Honor among Tax Havens

S. Bucovetsky
Arts/Economics
York University
Toronto Ontario Canada

February 8, 2010

Abstract

This note presents a simple, partial equilibrium model of the supply of offshore tax havens, when multinationals are capable of sheltering some of their worldwide income. It provides a few contrasting predictions to those in "Tax Competition with Parasitic Tax Havens" by Slemrod and Wilson. Slemrod and Wilson model tax sheltering as a production process which uses up scarce resources in the tax haven providing it. Here, multinational firms can transfer some of their income costlessly to an offshore tax haven, which charges a fee for this privilege. (So there are no real resource costs to tax sheltering activity in this model.) But the tax havens must commit credibly to honor their implicit promise to keep tax rates low. The cost of sheltering income, the number of tax havens, and the extent to which multinational firms shelter income there are all determined by this credibility requirement. Although the tax rates in the rest of the world (the larger countries which are not tax havens) will affect the number of tax havens, they will have little or no effect on the amount of income which multinationals choose to shelter.

1 Introduction

While the vast popular literature may exaggerate the allure of tropical offshore tax havens (or the perfidy of multinational firms which choose to incorporate subsidiaries there), there is no doubt that many multinational corporations use tax havens to reduce their tax payments. When the parent company is located in a country (such as Canada or Germany) which effectively allows income of foreign subsidiaries to escape all corporate taxation in the parent company's home jurisdiction, the advantages of transferring income to a tax haven are obvious. But even if the parent company's home jurisdiction uses the credit method, there are substantial advantages to transferring income to subsidiaries in low–tax jurisdictions.[1] Transferring income to subsidiaries in tax havens may have some (negative) real consequences on a firm's overall before–tax income, but transfer pricing, intra–company borrowing, and reallocation of ownership of patents and other sources of intangible income do seem widely used.

While the scholarly literature is growing on the nature and consequences of multinationals' use of tax havens, the literature on the decisions of countries to become tax havens is a much smaller one. Slemrod and Wilson (2009) is, to my knowledge, the only paper which analyzes formally the decisions of countries' governments whether or not to become tax havens. The purpose of this note is to specify a very different technology than that assumed by Slemrod and Wilson. Although the intellectual debt this paper owes to theirs is obvious, the modelling variation presented here may provide some testable distinctions. In particular, Slemrod and Wilson show how the supply curve of tax havens should slope up. This note provides an explanation of why that supply curve might be (almost) horizontal.

Slemrod and Wilson describe the tax havens they analyze as "parasitic" because they "sell protection from national taxation". In other words, the tax havens they describe do not levy lower taxes on capital in order to attract production. Firms, in their model, produce output (using capital and labor as inputs) in countries which are not tax havens. They purchase " 'services' that facilitate the concealment of taxable income" from tax havens. These tax havens are the sort identified in the 2000 OECD report, very small countries in which a negligible proportion of the world's output and employment is located.

I follow this interpretation of tax havens, that tax sheltering does not involve any

[1] See Desai, Foley and Hines (2003), for example.

movement of a firm's actual production. Use of tax havens of this sort involves purely notional transactions, in which ownership of a patent is transferred among subsidiaries, or in which a subsidiary in a high–tax country issues debt which is held by an affiliate in a tax haven. For my purposes, what is important is that assets can be moved quickly by a parent among its subsidiaries. The hostage problem a company faces with a host country government is less severe than would arise if the company built a factory.

Now the data presented by Hines (2005) show that the previous paragraphs may exaggerate the ephemeral nature of activities in tax havens. He expands somewhat the OECD's list of tax havens. In his sample, although tax havens account for less than 1% of the world's population, 5.7% of the foreign employment of subsidiaries of American–based multinationals is located there, and over 8% of the plant and equipment. However, more than 3/4 of this employment, and more than 2/3 of the investment, is concentrated in Hong Kong, Ireland, Switzerland and Singapore, entities which the OECD report did not consider tax havens. Many of the (fiercely competitive) favors granted by these 4 governments seem to be inducements for multinationals to relocate production facilities, a different sort of activity than that considered by Slemrod and Wilson.[2]

There are a few features of tax havens, and of the companies which use them, which I wish to emphasize :

- Tax havens peddle avoidance, not evasion. Of course, one hardly expects any government to announce overtly that it is offering illegal services for sale. But even if multinationals may not be eager to trumpet to the world the details of their tax minimization strategies, their diffidence is motivated by public relations considerations, not fear of prosecution. While the OECD report emphasized secrecy as a "harmful" practice of tax havens, tax havens still seem to be thriving in a less secretive environment. Dharmapala and Hines (2009) note that "the vast majority of the world's tax havens rely on low tax rates and other favorable tax provisions to attract investment, rather than using the prospect that local transactions will not be reported".

[2]Of course, these larger "semi havens" do not neglect completely opportunities for paper shifting. Ireland's favorable tax treatment of patent income has induced Microsoft [a large purveyor of proprietary software, with an inexplicable popularity in the non–academic sector] to incorporate Round Island One in Ireland. The Irish subsidiary had gross profits of $9 billion in 2004, but is described (in Finfacts (2006)) as having a "thin roster" of employees, and as being located in a law office on a quiet street. It is this sort of tax preference which I am trying to model in this paper.

Slemrod and Wilson as well consider the activities of multinationals in tax havens as tax avoidance, not tax evasion. But their tax havens provide concealment services. Concealment takes some work, and uses up some resources. In contrast, providing an address for a holding company does not require much skill or effort : the people in the tax havens in my model won't do very much.

- Tax havens often charge a flat fee for their services. Non–resident corporations in Gibraltar, for example, are exempt from all taxes on income not derived from Gibraltar and not remitted to Gibraltar. Such companies must pay a flat annual fee of 230 pounds, in addition to a one–time set–up fee of 0.5% of authorized capital. Non–resident Panamanian corporations also pay no tax on income derived from activities outside of Panama, but pay an annual corporate franchise fee of $250. Annual licence fees in the Cayman Islands (a country with no corporate income tax at all) do vary with the corporation's capitalization, but in a stepwise fashion : $500 for a capitalization of $50,000 or less, $700 for a capitalization of $50,000 to $2,000,000, and $1750 for capitalization of $2,000,000 or more. International Business Corporations in Anguilla pay a flat annual licence fee of $230, as well as a one–shot flat set–up fee of $750.

- The value of tax havens to a firm seems to vary considerably with the nature of the firm's business. Certainly banks and shipping companies are often cited in the popular literature as being particularly egregious beneficiaries of offshore preferences. After all, their capital is pretty mobile. A list of the 25 (of the Fortune 500) American corporations with the most subsidiaries in tax havens[3] includes 7 whose primary business is banking, 4 in the energy sector, 2 insurance firms and 2 engineering firms ; there are few "traditional" manufacturing firms. The Cayman Islands[4] hosts headquarters of 75% of the world's hedge funds, and had susbsidiaries of 47 of the world's 50 largest banks in 2001.

- Many large multinationals incorporate many subsidiaries in tax havens. Enron, in its (brief) heyday, was perhaps an extreme example, with 882 different subsidiaries incorporated in tax havens. The vast majority of those were incorporated in the same country (the Cayman Islands), but Enron did use many different tax havens.

[3]Citizenworks (2004)

[4]Institutional Investor (2006), HSBC (2001)

While the practice of incorporating many subsidiaries in the same tax haven will not be addressed in this paper, the tendency to locate in several different tax havens will play an important role. It will be argued below that use of multiple tax havens will help provide insurance against tax–haven–specific risk. Desai, Foley and Hines (2003) show that use of several different tax havens may be necessary to minimize tax liabilities when the parent company's country uses the credit system. But insurance may be another motivation. Canada uses an exemption system, and each of the 5 major Canadian chartered banks has wholly–owned subsidiaries in 4 or more different tax havens.

- Despite the absence of tangible hostages, tax havens are perceived as somewhat risky. Perhaps the most compelling evidence on the perceived risk of offshore tax havens is provided by Dharmapala and Hines (2009), in which the quality of government has a significant positive impact on the probability of a country becoming a tax haven. Certainly these findings are consistent with the tax havens' own perceptions. Literature selling the services of tax havens (whether produced by government agencies or by private intermediaries) places a heavy emphasis on government stability and commitment.

