return R to rise more than it would in the absence of tax havens, and the result is a greater outflow of capital, shown in Eq. (10) by the marginal loss term, D_T, multiplying the capital demand elasticity, ε. The more elastic response of capital to changes in the effective tax rate increases the marginal cost of raising funds in this way. But in addition to this increased elasticity, there is the burden arising directly from the additional resources that go into tax haven activities when the tax rate is raised. Since labor is the immobile factor, it bears this burden in the form of a greater fall in the wage, reflected by the presence of D_T in the numerator of the expression for MC in Eq. (10). For both reasons—the direct burden of additional expenditures on havens, and the increase in the capital elasticity—tax havens tend to raise the marginal cost of public good provision.

One additional optimality condition is the requirement that the enforcement level minimize deadweight loss: $D_b(r, T, b, p) = 0$, for $b > 0$, given the tax variables, as previously explained. To shorten the exposition, we also assume that the equilibrium b is positive, unless stated otherwise.

4. The undesirability of tax havens

We now demonstrate that in our model tax havens are undesirable for non-haven countries. The argument proceeds by eliminating tax havens and showing that, for two reasons, welfare increases. First, each country's residents directly benefit from the productive use of resources that were previously used for income shifting and tax enforcement activities. Second, the marginal cost of the public good declines, inducing countries to increase their public good levels. We shall show that competition for capital implies that the equilibrium public good level remains below the level that is optimal from the combined viewpoint of all countries, and so eliminating tax havens moves the public good level closer to this optimum, increasing welfare. Thus, the following proposition obtains:

Proposition 1. *The elimination of all tax havens raises the equilibrium level of the public good and increases country welfare.*

Proof. Eliminating havens does not alter factor prices R and $W(R)$, which are determined by the equilibrium condition, $k(R) = k^*$. For a given g, however, the resulting efficiency gains raise private consumption, x.

But g does change. If it remained at its initial value, then the rise in x would increase the marginal benefit of g, given by u_g/u_x, since g is a normal good. But for a given value of T, the absence of havens would eliminate the marginal deadweight loss term, D_T, on the right side of Eq. (10), causing MC to fall (recall that R does not change). With the marginal benefit now greater than the marginal cost of public good provision, equilibrium would be restored through an increase in every country's g, as shown in Fig. 1.

To conclude the proof, we show that this increase in g in every country raises each country's welfare. Set g at its new equilibrium level, where

$$\frac{u_g}{u_x} = \frac{1}{1 - \frac{T}{R}\varepsilon} > 1. \tag{13}$$

When all countries raise g by increasing their taxes, no country's capital stock changes, and so the wage rate also remains fixed. Thus, there is no loss in revenue from capital outflows: that is, the term $T\varepsilon/R$ drops out of Eq. (13), lowering the marginal cost to one. Countries therefore provide g at the level where increasing g by a unit in every country, financed by raising t, would provide a marginal benefit, u_g/u_x, that exceeded the marginal cost. It follows that the positive impact of the elimination of tax havens on each country's g raises welfare. □

As previously explained, tax havens increase the marginal cost of public good provision because the higher tax on capital needed to finance additional provision induces firms to make greater use of tax havens, increasing the deadweight loss from these havens and, as a result, causing a greater outflow of capital from the country. Although the model developed here assumes that the capital tax is the only available means of financing the public good, an earlier version of the paper demonstrates that all of our main results extend to the case where both mobile capital and immobile labor can be taxed. To see this, note that if a tax on labor could be costlessly collected, then governments would prefer a labor tax to a capital tax, since the latter distorts investment. Even if we introduced a labor–leisure distortion into the model, the labor tax would still be preferred; as shown by Gordon (1986) and Bucovetsky and Wilson (1991), a small open economy should not tax capital income at source if a tax on (immobile) labor income is available, regardless of the labor supply elasticity. But these arguments ignore the administrative costs involved in taxing wage income, including those associated with addressing tax evasion and avoidance activities. Standard models predict that employers and employees face incentives to engage in these activities (see Slemrod and Yitzhaki, 2002, for a review). In the