  In the model developed below, two different types of confiscation risk will be identified. One is an exogenous risk of regime shift. This risk is determined by factors out of the control of the current government of the tax haven, which would correspond to the measures used in Dharmapala and Hines. The other is the risk that the current government may choose to confiscate. In the model, firms will locate in a tax haven only if the current government can commit credibly not to confiscate while it is in power. The annual fee charged to shelter income will turn out to provide such a commitment, in the equilibrium considered.

2 The Model : Timing

At the beginning of each period countries' governments are assumed to choose whether to be tax havens, or "normal countries". Then normal countries choose their capital tax rates, simultaneously and non–cooperatively, and tax havens choose the annual fee which they will charge for incorporation. These fees are also chosen simultaneously and non–cooperatively. Each multinational firm then decides whether to incorporate any subsidiaries in tax havens, and how many subsidiaries to incorporate. After the

multinational corporations have all made their tax sheltering decisions, and paid their fees to the tax havens' governments, the tax havens' governments then get to decide (simultaneously and non–cooperatively) whether to remain tax havens, or to renege on their commitment and try and expropriate rents from firms which have chosen to incorporate subsidiaries. Finally, nature moves : with some small positive probability, the tax sheltering arrangement in any tax haven will collapse. This exogenous, low–probability event can be viewed as a change of government.

The usual requirement of sub–game perfectness is imposed. Governments anticipate correctly the equilibrium tax rates, and the equilibrium annual fees for incorporation, when they make their decision whether or not to become tax havens. They anticipate firms' responses when they choose their annual fees (if they have chosen to become tax havens). Firms, when they choose whether and where to shelter income, anticipate the subsequent behavior of tax havens' governments : they will only choose to incorporate in a tax haven if they anticipate that the government of that tax haven will find it in its own interest to remain a tax haven.

All agents are risk neutral. In particular, firms care about the expected reduction in their annual global tax liabilities when they make their tax sheltering choices.

3 The Model : Technology

I assume that the amount of annual taxable income which a firm may be able to shelter is given. This amount, denoted z, will vary among firms. It depends on the size and profitability of the firm, and of the nature of the firm's business. Firms in industries in which a large fraction of the assets are mobile, or in which a large fraction of the costs are intangible, will tends to have higher values for z, other things equal. The amount of income a firm can shelter in a tax haven depends as well on the nature of its home country's tax treaties, but here I will be assuming that all countries in the rest of the world are identical in this respect.

The distribution function $F(z)$ of firms' income which can be sheltered will be assumed to have no mass points, and to be continuously differentiable.

The effective corporate income tax rate in the rest of the world will be denoted τ. I will assume that this tax rate is the same in all countries in the rest of the world. If no country is large enough to have a non–trivial effect on the world net return to capital

— and if countries are identical in all other respects except for population — this will be the case in equilibrium.

A multinational can avoid paying taxes on its "shelterable" income z by incorporating a subsidiary in a tax haven. I assume that each tax haven chooses to charge a flat fee for the privilege of incorporation of a subsidiary. Let x_i denote the annual fee chosen in tax haven i. If the multinational were to incorporate a subsidiary in tax haven i (and in no other tax havens), and if there were no risk of the tax haven's policy changing, then the firm would gain

$$\tau z - x_i$$

by this strategy.

As mentioned in the previous section, I assume that there is a small positive probability that any tax haven's tax sheltering regime will collapse. I assume that this exogenous probability is the same in each tax haven, and denote the probability by γ.

There are no fixed assets invested in any tax haven which can be confiscated. The worst that can happen to a multinational with a single subsidiary in a tax haven is that it loses the opportunity to shelter income. If the regime in the tax haven collapses, the multinational is assumed to be unable to avoid any of its (home country) tax liabilities.

Thus, if the mulitnantional incorporates a subsidiary (only) in tax haven i, its expected gain from the strategy is

$$(1-\gamma)\tau z - x_i$$

If a multinational's shelterable income z is so low that the above expression is negative for all tax havens, then it will choose not to shelter any income.

If x_1 is the lowest incorporation fee, among all tax havens which can credibly commit not to renege on their promises, then the proportion of firms which choose to incorporate at least one subsidiary in a tax haven is

$$1 - F(z_1)$$

where

$$z_1(x_1) \equiv \frac{x_1}{(1-\gamma)\tau} \tag{1}$$

The probability γ that the firm's tax avoidance strategy will fail is assumed to capture events which are beyond the control of the tax haven's current government. The

tax haven's government takes γ as given. However, it can alter the rules itself. After subsidiaries have been incorporated, the tax haven's administrators can choose to tax, or confiscate, the earnings which have been allocated to the offshore entity. The maximum that the tax haven can confiscate from a firm is the tax liability τz which the firm would have paid in its home country. Presumably, a multinational firm with mobile assets in an offshore subsidiary can simply repatriate the assets to the home country should the offshore government's policies change. These are paper assets, not physical investment.

But a large multinational can do better yet to protect itself against an exogenous regime shift in a tax haven. If it establishes subsidiaries in 2 different tax havens, then it can transfer assets from one tax haven to another. If the probability γ of (exogenous) failure of tax avoidance is independent across tax havens, and if both tax haven 1 and tax haven 2 commit credibly not to confiscate, the firm will gain

$$(1-\gamma^2)\tau z - x_1 - x_2$$

through incorporation of 2 subsidiaries, one in each of tax havens 1 and 2. It will thus choose to incorporate a second subsidiary if $(1-\gamma^2)\tau z - x_1 - x_2 > (1-\gamma)\tau z - x_i$. So all firms with earnings z_2 of more will choose to incorporate 2 or more entities, where

$$z_2(x_2) \equiv \frac{x_2}{\gamma(1-\gamma)\tau} \tag{2}$$

The higher the firm's shelterable earnings, the more subsisidries it chooses to incorporate. All firms with shelterable earnings between z_j and z_{j+1} will incorporate subsidiaries in j different tax havens, where

$$x_j(x_j) \equiv \frac{x_j}{\gamma(1-\gamma)^{j-1}\tau} \tag{3}$$

and where the tax havens are numbered in increasing order of their annual fees.

If the tax havens can all commit credibly not to confiscate, firms will all prefer to locate in the tax haven with the lowest annual fee. If tax haven 1 has strictly the lowest annual fee among all credible tax havens, then it will host subsidiaries of a proportion $(1 - F(z_1))$ of the multinationals. If several tax havens charge exactly the same annual fee, then I assume that they each get an equal share of the multinationals. In particular, if there are n tax havens in total, all charging the same annual fee x, then each will get a fraction j/n of the multinational firms of type z, if $z_j < z < z_{j+1}$.

4 The Incentives to Confiscate

Now consider the choice of annual fee y by some individual tax haven, if all other tax havens which have chosen to levy an annual incorporation fee of x, and if all the other tax havens can commit credibly not to confiscate. If the tax haven undercuts the others by choosing $y < x$, then presumably each multinational firm would prefer to shelter its income in this lower–cost tax haven, rather than in one of the other tax havens, which levy a higher annual fee. The only multinationals which would choose to incorporate a subsidiary in one of the higher–price tax havens (charging $x > y$) will be those who have chosen to protect themselves against the (exogenous) risk of confiscation by incorporating subsidiaries in two or more different jurisdictions.

So if the tax haven in question chooses an annual fee of $y < x$, then all multinationals for which $z_1(y) < z < z_2(x)$ will locate a single subsidiary in the lowest–priced tax haven ; the multinationals which have higher earnings to shelter will also incorporate in one or more other tax havens.

What would happen if the low–cost tax haven chose to renege on its implicit commitment to shelter income? The most income which it could confiscate (in a year) from a firm of type z is τz ; were it to choose a higher tax rate, then the multinational could transfer all earnings to the parent company's (high–tax) home jurisdiction. It can confiscate this income only from firms for which $z_1(y) < z < z_2(x)$, since firms for which $z > z_2(x)$ have incorporated at least one subsidiary in another tax haven to which they can costlessly transfer all their income. Therefore, the amount of income which the tax haven could confiscate is

$$\tau N \int_{z_1(y)}^{z_2(x)} z dF(z)$$

where N is the total number of multinational firms.