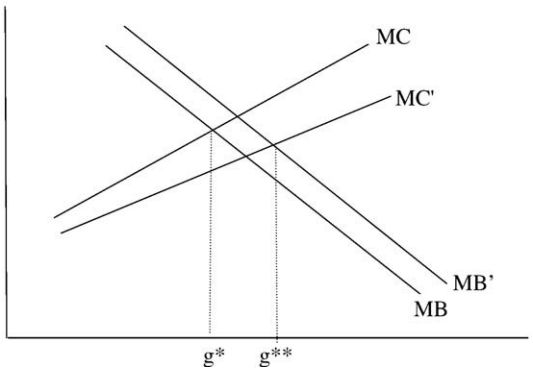

Fig. 1. Public Good Provision.

[19] These properties are used in Proposition 2, and are assumed to hold with r adjusting to keep R fixed at its equilibrium level. As T rises, the higher statutory tax rate (t) will lead to greater income shifting, narrowing the tax base and therefore requiring a higher increase in the tax rate (t) to raise T by a unit. The greater rise in t implies a greater increase in the deadweight loss, D_T. By a similar argument, financing a given T with a lower t and higher b can be expected to lower D_T. Note too that MC rises in T, given D_T and R. These observations justify the two properties.

earlier version, we develop a reduced-form model of wage taxation that recognizes the costs associated with the evasion and avoidance activities. In this model, countries choose to tax both wage and capital income. As stressed in Mayshar (1991) and Slemrod and Yitzhaki (2002), under an optimal tax system, the marginal efficiency cost of funds should not depend on how these funds are obtained at the margin. Thus, the marginal cost of the public good should not depend on whether the source of marginal financing is the labor tax or the capital tax. Eliminating tax havens enables this equality of marginal costs to be obtained with a higher tax rate on capital income and a lower tax rate on wage income. The lower wage tax implies that the common marginal cost must be lower, thereby increasing public good provision.

In contrast to the assumptions of this analysis, there may exist administrative or political reasons for a country to levy taxes at the same statutory rate on both wage and capital income. In this case, governments may have an incentive to allow tax havens to exist, because their presence lowers the effective tax rate on mobile capital.[20] But it would be preferable to lower this effective tax rate simply by reducing the statutory rate, rather than allowing havens to flourish, because tax havens raise the cost of collecting any given amount of revenue derived from taxing capital income.

Note, too, that even if we impose the requirement that capital and wage income must be taxed at the same statutory rates, it might still be the case that eliminating all tax havens is beneficial. Assuming that taxes on wage income induce evasion and avoidance, the optimal tax system involves some taxation of capital income, and so governments will engage in costly enforcement activities to collect this tax. Eliminating havens reduces these enforcement costs, but the resulting effective tax rate on capital is presumably too high when capital and wage income must face the same statutory tax rate. These two considerations work in opposite directions, so in the political-constraint scenario, we cannot say for sure whether tax havens are good or bad. However, the next section demonstrates that it is always desirable to eliminate *some* havens, provided enforcement costs are initially positive, and this result extends to the case in which all income is taxed at the same statutory rate.

5. Partial elimination of tax havens

Partial elimination of tax havens raises some issues that complete elimination does not. In particular, if some, but not all, tax havens are eliminated, then countries are affected by the reduction in the supply of concealment services, because the equilibrium price of these services will increase (see Section 7). The question thus becomes whether country residents are better off when p increases, but not all the way to infinity. This section answers that question in the affirmative.

To establish this result, we need to place restrictions on the form of the income-shifting function, $s(c, b)$. In particular, assume that this function can be written as $s(c/(\gamma+b))$, where $s(0)=0$, $s'(\cdot)>0$, and γ is a positive parameter. For small values of this parameter, it is then approximately true that equal percentage changes in concealment services (c) and enforcement expenditures (b) leave unaffected the optimal amount of income shifting. To shorten notation, define $B=\gamma+b$, in which case we may describe $s(c/B)$ as homogeneous of degree zero in c and "adjusted enforcement," B. Then the first-order condition for a firm's optimal choice of c, given by Eq. (2), becomes:

$$ts'\left(\frac{c}{B}\right) = pB. \tag{14}$$

[20] This is the logic underlying the "tax-havens-are-good" literature discussed in Section 1.

Referring to $s(c/B)$ as the "homogeneous income-shifting function," we prove the following lemma in Appendix A:

Lemma 1. *For the homogeneous income-shifting function, if $b>0$ in equilibrium, then a rise in the unit price of concealment services, holding fixed the after-tax return, r, raises a country's welfare.*

By Eq. (14), the increase in p enables countries to reduce their enforcement expenditures, b, without causing the amount of income shifting to rise. Since b is financed out of the government budget, countries are then able to increase public good provision.

The behavioral response of countries to a higher p creates externalities through their impact on the after-tax return, r. The proof in Appendix A of Proposition 2 below shows that the increase in p increases the equilibrium public good level by shifting down the marginal cost of funds curve, and shifting up the marginal benefit curve. In Fig. 1, the new equilibrium public good level is denoted g^{**}. Countries respond to the rise in p by increasing public good provision and their taxation of capital, which drives down r. In the standard tax competition story, welfare rises in every country because no country experiences a capital outflow when their taxes all rise by identical amounts. Instead, r falls enough to keep the before-tax return R unchanged, thereby eliminating incentives for capital to exit any country.

But when tax havens are present, the reduction in r may increase the costs associated with these havens. In particular, the unit tax tR falls as r declines, requiring a higher t to offset the revenue loss. But this higher statutory rate increases incentives to shift income through the use of tax havens. As a result, it appears possible for welfare to fall as each country's public good level rises above the equilibrium value. In other words, we cannot rule out the possibility that the equilibrium level of public good provision is inefficiently high.

The public good must be underprovided when the number of havens is sufficiently small, because the higher t no longer has much effect on tax haven activities, relative to the fiscal externalities that lead to public good underprovision. Thus, we can say that a large enough elimination of havens must improve welfare (assuming that b remains positive, as required for Lemma 1). In addition, our previous examples suggest that the fiscal externalities leading to public good underprovision will in many cases outweigh the new "avoidance externality" identified in the previous paragraph, provided the capital tax is not too high. In particular, recall our examples where $dc/dt=0$ at $t=0$. In this case, small taxes create no first-order demand for concealment services, and therefore no first-order participation in tax havens. As a result, the efficiency losses from the fiscal externalities dominate those from capital tax avoidance if t is not too high.

Thus, underprovision of public goods remains a relevant problem in economies with both tax competition and tax havens, and reducing the number of tax havens is beneficial because it increases public good provision. Using Lemma 1, we may then state:

Proposition 2. *Assume a homogeneous income-shifting function, and consider an equilibrium where $b>0$. By increasing the concealment price p, a reduction in the number of havens causes all countries to increase their public good provision. Provided that tax competition leads to underprovision of the public good, this reduction in havens must raise welfare.*

The proofs of Lemma 1 and Proposition 2 in Appendix A do not depend on whether labor is taxed, either optimally or at the same statutory rate as capital income. The basic idea is that raising the concealment price p enables enforcement expenditures b to be reduced, without lowering concealment expenditures pc or the amount of income shifting, s. The extra revenue made available by the fall in enforcement expenditures can be used to lower taxes, thereby encouraging public good provision by lowering its cost. If

wage and capital income are taxed at the same rate, both taxes fall, but public good provision still rises.

As the number of havens is reduced, raising p, it becomes increasingly likely that a corner solution will be reached, where governments realize it is no longer optimal to pay for enforcement activities. In this case, our proof of Proposition 2 is no longer valid.[21] However, the possibility that havens could be limited this much is perhaps farfetched. We return to the issue of haven reduction in Section 7. It is noteworthy that, although Hong and Smart (2005) argue in favor of tax havens, within their own model it is socially optimal for governments to limit the income-shifting activities of multinationals once the deadweight losses associated with these activities are incorporated into the model.[22]