If the tax haven were to renege on its commitment to low taxes, it would certainly lose some credibility. It would lose its revenues

$$y(1 - F(z_1(y)))N$$

from its incorporation fees, in future years, as long the bad reputation it has earned persists. Implicit in this formulation is that a bad reputation precludes any investment : reneging on a commitment loses not only the possibility of acting as a tax haven, but dissuades all foreign investors from physical investment in the country, so that its

government gets no revenue from any foreign investment. [5] Let δ be the rate at which the country discounts this future income. It will be assumed that

$$\delta = \zeta + \gamma \tag{4}$$

where $\zeta > 0$. If a bad reputation lasted forever, ζ would be the rate at which the tax haven's government discounted future income.

The tax haven will wish to confiscate the income of multinational subsidiaries, once it has received their annual fees, if

$$N[\tau \int_{z_1(y)}^{z_2(x)} z dF(z) - \frac{1}{\delta} y(1 - F(z_1(y))] > 0$$

Of course, if this condition holds, no firm will be willing to incorporate an entity there, since the tax haven's government cannot commit credibly to keeping its taxes low. In order to attract any business, the tax haven must set its annual fee y such that

$$\delta\tau \int_{z_1(y)}^{z_2(x)} z dF(z) - y(1 - F(z_1(y)) \leq 0 \tag{5}$$

Why might high annual fees serve as a guarantee of the tax haven's government's commitment not to confiscate? The basic reasoning is not subtle : higher fees mean that the opportunity cost of confiscation (foregone future fees) is higher. This is the same reasoning, for example, as the argument that higher salaries for politicians may discourage corruption, if there is some chance that corruption leads to detection, and that detection leads to defeat at the polls.

So if y were very low, and expected to stay very low, then the opportunity cost $y(1 - F(z_1(y))$ of confiscation would also be low.

However, there are some complications here. Since multinationals choose whether or not to incorporate subsidiaries in the tax haven, lowering the fee y encourages more multinationals to locate in the tax haven. That means more money to confiscate, but it also means more foregone fees as a consequence of being seen to renege. This effect of z_1

[5] The fact that the country is choosing to be a tax haven means that it would earn more revenue from these fees than from choosing to be an "ordinary" country which taxes corporate earnings at the rate τ. The assumption that reneging on an agreement to shelter income will scare off all investment means that the future registration fees are the opportunity cost of confiscation.

on the left side of inequality (5) has two terms, one of each sign. But the overall effect certainly can be positive, for example if the discount factor δ is less than $1-\gamma$. The marginal firms, of type z_1 pay the same fees as any other firm, but have fewer assets. Therefore, a fall in this margin makes confiscation less attractive, at least relatively speaking, since the marginal firms offer more in annual fees than they do in taxable income to confiscate.

As well, the incentive of a tax haven to confiscate depends on the fees in the other tax havens. The tax haven with the lowest fee can only confiscate from firms which have not insured themselves by incorporating in other tax havens. Lower fees elsewhere make this insurance cheaper, and thus reduce the temptation of confiscation, since there are fewer firms vulnerable to confiscation.

Given that

$$z_1(y) = \frac{y}{(1-\gamma)\tau}$$

condition (5) can be written with the threshold level of earnings z_1 as the tax haven's choice variable : it can commit not to confiscate only if the threshold level z_1 is such that

$$\Psi(z_1; z_2) \equiv \delta \int_{z_1}^{z_2} z dF(z) - (1-\gamma) z_1 (1 - F(z_1)) \leq 0 \tag{6}$$

Now if $z_2 > 0$, and if $F(z_2) < 1$, then

$$\Psi(0; z_2) > 0 > \Psi(z_2; z_2) \tag{7}$$

so that, for any $z_2 > 0$, there must be a minimum value of $z_1 > 0$ for which $\Psi(z_1, z_2) = 0$, and for which $\Psi(z; z_2) > 0$ for all $0 \leq z < z_1$. This minimal z_1 defines the lowest plausible fee y which the tax haven can levy, given that all the other tax havens are charging an annual fee of x ; any $y < (1-\gamma)\tau z_1$ would be so low a fee that the tax haven would not want to honor its commitment to shelter multinationals' income, and would prefer to forego any future fees by raising its taxes after firms had chosen to incorporate for the year.

Let $z_1^r(z_2)$ denote this minimum value, that is the lowest value of z_1 for which $\Psi(z_1; z_2)$ is non–positive.

The equilibrium proposed here is one in which all tax havens have the same fee, and in which no tax haven chooses to confiscate. A common fee x^*, levied by all n tax havens,

will form such an equilibrium if

(i) no tax haven can lower its fee below x^* without losing its commitment not to confiscate

(ii) no tax haven wishes to raise its fee above x^* (thereby attracting only multinationals who have chosen to insure themselvs by incorporating in more than one tax haven)

The first property of the equilibrium, the credibility of commitment, is the one to which the most attention will be paid. For a fee x^* define the threshold income levels

$$z_1^* \equiv z_1(x^*) = \frac{x^*}{(1-\gamma)\tau}$$

$$z_2^* \equiv z_2(x^*) = \frac{x^*}{\gamma(1-\gamma)\tau}$$

Then, property (i) of the equilibrium will hold if and only if

$$z_1^r(z_2^*) = z_1^* = \gamma z_2^* \tag{8}$$

In general, such an equilibrium z_2 may not exist. For some distributions of firms' earnings (and some values of γ and δ), it may be the case that $z_1^r(z_2) < \gamma z_2$ for all $z_2 > 0$. In other cases, the minimum credible value $z_1^r(z_2)$ may not be a continuous function of z_2.

5 Existence of An Equilibrium Registration Fee

Consider first property (ii) of the equilibrium, that no tax haven wants to raise its annual fee above the common level x^*.

If there are n tax havens, each charging an annual fee of x^*, and each credibly committed not to confiscate, what business could another tax haven attract if it charged an annual fee of $y > x$? Multinationals would all choose to incorporate subsidiaries first in the tax havens with the lower fees, since the tax havens are otherwise identical. The only reason a firm would incorporate in the higher–fee tax haven would be as insurance against regime collapse. And if there were n tax havens charging a fee of x^*, a multinational would choose to incorporate in a tax haven charging $y > x^*$ only if had already chosen to incorporate in each of the n lower–fee tax havens.

That is, only firms whose shelterable income was z_{n+1}^* or greater would incorporate a subsidiary in the higher–priced tax haven. If there were no firms with income that

high, then there could be no profitable deviation upward from a fee of x. Thus the following condition is sufficient to ensure that property (ii) of an equilibrium will be satisfied when n tax havens each charge an annual fee of x^*.

CONDITION The distribution of shelterable income $F(\cdot)$ has finite support $[0, Z]$, and the number of tax havens n and the annual fee they charge x^* are large enough so that

$$\frac{x^*}{\gamma^n(1-\gamma)\tau} > Z$$

Of course this condition is expressed in terms of the equilibrium annual fee, and the number of countries which choose to become tax havens, both of which are endogenous. But it will be assumed from here on that this condition is satisfied at any equilibrium. If it were not satisfied at some (x^*, n) which satisfied the other equilibrium conditions, then there would exist an equilibrium in which there were two or more types of tax havens, with the higher–priced havens attracting only the subsidiaries of a few large firms, which had already exhausted all of the low–priced opportunities for incorporation of tax havens.

The remainder of this section is devoted to demonstrating that property (i) of an equilibrium, that no tax haven can credibly lower its fee, can be satisfied. First a special case.

Proposition 1 *If the distribution $F(\cdot)$ of firms' earnings which can be sheltered is uniform over some interval $[0, Z]$, then an equilibrium must exist if (and only if), the reputation effects are small enough such that*

$$\delta(1+\gamma) \geq 2\gamma(1-\gamma) \tag{9}$$

Proof. See the appendix

Condition (9) must hold if the probability of exogenous regime shift is sufficiently small. The following proposition shows that, for a fairly broad class of distributions, if this probability is small enough, then there must exist an equilibrium, with particular comparative static properties.