6. Enforcement expenditures

Instead of attempting to control the number of tax havens, countries could instead coordinate their enforcement activities. If public goods are underprovided, then mandating stricter enforcement might improve welfare in part by leading to additional public good provision. However, such mandates would also affect the mix of taxes and enforcement used to finance the chosen public good level. We next argue that the equilibrium mix (i.e., without coordination) of tax rates and enforcement is inefficient under our assumption that the supply curve for concealment services is upward-sloping (i.e., when $p'(C)>0$). In this case, a higher tax rate on capital or a lower enforcement level will increase the equilibrium price of concealment services by increasing the demand for these services. We have already seen that this higher price raises welfare in all countries. One country's policy change causes only a small change in p, but this price change impacts a large number of countries, making its welfare effect non-negligible. This "cost externality" is not found in standard tax competition models. Here, it implies that countries finance their chosen public good supply with an inefficiently high level of enforcement, because they do not take into account that a lower level will, by raising p, benefit all countries.

The next proposition provides an exact sense in which enforcement is inefficiently high. The assumption that $p'(C)>0$ ensures that an increase in the demand for concealment services raises p, whereas the other assumptions were previously shown to imply that welfare rises with p.

Proposition 3. *Assume that:* (1) *the avoidance technology implies a homogeneous income-shifting function; and* (2) $b>0$ *in the initial equilibrium. Then countries acting independently enforce their capital tax collections too stringently. In particular, if each country reduces the enforcement level b by the same amount, while adjusting its capital tax t to keep its cost of capital unchanged, given the equilibrium r and p, then p will rise and all countries will be better off.*

Proof. Suppose first that that a single country raises the statutory rate t by a small amount but then lowers enforcement b enough to keep T unchanged. Given that the country has optimally chosen t and b, there is no first-order change in D, in which case $T+D$ is unchanged, thereby leaving the before-tax return, R, unaffected. In this case, there are no capital inflows or outflows and therefore none of the resulting externalities. However, both the rise in t and fall in b induce firms to demand more concealment services, driving up the price. If we implement this policy change in every country, p will rise and, as we have seen, all countries will benefit from the higher price. In particular, the proof of Lemma 1 shows that the rise in p can be accompanied by a further reduction in b so that these two changes together create surplus in the government budget while leaving unaffected $T+D$. The surplus then funds higher public good levels for all countries, implying an increase in welfare.[23] □

This proposition qualifies results in previous literature saying that governments compete for capital by reducing their enforcement activities (e.g., Cremer and Gahvari 1997, 2000), and it arises from cost externalities not found in the standard tax competition model. If the supply curve for concealment services were completely elastic ($p'(C)=0$), then these externalities would disappear, and so capital taxes would be collected using the level of enforcement that is socially optimal for the system of countries as a whole. But our analysis of haven formation in the next section suggests that an upward-sloping supply curve is the norm.

7. Country size and tax havens

We now model the formation of tax havens, in a way that generates an upward-sloping relation between the number of havens and the concealment price, and explains why relatively small countries are more likely to become tax havens.[24] The basic idea is that the costs incurred in becoming a haven grow with country size, whereas the benefit remains largely unchanged because a country's productivity in supplying concealment services is unrelated to its size. In other words, what enables a jurisdiction to provide concealment services (i.e., facilitate income shifting) is that it is *a* jurisdiction, not that it is a *large* jurisdiction.

Now suppose that countries are identical except for their population sizes, with $L(i)$ denoting the population of country i, where countries are ranked by size so that $L(i)$ rises with i. All residents within each country are assumed to be identical. In light of the constant-returns technology for concealment services, as well as tax enforcement, we can consider a symmetric equilibrium, under which all non-haven countries demand the same concealment services per unit of labor. We continue to assume that each country is small enough to have no significant impact on the after-tax return r and concealment price p. Thus, each country optimizes, conditional on these prices, and their optimal policies imply a before-tax return, $R(p, r)$. In equilibrium, p and r must then equate demand with supply in the capital market:

$$k(R(p,r)) = k^*. \tag{15}$$

Given p, Eq. (15) determines a market-clearing r, denoted $r(p)$. Using this function, we may then define a single country's per-capita demand for concealment services as a function of p alone, $d(p)$.

For mathematical convenience, assume a continuum of countries, indexed over the unit interval. Then we can integrate over havens and non-haven countries to obtain the total supply and demand of concealment services. Letting $c_i(p)$ denote haven i's total supply of concealment services, the market-clearing condition for p is:

$$\int_{i\in N} L(i)d(p)di = \int_{i\in H} L(i)c_i(p)di, \tag{16}$$

where N is the set of (non-haven) countries and H is the set of havens.

We shall argue that, under some assumptions, the per-capita benefit of becoming a haven falls with country size. Consider first the non-haven countries, which are free to choose any desired tax system.

[21] For income-shifting functions that do not satisfy our homogeneity assumption, we would need to rule out the possibility that Proposition 2 is reversed by asymmetries in the incentive effects associated with marginal changes in p and b.

[22] See their Proposition 6, which states, "The socially optimal degree of tax planning is positive but less than that preferred by multinational firms."

[23] If the model is extended to include a tax on wage income, then this budget surplus could alternatively be used to fund a reduction in this tax.

[24] We abstract from the fact that there may be heterogeneous characteristics of countries that make them intrinsically more or less attractive as havens. Dharmapala and Hines (2006) argue that one such characteristic is governance: well-governed small countries are, ceteris paribus, more likely to be tax havens.

In light of our constant-returns assumptions, the maximum value of a resident's utility is independent of country i's population level, $L(i)$. Using the function, $r(p)$, we may define this utility as a function of p alone: $v^n(p)$.

Turning to havens, define $v^i(p, pc)$ as the utility for a resident of a haven i, given a price p for concealment services and a value pc of the services provided by the haven. Suppose first that no concealment services are provided, implying that utility is $v^i(p, 0)$. The difference $v^n(p) - v^i(p, 0)$ may be interpreted as the cost of becoming a haven. In our model, the simplest way to view this cost is that it is the utility reduction associated with the requirement that havens lower their statutory tax rates on capital to inefficiently low levels, which in the prior analysis we have taken to be zero. Under our assumption that only capital is taxed, this would imply zero public expenditures. More generally, the mix of taxes used to finance these expenditures would also be inefficiently tilted towards too little taxation of mobile capital and too much taxation of immobile factors. Other costs might include inefficiencies in the financial system that result from concealment activities, such as the need to reduce the transparency of financial transactions. Once again, we may assume that these (per-capita) costs do not depend on country size, given our constant-returns assumptions: $v^i(p, 0)$ is independent of i. More generally, let us extend this independence property by assuming that $v^i(p, pc)$ takes the form $v(p, pc/L_i)$, reflecting the idea that residents care about per-capita benefits from the provision of concealment services, not total benefits.[25]

A haven's choice of concealment services c will depend on the variable costs incurred in providing these services. These costs could be modeled by specifying a cost function for providing these services, and then equating marginal revenue with marginal cost. For example, the haven banking system could be viewed as being involved in the production of concealment services, with the chosen level of these services then determined by solving a standard profit-maximization problem. If there are decreasing returns to scale, the resulting profits will rise less than proportionally with haven size, giving an advantage to small havens over large havens.

An alternative view of tax havens is that the incremental resources involved in concealing more income are minor, suggesting that decreasing returns is not at work and raising questions about what factors limit the provision of concealment services. Our view is that if a haven conceals too much revenue, those countries that are losing tax revenue will undertake activities to shut the haven down. To illustrate this mechanism, suppose that $\pi(c)$ denotes the probability that a haven is shut down next period, given the concealment services it provides now.[26] Let $V(p, pc/L_i)$ and $V^n(p)$ denote the expected present discounted values of the utility of a resident of a haven and non-haven, respectively, and assume that there is a cost Z of shutting down the haven and transitioning to a non-haven country. We may then write,

$$V(p, pc_t/L_i) = v(p, pc_t/L_i) + \frac{(1-\pi(c_t))V(p, pc_{t+1}/L_i) + \pi(c_t)[V^n(p) - Z]}{1+\rho}. \quad (17)$$

where the subscript t denotes time, and ρ is a discount rate. An interior solution can then be assured by making $\pi(c_t)$ sufficiently convex. This solution is obtained by differentiating $V(p, pc_t/L_i)$ with respect to c_t and setting the derivative equal to zero.