Proposition 2 *Suppose that the distribution $F(\cdot)$ of firms' earnings which can be sheltered has the following two properties :*

a the distribution has finite support $[0, Z]$

b $\lim_{z \to 0} z f(z) = 0$

Then if the exogenous probability γ *of removal of tax shelter status is sufficiently small, so that*

$$\delta \bar{z} \geq \gamma(1-\gamma)Z \tag{10}$$

(where $\bar{z}$ *is the mean level of shelterable income among all multinational firms), there must exist an equilibrium, at which the "minimum credible fee" function* $z_1^r(z_2)$ *cuts the curve* $z_1 = \gamma z_2$ *from below.*

Proof. See the appendix.

Figure 1 illustrates the reaction curve $z_1^r(z_2)$ and its intersection with the curve $z_1 = \gamma z_2$ (using the parameter values of the example of section 9 below).

Condition (10) is a sufficient condition, not a necessary one. But the previous proposition contained a necessary and sufficient condition, for the case of a uniform distribution.[6]

What happens if the parameters are such that the conditions of Proposition (2) do not hold? Then there may not exist an equilibrium in which all tax havens charge the same fee. That will certainly be the case if the distribution is uniform, and condition (9) is not satisfied, or if the distribution is exponential (for any parameter values), for example.

The equilibrium existence issue in these cases is not a new one. It would probably not surprise M. Bertrand, were he still alive. Firms here are assumed to regard all tax havens as perfect substitutes for each other, provided the probability of confiscation is the same in all of them. Tax havens are assumed to set their annual fees non–cooperatively. That means that the usual undercutting problem, in price competition among perfect substitutes, arises. Were there no problem in commitment not to confiscate, one tax haven can attract each firm's first offshore subsidiary, simply by undercutting all of the other tax havens slightly.

[6] When the distribution is uniform, condition (10) is $\delta > 2\gamma(1-\gamma)$, which is a stronger condition than (9).

Given the incentives to undercut, what prevents price competition from driving annual fees to zero? Here it is the inability of tax havens to commit not to confiscate, if their annual fee is too low. If the conditions of Proposition 2 hold, then there exists a (positive) annual fee x at which no tax haven can undercut : all tax havens are barely able to commit credibly when they each charge x, and any undercutting would not be credible, and thus could not attract any firms.

As the proof of the proposition demonstrates, if condition (10) does not hold, then it may be the case that $\Psi(\gamma z; z) < 0$ for all $0 < z < Z$. This means that commitment is too easy : whatever is the value of the annual fee, if all tax havens charge it, then a tax haven which charges a slightly lower fee can still commit not to confiscate.

Here, then, the temptation to confiscate helps tax havens avoid the race to the bottom implied by Bertrand competition.

Suppose, for example, that reputation effects are perceived as very persistent, so that the discount rate δ used by tax havens to evaluate the future losses from reneging on a commitment is low. That means commitment is easier, since the present discounted value of foregone fees is high. In this case, when δ is low, condition (10) is less likely to hold.

As well, a high probability γ of an exogenous regime shift makes (10) less likely to hold (assuming that this probability is significantly less than 50 percent per year). If there is a relatively high probability of a regime shift, which no tax haven's government can do anything about, then multinationals are much more likely to insure against these shifts, by opening multiple subsidiaries. But if most multinationals have multiple subsidiaries, then tax havens' governments' temptation to confiscate is lessened : the governments know that they can confiscate only from firms which have no other offshore subsidiary to which income can be shifted. So a higher value of this exogenous parameter γ leads to more diversificaton by multinationals, leading to easier commitment for tax havens not to confiscate, which will makes undercutting more of a problem.

What would happen if δ were low enough, and γ high enough, that Proposition 2 does not hold? The issues here are ones which have been dealt with extensively in industrial organization. For example, a well–behaved equilibrium might exist if all tax havens were not regarded as perfect substitutes by firms. But the case in which the proposition does not apply will not be analyzed further here ; if there is enough political stability then commitment difficulties alone can prevent undercutting.

6 The Invariance of Tax Evasion

If, in the interests of making notation shorter, the cut–off level z_2^* of shelterable income at which a multinational chooses to incorporate more than 1 subsidiary is denoted more simply as z, then the condition defining an equilibrium registration fee can be written

$$(\zeta + \gamma) \int_{\gamma z}^{z} v dF(v) = \gamma(1-\gamma)z(1-F(\gamma z)) \tag{11}$$

Equation (11) defines this cut–off level of income z as a function of the distribution of shelterable income $F(\cdot)$, the probability γ of a regime change, and the rate ζ tax havens use to discount reputation effects. Perhaps a more significant cut–off income level is z_1, the level of earnings which induces a multinational to incorporate in one tax haven. In equilibrium, $z_1^* = \gamma z$.

But note what variable does not appear explicitly in equation (11) : the tax rate τ in the rest of the world.

The annual fee x charged by each tax haven does vary with this tax rate ; equation (2) shows that it is inversely proportional to τ. But a consequence of (11) is

Proposition 3 *A change in the effective tax rate τ in the rest of the world has no effect on multinationals' decisions whether to, and where to, shelter income in tax havens, if the tax change does not affect the discount rate ζ, the probability γ of regime shift, or the distribution of firms' earnings.*

This proposition contrasts with the result of Slemrod and Wilson (2009), in which the supply curve for tax sheltering services slopes up. Here the reduction in the benefit of tax sheltering caused by a fall in τ would be exactly offset by a fall in the annual fee x. Changes in τ change the profitability of being a tax haven, and (as will be shown) the number of tax havens. But these changes do not change the amount of tax sheltering undertaken in these tax havens by multinationals.

Of course the proposition refers only to the direct effects of changes in τ. If world capital markets are integrated, then the discount rate ζ used by administrators in tax havens should depend on the net world rate of return to investment. Any changes to this net rate of return caused by changes in the effective tax rate τ would affect the cut–off income level z_1. But this effect might be quite small.

Turning to the effects of other parameters on the equilibrium, consider first an increase in the probability γ of an exogenous regime shift. First assume that the discount rate δ which tax havens to value reputation stays constant.

To consider these effects, it is perhaps best to use figure 1, which depicts an equilibrium of the type described in Proposition 2. This equilibrium can be characterized as an intersection of the curves $z_1 = z_1^r(z_2)$ and $z_1 = \gamma z_2$. Proposition 2 shows that both curves slope up at this intersection, and the $z_1^r(z_2)$ is steeper (when z_1 is graphed on the vertical axis).

If γ were to increase, the curve $z_1 = \gamma z_2$ shifts up in z_2–z_1 space. But so does the other curve : increases in γ must increase $\Psi(z_1; z_2)$, so that a fall in z_1 is needed to make the condition $\Psi(z_1; z_2) = 0$ hold.

Thus the overall impact of an increase in γ on the threshold income levels z_1 and z_2 is theoretically ambiguous. If the reaction curve $z_1^r(z_2)$ does not shift up much, then both z_1 and z_2 must increase ; if there is a moderate shift up, then z_1 will increase and z_2 fall ; if there is a large shift in the reaction curve, then both z_1 and z_2 will fall.

In other words, increased political stability in tax havens may not lead to more offshore tax sheltering by multinationals, when the equilibrium fee–setting behavior of tax havens' governments is taken into account.

The effect of an increase in δ is more straightforward : it shifts up the $z_1^r(z_2)$ curve, so that both z_1 and z_2 (and the annual fee x) must fall when the discount rate δ rises.That is, weaker reputation effects lead to more sheltering : when the temptation of confiscation is higher, tax havens' stronger incentives to confiscate lead to a lower equilibrium fee.

7 Tax Havens' Revenue

Suppose that n countries choose to become tax havens, each levying the same annual fee x defined implicitly by equation (11). [Explicitly : $x = \gamma(1-\gamma)z$, if z satisfies (11).] There are N multinational firms in total. The total number of subsidiaries which these firms choose to incorporate in tax havens is

$$N \sum_{i=1}^{\infty} i[F(z_{i+1}) - F(z_i)]$$

where z_i is the level of earnings which leaves a multinational firm indifferent between incorporating $i-1$ and i subsidiaries in tax havens :

$$z_i = \frac{x}{\tau\gamma^{i-1}(1-\gamma)} \tag{12}$$

Each tax haven gets the same share $1/n$ of the subsidiaries, so that the total revenue received from incorporation fees in any tax haven is

$$X = \frac{Nx}{n}\sum_{i=1}^{\infty} i[F(z_{i+1}) - F(z_i)] \tag{13}$$

Naturally, this revenue decreases with the number of tax havens. If Proposition 3 holds, then it is an increasing function of the tax rate τ prevailing in the rest of the world. The effect of the political stability parameter γ on the revenue from being a tax haven is ambiguous.

Nonetheless, for given τ and γ (and distribution of firms' earnings), equation (13) defines a very simple relation between the number of tax havens and the return to being a tax haven. Entry dissipates the rents to being a tax haven, as more and more countries share a fixed pool of incorporation fees.

8 The Number of Tax Havens

There is little new or surprising in this section that is not spelled out better in Slemrod and Wilson. Countries choose whether to be tax havens or normal countries, and it is the smallest countries which will choose the former status.

The simplest way of modelling the choice of whether or not to be a tax haven here is to assume that there are only two possible revenue sources for countries' governments : capital tax revenues, or incorporation fees. If a country chooses to be a tax haven, then its total government revenue is X, as defined by equation (13) above. If it chooses to be a normal country, and to levy a unit capital tax at the rate t[7], then its total tax revenue is

$$tk(t+\rho)P$$

[7]The tax rate "τ" referred to in the previous sections is the proportional tax rate, as a fraction of capital income ; t is the corresponding unit tax rate.

where ρ is the net return to investment in the world, P the (fixed) population of the country, and $k(t+r)$ the capital–labor ratio in the country. Each country is small enough to take the world return to investment as given, so that all normal countries (those in the "rest of the world") choose the same tax rate t, the one which maximizes $tk(\rho+t)$. [The equilibrium net return to investment is the value of ρ for which aggregate saving in the world, some function of ρ, equals aggregate investment.]

Countries must choose one revenue source or the other. They are not able to discriminate between notional earnings of subsidiaries set up to shelter income, and earnings from physical investment in the country, so that any tax haven must set $t = 0$.

There are two factors of production, mobile capital and immobile labor, which is fixed in supply. Each identical resident of a country has the same utility function

$$u = w + \rho e + gG$$

where w is wage income, e is the person's endowment of capital, G is government expenditure per person, and $g > 1$ is the marginal valuation of public expenditure. The wage rate w is a decreasing function of the gross return $\rho + t$ to capital.

Under these assumptions, the utility of a resident of a tax haven is

$$u_{th} = w(\rho) + \rho e + g\frac{X}{P} \tag{14}$$

and the utility of a resident of a normal country is

$$u_{nc} = w(\rho + t) + \rho e + gtk(\rho + t) \tag{15}$$

The assumption that the services of a tax haven require no inputs from local inhabitants ensure that it is smaller countries which choose to become tax havens. Since registration fees are shared equally among all residents of a country, and since there are constant returns to scale in population for normal countries, u_{th} declines with P and u_{nc} does not vary with P.

Since the wage rate is a decreasing function of the cost of capital, tax havens must have higher wage rates than countries in the rest of the world. Equations (14) and (15) then imply that tax revenue per capita must be lower if the marginal country chooses to be a tax haven, than if it chooses to tax capital at the same rate as the rest of the world. At the margin, free entry by tax havens dissipates all the rents received from the incorporation fees. Of course infra–marginal tax havens may be strictly better off

than the marginal ones. The predictions of the equilibrium condition $u_{th} = u_{nc}$ for the largest tax haven are

- tax havens have higher wages, and higher investment per capita, than countries in the rest of the world
- the largest tax havens have smaller public expenditure per capita than countries in the rest of the world
- total public expenditure does not vary with population among tax havens (but is proportional to population in the rest of the world)

Another implication of the endogenous choice of tax haven status is the effect of a change in the tax rate in the rest of the world on the number of tax havens. Suppose that all the normal countries were suddenly to coordinate their tax policy, and to raise their common tax rate τ — without altering any tax treaties, or otherwise modifying the tax bases, so that the distribution $F(\cdot)$ of shelterable income of mulitnational remained unchanged.

Proposition 3 shows that in these circumstances, the cut–off income levels $z_i(x)$ would not change. The equilibrium annual fee x would rise by the same proportion as the tax rate τ, and no multinational firm would change the number of subsidiaries it incorporated in tax havens.

Now the world return to capital ρ is determined by the market clearing condition

$$P_h(n)k(\rho) + (\bar{P} - P_h(n))k(\rho + t) = e(\rho)\bar{P} \tag{16}$$

where $\bar{P}$ is the total world population, and P_h is the total population resident in tax havens, an increasing function of the number n of tax havens.

Equation (16) implies that if the number n of tax havens were to remain constant, an increase in τ would result in a decrease in the net return ρ to saving, and in an increase in the cost of capital $\rho + t$ in the rest of the world (at least if $e'(\rho) > 0$). This is hardly a surprising result. But it implies that the effect of an increase in τ on the relative advantage of being a tax haven is

$$d(u_{th} - u_{nc}) = k(\rho + t)d[\rho + t] - k(\rho)d\rho + g[\frac{dX}{P} - k(\rho + t)] - gtk'(\rho + t)d(\rho + t) \tag{17}$$

where I have used the fact that $w'(\cdot) = k(\cdot)$.

Now if the number of tax havens n has not changed, equation (13) implies that the total revenue X from fees of each tax haven must move proportionally with the tax rate τ, so that $dX = \frac{X}{\tau} d\tau$.

Therefore, for the marginal country, for which $u_{th} = u_{nc}$, the change in the advantage of tax haven status from a tax rate increase would be

$$d(u_{th} - u_{nc}) = [k(\rho+t)d[\rho+t] - k(\rho)d\rho] - [w(\rho) - w(\rho+t)]\frac{d\tau}{\tau} - g\tau k'(\rho+t)d(\rho+t) \quad (18)$$

The first and third terms on the right side of equation (18) are both positive, but the middle term is negative. Which term dominates depends on how elastic the capital–labor ratio is to the cost of capital. If the capital supply to a region is not very responsive to the cost of capital there, then expression (18) may actually be negative. If the production technology were CES, for example, then this possibility would arise if the elasticity of substitution were low in absolute value.[8]

The derivations (17) and (18) were calculated under the assumption that the number n of tax havens was constant. This will not be the case. But stability considerations suggest that the equilibrium number of tax havens will rise after a shift upward in tax rates, if and only if tax haven status would be more attractive when n is held constant. Under this presumption, a negative sign for expression (18) would imply the possibility of increased tax rates in the rest of the world actually leading to a decrease in the number of tax havens.

Of course, the number of tax havens is probably not the main concern of policy makers in the rest of the world. The invariance result, Proposition 3, shows that tax rate harmonization should have no effect on the total amount of income which multinationals choose to shelter, regardless of the change in the number of tax havens.

[8] If the output per worker were $(1 + k^{-5})^{-0.2}$, for example, and savings per person were fixed at 0.5, then an increase in the source–based capital tax rate from 5 percent to 10 percent would lead to the relative attraction of tax haven status falling at the margin, if the number of tax havens did not change.

9 Back of the Envelope

A consequence of equations (14) and (15) is that, for "reasonable" equilibrium outcomes, there will be a large number of subsidiaries incorporating in each tax haven. The number of subsidiaries per resident in a tax haven equals X/Px. If a country chooses to be a tax haven, so that $u_{th} \geq u_{nc}$, then equations (14) and (15) imply that the number of offshore subsidiaries per resident is at least

$$\frac{\tau k(\rho+\tau)}{x} - \frac{w(\rho) - w(\rho+\tau}{gx}$$

Since $w'(\rho) = k(\rho)$, this expression is approximately

$$\frac{k\tau}{x}\frac{g-1}{g} \tag{19}$$

when $k(\rho)$ and $k(\rho+\tau)$ are not too different.

The first fraction in expression (19) is the ratio of corporate tax revenue per person in the rest of the world to the annual fee charged per subsidiary in tax havens. This ratio probably exceeds 1. Corporate tax revenues account for just under 10 percent of total government revenue in OECD countries[9] (although there is, of course, considerably variation in that ratio), so that τk would exceed 3 % of income per person ; some of the examples in the introduction indicate that annual incorporation fees can be less than $1000 (US) per year. Thus as small a premium as 10 percent for the excess marginal cost of public funds would imply 1 offshore subsidiary for every 10 residents for the most populous tax havens. And the presence of many more offshore subsidiaries than residents for the smaller tax havens is quite consistent with this model.