With this setup, it is clear that the maximized value of resident utility is declining with haven size, because the benefits from providing a particular level of concealment services must be spread over a larger population, whereas the probability of losing haven status, $\pi(c)$, is based not on the size of the country, but rather on the concealment-service level. Letting $V^i(p)$ denote this maximized value for country i, we may therefore conclude that there is a country i^* such that $V^i(p) < (>) V^n(p)$ for all $i > (<) i^*$, with country i^* indifferent about becoming a haven.[27]

Thus, we have found that only the smaller countries choose to become havens. As a result, the world supply curve, $p(C)$, is upward-sloping not only because a higher price induces existing havens to provide more concealment services, but also because it induces marginally larger countries to become havens. In our previous model with a fixed number of havens, only the first source of additional concealment services is present. In the case of a variable number of havens, we may assume that some countries choose to become havens in equilibrium, because reducing the number of havens towards zero drives up the equilibrium price p to the point where $V^i(p) > V^n(p)$ for some values of i.

We close by relating this model of haven formation to our previous results. Consider Proposition 1, which states that the elimination of all havens raises the level of public goods and welfare in non-haven countries. With an endogenous number of havens, the complete elimination of havens will improve welfare in all countries that are not initially havens, as well as in the larger havens, which are close to being indifferent about their haven status. However, the countries that were small havens may be worse off, because they had relatively high benefits from their haven status.

Proposition 2 considers an exogenous reduction in the number of tax havens (but not complete elimination), with the resulting reduction in the supply of concealment services raising the equilibrium price of these services. This higher price implies that the remaining havens are better off. In addition, Proposition 2 states that those countries that were not havens before the change are also better off. If the number of havens were initially determined endogenously, then the largest haven was indifferent about being a haven, so it does not suffer a welfare loss from being forced to give up its haven status; in fact, it shares in the welfare gains associated with the higher concealment price p. Thus, every country is better off. This result provides a possible explanation for why international agreements might successfully restrict the number of havens by some small amount, whereas large restrictions are not politically feasible. Propositions 1 and 2 address the welfare impacts of restrictions on havens, but not their political feasibility.

Finally, Proposition 3—that a coordinated reduction in enforcement combined with an increase in tax rates could make all countries better off—clearly extends to the endogenous-haven case. If enforcement is reduced and the statutory rate increased, then the higher p not only benefits non-haven countries, but it is also clearly to the advantage of havens. Thus, everyone in the world economy should desire less enforcement and higher statutory rates.

8. Conclusion

Unless territorial capital income taxes are dominated by other taxes, it is optimal for countries to devote resources to defend this revenue base. Tax haven jurisdictions make this more difficult by, in return for some compensation, facilitating tax avoidance in the form

[25] This function could easily be generalized by assuming that there is some rivalry in the benefits from providing concealment services, but not complete rivalry.

[26] Within the context of the model, such activities would involve some form of collective action, since no single country is large enough to significantly influence the price of concealment services. The probability function $\pi(c)$ then reflects the political activities that lead to this collective action. A more elaborate model would recognize that firms operating in a given country may concentrate their income-shifting activities in a small subset of havens, in which case the country would take the lead in attempting to shut down these havens if they become too large. Whereas the random collective actions underlying $\pi(c)$ are endogenous to the model, we use the model in this section to consider exogenous restrictions on havens that target the largest havens for shutting down, independently of their menu of concealment services.

[27] To ensure exact indifference, we employ our assumption of a continuum of haven sizes as an approximation of a discrete number of such sizes.

of income shifting. Incentives to participate in tax havens increase with capital income tax rates, and governments react to these incentives both by expanding enforcement activities and by reducing their overall levels of public expenditures.