The system of equilibrium conditions of the model is "almost recursive", in that the cut–off levels of shelterable income z_i can be determined separately from the number of tax havens[10].

As a crude test of the plausibility of the model, I have calculated a simple parameterization of the supply side of the model on a spreadsheet, deriving the cut–off levels of shelterable income of companies for a given distribution of that income.

[9]Figure 18.2 in Gruber (2005) indicates that corporate income taxation provided 9.3% of total tax revenue in OECD countires in 2001

[10]provided that the tax rate τ in the rest of the world, and the discount rate ζ used by tax havens' governments, are not changed by marginal changes in the number of countries which choose to be tax havens

I assume that firms' shelterable income has the beta distribution. This distribution has the two virtues of being relatively tractable, and being consistent with the existence of equilibrium.[11] If the maximum shelterable income is Z, and the ratio of shelterable income z to this maximum has distribution function $B(\alpha, \beta)$, then the equilibrium condition (11) is

$$\delta(C+x)[B(\frac{z_2}{Z};\alpha+1,\beta)-B(\frac{z_1}{Z};\alpha+1,\beta)]-(1-\gamma)xz_1[1-B(\frac{z_1}{Z};\alpha,\beta)]=0$$

where $B(z;\alpha,\beta)$ is the incomplete cumulative distribution function (up to an income level of z) for the beta distribution.

However, the theoretical model was modified slightly in this exercise. There may be other costs to incorporation of an offshore subsidiary, in addition to the annual fee. These costs would include payments to lawyers, accountants and other professional advisers. Since many of these professionals are based in the rest of the world, not in the tax havens, I assumed that not all of the costs paid by firms to incorporate subsidiaries actually go to the tax haven's treasury. So the theoretical model was modified by assuming that the tax haven's government received a share s of the annual costs of incorporation, changing the equilibrium condition to

$$\delta(C+x)[B(\frac{z_2}{Z};\alpha+1,\beta)-B(\frac{z_1}{Z};\alpha+1,\beta)]-(1-\gamma)sxz_1[1-B(\frac{z_1}{Z};\alpha,\beta)]=0 \quad (20)$$

The spreadsheet exercise was a simple one : some parameters were picked arbitrarily, while others were determined endogenously so as to make some of the equilibrium values look "reasonable". The targets set for the equilibrium values were that 50% of firms chose to incorporate offshore subsidiaries, that the mean value of shelterable income be 10% of the maximum value Z, and that the annual costs of incorporating a tax shelter be 1 (measured in thousands of euros per year). The parameters determined endogenously so as to hit these targets were the parameters α and β of the distribution, and the share s of costs which accrued to the tax haven. I picked arbitrary values for the remaining parameters : the probability γ of regime shift in a tax haven ; the rate δ used by tax havens to discount reputation effects, the corporate tax rate τ in the rest of the world ; the maximum level Z of shelterable income.

[11] Some other simple distributions do not have this second property : there can be no equilibrium if the distribution of firms' earnings were Pareto, and if the distribution were exponential the gain from confiscation if all tax havens are identical, $\Psi(\gamma z_2(x); z_2(x))$ will be negative for all x or positive for all x, except in a measure–zero case in which it is 0 for all x.

The value I chose for Z is unrealistically low, (1 million euros per year)[12]. This low value was chosen because higher choices did make the equilibrium values look less plausible. But the upper tail of the distribution is not crucial in this exercise. What matters in the determination of the equilibrium annual fee, equation (20), is the left tail. Any shift in the distribution, moving a mass of firms' shelterable income from $(z, z+\delta)$ to $(z', z'+\epsilon)$ would have no effect at all on the equilibrium values calculated below, provided only that $z > z_2$. So a distribution which was beta over some interval $(0, \hat{Z})$, but had a "stretched" right tail would have exactly the same equilibrium provided that $\hat{Z} > z_2$. Changes in the right of the distribution affect the total number of subsidiaries of multinationals, and thus the overall profitability of being a tax haven, but not the decision whether or not to confiscate ; firms on the right of the distribution are irrelevant to the confiscation decision since they have chosen to diversify and thus are immune from confiscation.

I also should note that condition (10) of Proposition 2 does not hold in this little example, demonstrating that this condition is sufficient, but not necessary, for the existence of an equilibrium in which all tax havens charge the same fee.

The table below summarizes the equilibrium in the example. Variables marked with an "x" were the ones I chose arbitrarily, equilibrium variables marked with a "t" were set as targets ; the remaining variables were determined endogenously by the equilibrium condition.

α	0.12878
β	1.15905
Z (x)	1000
γ (x)	0.1
δ (x)	0.4
s	0.62931
τ (x)	0.3
z_1	3.70377
z_2	37.03769
x (t)	1
$F(z_1)$ (t)	0.5
$F(z_2)$	0.6721

[12]As the example in footnote 2 above suggests.

The above results certainly do not constitute any sort of a test for the model. They show that parameters can be picked to make some aspects of the equilibrium look reasonable. But the fitted results make sense only if the distribution is regarded as a truncated version of the true distribution of firms' earnings. As well, in the above equilibrium, of the firms which choose to incorporate in a tax haven, nearly $\frac{2}{3}$ choose to use more than one tax haven. It is a fairly narrow band of earnings for which firms choose exactly one offshore subsidiary, as figure 2 illustrates.

But the main purpose of the above example is to do some comparative–static exercises, to confirm the earlier analytic results, and to give some indication of what might happen when theoretical results are ambiguous. The accompanying table lists the effects of changing the parameters one (and in some cases, two) at a time, starting from the base example (which is the first row of the table).

The first seven columns of the table below are the exogenous parameters, and the last 5 columns are the endogenous variables. The one new variable is C. This variable represents the fixed cost for a company of becoming a multinational. As in Bucovetsky and Haufler (2008), when $C > 0$, firms must pay some (annual) cost to become a multinational. They must pay this cost if they are to incorporate any offshore subsidiaries, but once they have paid this fixed cost, they can incorporate as many subsidiaries as they wish (at a cost of x per subsidiary). If $C > 0$, then Proposition 3 would not hold.

Table : Perturbation Results

γ	δ	s	α	β	C	τ	z_1	z_2	x	$F(z_1)$	$F(z_2)$
0.1	0.4	0.629	0.129	1.159	0	0.3	3.70	37.0	1.000	0.50	0.67
0.11	0.4	0.629	0.129	1.159	0	0.3	5.55	50.4	1.481	0.53	0.699
0.11	0.41	0.629	0.129	1.159	0	0.3	5.06	46.0	1.350	0.52	0.69
0.1	0.5	0.629	0.129	1.159	0	0.3	1.47	14.7	0.397	0.44	0.60
0.1	0.4	0.700	0.129	1.159	0	0.3	5.57	55.7	1.505	0.53	0.71
0.1	0.4	0.629	0.150	1.350	0	0.3	3.40	34.0	0.918	0.45	0.64
0.1	0.4	0.629	0.150	1.159	0	0.3	4.15	41.5	1.122	0.45	0.64
0.1	0.4	0.629	0.129	1.500	0	0.3	2.64	26.4	0.713	0.50	0.67
0.1	0.4	0.629	0.129	1.159	1	0.3	7.44	37.3	1.008	0.55	0.67
0.1	0.4	0.629	0.129	1.159	0	0.4	3.70	37.0	1.333	0.50	0.67

The second and third row of the table show that, in this example, increased political instability (a higher value for γ) leads to higher annual fees, fewer firms choosing to incorporate offshore subsidiaries, and fewer firms with multiple subsidiaries. This is true whether or not the increased probability of regime shift also increases the discount rate used by tax havens' governments (although this latter effect attenuates the effects). Weaker reputation effects (higher δ) increase the temptation to confiscate, resulting in equilibrium in a substantial reduction in the annual cost, and an increase in the amount of income which firms choose to shelter offshore.

Increasing the share s of firms' offshore incorporation costs which actually go to the tax havens' decision makers results in this example in a substantial increase in the annual fee, and leads to considerably less tax sheltering activity. In other words, in this example, if countries in the rest of the world imposed a proportional tax on offshore incorporation fees paid by multinationals, this tax would lead to an increase in tax sheltering activity in equilibrium.

The 6th, 7th and 8th rows of the table show the effects of changing the shape of the distribution of shelterable earnings. In the 7th and 8th rows, the parameters α and β are changed, 1 at a time, whereas the change in the 6th row keeps the mean of the distribution constant (and increases its variance). The second–last row shows that

introducing a fixed cost of multinational form does not have a very large effect in equilibrium in this example (the fixed cost of 1 here equals the original equilibrium annual fee per subsidiary). Finally, the last row confirms the invariance result, Proposition 3.

10 Concluding Remarks

While defending the use of offshore tax havens by multinationals is not a politically popular posture, there is a fairly common response in the business community to attempts to curtail this use. It is often argued that loopholes are very difficult to plug. A more practical solution would be to lower tax rates in developed countries, thereby weakening firms' incentives to shelter income offshore.

The model constructed here may indicate that the second part of the above argument could be a weak one. In assessing the effects of tax cuts on multinational firms' behavior, we should not assume behavior of tax havens' governments is immutable. Slemrod and Wilson (2009) made this point very clearly. In their model, tax sheltering brings rents to tax havens' governments. The modification of that model done here is motivated by the notion that sheltering a lot of income can be done without using many resources.

Taking that notion to its extreme, suppose that tax sheltering requires no scarce resources, and generates no rents. In that case, what do tax havens sell, when they charge for incorporation of subsidiaries? Assuming that they are selling reliability does explain some features of the behavior of multinationals and of their hosts (while leaving other important features unexplained). If they are selling reliability, tax havens will react differently to tax cuts in the rest of the world than if they are selling costly services. Tax cuts in the developed world may hurt tax havens, and may reduce the number of tax havens. But they may have very little effect on the total amount of tax sheltering.

11 Appendix

Proof of Proposition 1 If the distribution of shelterable income is uniform on $[0, Z]$, then

$$\Psi(z_1; z_2) = \frac{1}{2Z}[\delta(z_2^2 - z_1^2] - 2(1-\gamma)z_1(Z - z_1)] \tag{21}$$

In this case, $\Psi(0; z_2) > 0$, $\Psi(z_2; z_2) < 0$, and $\Psi(z_1; z_2)$ is a quadratic function of z_1. Therefore, for a given z_2 (with $0 < z_2 < Z$), the graph of $\Psi(z_1, z_2)$ crosses the y–axis exactly once, from above. For given z_2, there is a unique $z_1 = z_1^r(z_2)$, and this z_1 is a continuous function of z_2. Since $\Psi(z_1; z_2)$ is an increasing function of z_2, it is also the case that $z_1^r(z_2)$ is an increasing function.

Thus any x^*, and $z_2^* = \frac{x^*}{\gamma(1-\gamma)\tau}$ will satisfy property (ii) of an equilibrium if (and only if) $\Psi(\gamma z_2^*; z_2^*) = 0$. Substituting in (21), an equilibrium will exist if and only if there is some z, with $0 < z < Z$, such that $\Phi(z) = 0$, where

$$\Phi(z) \equiv \delta z^2(1-\gamma^2) - 2\gamma(1-\gamma)z(Z-\gamma z) \tag{22}$$

Since

$$\Phi(0) = 0$$

and

$$\Phi'(0) = -2\gamma(1-\gamma)Z < 0$$

a sufficient condition for the existence of a $z \in (0, Z)$ for which $\Phi(z) = 0$ is that

$$\Phi(Z) > 0$$

But

$$\Phi'(z) = \frac{2}{z}\Phi(z) + 2\gamma(1-\gamma)Z$$

so that $\Phi'(z) > 0$ whenever $z > 0$ and $\Phi(z) = 0$. Therefore $\Phi(Z) > 0$ is also necessary condition for the existence of a $z \in (0, Z)$ for which $\Phi(z) = 0$, since the graph of $\Phi(z)$ must cross the y–axis from below.

Since

$$\Phi(Z) = (1-\gamma)Z[\delta\tau(1+\gamma) - 2\gamma(1-\gamma)]$$

a necessary and sufficient condition for the existence of equilibrium when the distribution is uniform is (9). •

Proof of Proposition 2

There will be an equilibrium in which all tax havens levy the same annual fee x, if

$$\Psi(\gamma z_2; z_2) = 0$$

for some $0 < z_2 < Z$, with the annual fee x determined by the condition

$$z_1 = \gamma z_2 = \frac{x}{\tau(1-\gamma)}$$

where the function Ψ is defined by

$$\Psi(z_1; z_2) \equiv \delta \int_{z_1}^{z_2} v dF(v) - (1-\gamma) z_1 (1 - F(z_1))$$

At this equilibrium the reaction curve $z_1 = z_1^r(z_2)$ cuts the curve $z_1 = \gamma z_2$ from below, if $\Psi(\gamma z; z)$ is an increasing function of z at $z = z_2$.

Since

$$\frac{\partial \Psi(z; \gamma z)}{\partial z} = \delta[zf(z) - \gamma z f(\gamma z)] + (1-\gamma)(\gamma)^2 z f(\gamma z) - (1-\gamma)(1 - F(\gamma z_2)) \quad (23)$$

condition (b) of the proposition ensures that $\frac{\partial \Psi(\gamma z; z)}{\partial z} < 0$ at $z = 0$, so that $\Psi(z; \gamma z) < 0$ for z small but positive. Under condition (a) of the proposition,

$$\Psi(\gamma Z; Z) = \delta \int_{\gamma Z}^{Z} v dF(v) - (1-\gamma)\gamma Z (1 - F(\gamma Z)) \quad (24)$$

The integral in equation (24) is $(1 - F(\gamma Z)$ times the expected value of shelterable earnings — conditional on earnings being γZ or more. Therefore it must be greater than $(1 - F(\gamma Z))$ times the expected value of shelterable earnings, so that

$$\Psi(\gamma Z; Z) > (1 - F(\gamma Z))[\delta \bar{z} - (1-\gamma)\gamma Z] \quad (25)$$

Inequality (25) shows that condition (10) is sufficient to ensure that $\Psi(\gamma Z; Z) > 0$.

Therefore, under the conditions of the proposition, $\Psi(z; \gamma z)$ starts out negative for small values of z, and is positive for values of z near Z, so that there must be at least one value of z_2 at which $\Psi(\gamma z_2; z_2) = 0$, at which $\Psi(\gamma z; z)$ is an increasing funtion of z. •

References

[1] S. Bucovetsky and A. Haufler. Tax Competition when Firms Choose their Organizational Form : Should Tax Loopholes for Multinationals be Closed? *Journal of International Economics*, 74(1):188–201, 2008.

[2] Citizenworks. 25 Fortune 500 Corporations With the Most Offshore Tax-Haven Subsidiaries. http://www.citizenworks.org/corp/tax/top25.php, 2004.

[3] M. Desai, C. Foley, and J. Hines. Chains of Ownership, Regional Tax Competition, and Foreign Direct Investment. In H. Herrmann and R. Lipsey, editors, *Foreign Direct Investment in the Real and Financial Sector of Industrialized Countries*, pages 61–99. Springer-Verlag, 2003.

[4] D. Dharmapala and J. Hines. Which Countries become Tax Havens? *Journal of Public Economics*, 93(9 – 10):1058–1068, October 2009.

[5] Finfacts Team. Microsoft to hide Irish Tax Haven data of subsidiaries that have saved it billions of dollars in US taxes. http://www.finfacts.com/irelandbusinessnews/publish/article_10005150.shtml, March 2006.

[6] J. Gruber. *Public Finance and Public Policy.* Worth, 2005.

[7] J. Hines. Do Tax Havens Flourish? In J. Poterba, editor, *Tax Policy and the Economy*, number 19, pages 65–99. MIT Press, 2005.

[8] HSBC. The Cayman Islands. http://www.hsbc.ky/RELSITES.HTM, 2001.