Our analysis justifies concerns about the prevalence of tax havens. In an explicit equilibrium model where jurisdictions independently choose their optimal policies, the elimination of havens makes all non-haven countries better off. When the model is extended to incorporate the decision of a country to become a haven, however, smaller havens may be worse off if forced to give up their haven status. Whereas the elimination of a sufficiently small number of havens will leave all countries better off, the analysis points to the potential difficulties involved in eliminating large numbers of havens, including small ones.

The model presented here points the way to two potentially valuable research directions. One would integrate the key aspect of "havens-are-good" models—sub-optimizing governments—with the key aspects of the model presented here. Another promising research direction would address the dual motivation of some "bricks-and-mortar" low-tax countries that levy low tax rates in part to attract real investment, knowing that the low statutory rate lowers the effective tax rate on investment because it facilitates multinationals companies' income shifting.

Appendix A

Proof of Lemma 1. Applying the envelope theorem, we know that the impact of a rise in p on a country's welfare does not depend on how the common values of b and t change, since they are initially optimized. In particular, we may compute the welfare change by holding t fixed as p rises, and adjusting b in any way we find convenient; the welfare effect will be the same regardless of how we choose to change b. Since Eq. (14) tells us that s and c/B stay fixed if pB (and t) does not change, let us therefore reduce b enough to keep pB fixed as p rises, so that:

$$\frac{dB}{dp} = -\frac{B}{p}. \tag{A.1}$$

The constancy of pB and c/B also implies no change in pc, and along with the constancy of s, we can conclude that the number of firms participating in havens stays fixed. It follows that the only reason that the effective rate T changes is that enforcement expenditures decline (see Eq. (5)). The resulting rise in T creates a surplus in the government budget, which can then be used to increase the public good supply. With r and R unchanged (the change in b alone does not affect $R=r+T+D$, because T and D move in opposite directions by an identical magnitude), there is no change in private income, $x=rk^*+w(R)$. Thus, country welfare increases. □

Proof of Proposition 2. We need to show that the increasing p raises welfare. Consider first the policy response described in the proof of Lemma 1, where b is reduced as p rises so that pB stays constant. We know from the proof of Lemma 1 that T rises, only because b falls. As a preliminary step, hold g fixed by taking the revenue generated from the reduced enforcement expenditures and essentially throwing it away: the lower b in the expression for T given by Eq. (5) is replaced with $b+w$, where waste w is sufficient to keep T unchanged. Despite this waste, we show below that the marginal cost of public good provision is lower than before and, therefore, countries have an incentive to increase their public good levels, holding w fixed. Eliminating the waste w enables the capital tax to be reduced, further lowering the marginal cost of public good provision at the initial g. Moreover, the lower tax increases private consumption, x, which increases the marginal benefit of g, $MB=u_x/u_g$ (assuming g is a normal good). As shown in Fig. 1, the optimal level of public good provision rises to g^{**}. Under our assumptions, this greater provision improves welfare.

Consider first the impact of the changes in p and b on the capital tax-financed marginal cost of the public good, MC in Eq. (10). By Eq. (14), the constancy of pB implies no change in c/B and, consequently, no change in income shifting, $s(c/B)$, no change in its derivative, and no change in concealment expenditures, pc. Again using Eq. (14), we can also conclude that the marginal impact of t on c/B and hence s will be unaffected by these changes in p and B. Although the lower B implies that c will fall less in response to the tax-induced fall in c/B, the change in pc will remain the same, given the higher p. Given these results, neither the number of firms participating in havens, nor the marginal impact of t on these firms, will change. Collecting all of these results, we find that there is no change in the marginal cost of the public good, as defined in the text.

On the other hand, the higher p means that a unit rise in b will increase the right side of Eq. (14) more than before, leading to a greater fall in c/B and therefore greater fall in s. To satisfy each country's optimality condition for b, holding fixed T, we will therefore need to raise b and reduce t in each country, leading to a fall in D_T (footnote (22)). Moreover, the surplus in the government budget can then be used to lower the tax rate, while adjusting b optimally, which further reduces the marginal cost of public good provision at the initial g, while raising the marginal benefit. As explained above, the resulting rise in the equilibrium g further increases welfare. □

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