[9] Institutional Investor. They Cayman, They Saw, They Conquered. http://www.dailyii.com/article.asp?ArticleID=1039798, May 2006.

[10] J. Slemrod and J. Wilson. Tax competition with parasitic tax havens. *Journal of Public Economics*, 93(11 –12):1261–1270, December 2009.

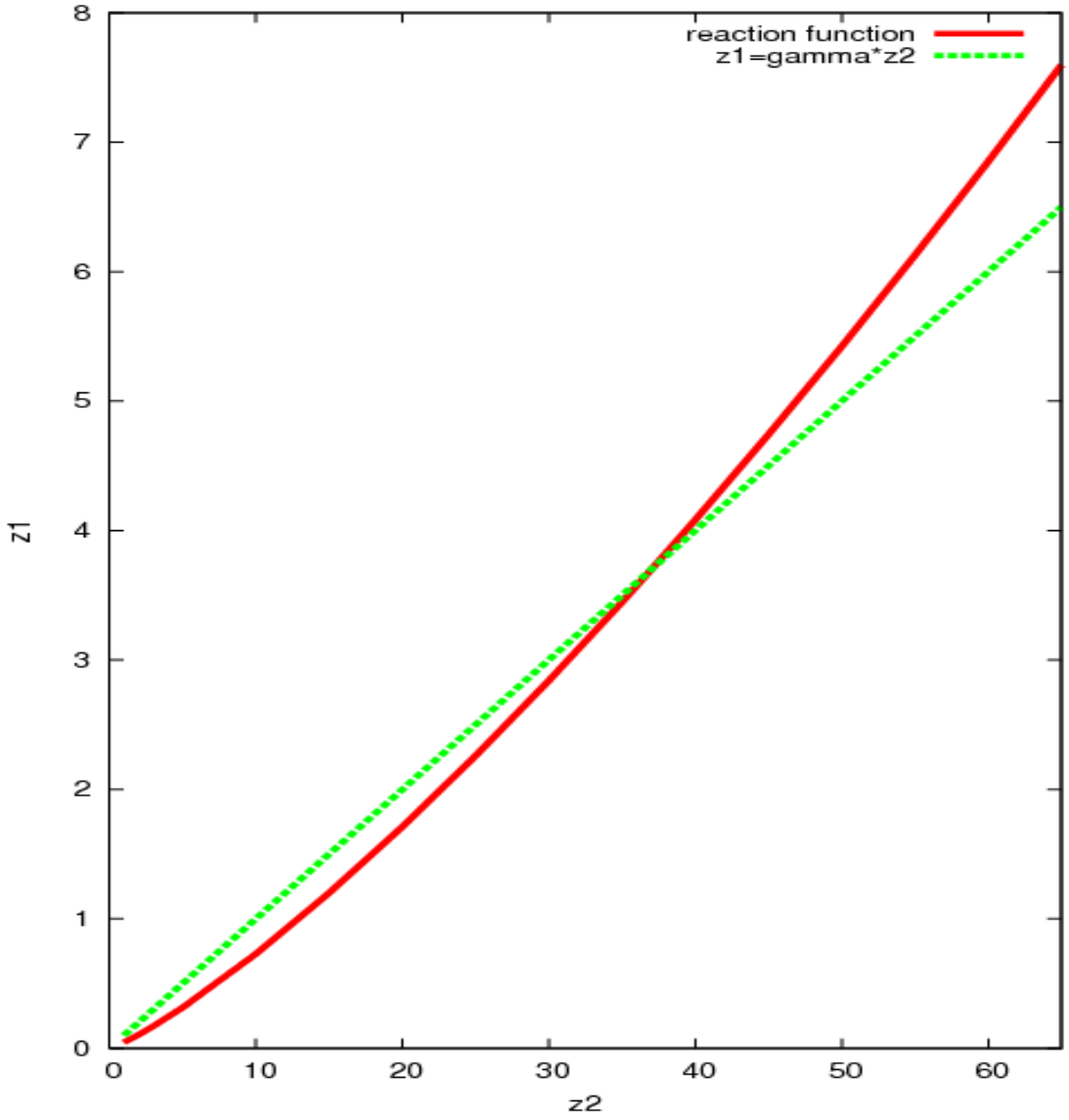

Figure 1 : An equilibrium in which the $z_1^r(z_2)$ curve cuts the curve $z_1 = \gamma z_2$ from below

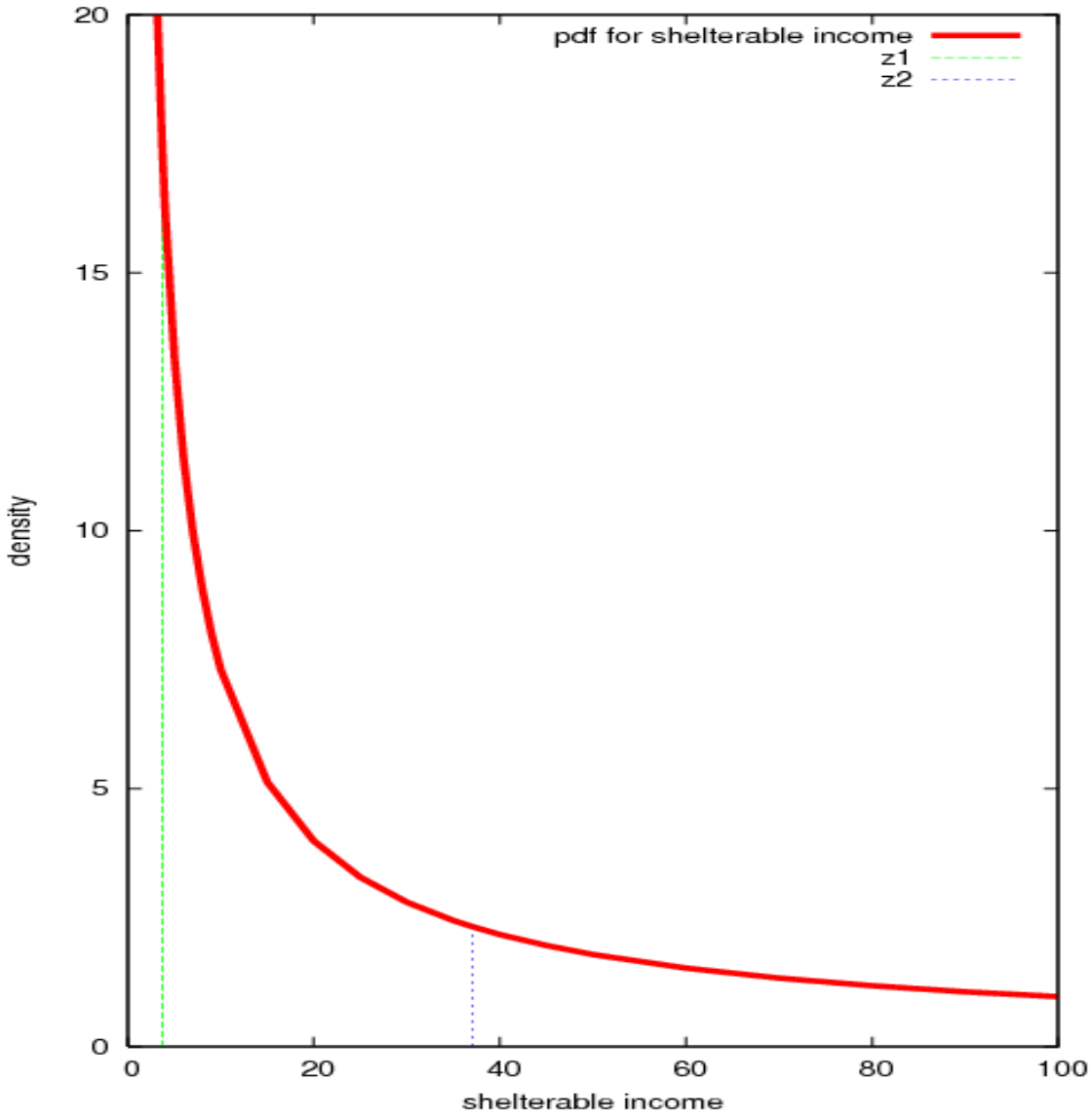

Figure 2 : The distribution of shelterable earnings in the example of section 9