Tax Competition for Headquarters

S. Bucovetsky
Economics, LAPS, York University
Toronto ON M3J 1P3 Canada

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Abstract

Firms' ability to shift taxable profits to subsidiaries in low–tax jurisdictions creates an incentive for countries to deviate from the territoriality principle, in taxation of profits of subsidiaries. Here, I consider how countries might compete for headquarters location of firms, by choosing how much to deviate from territoriality. Not surprisingly, more profit shifting among subsidiaries leads in equilibrium to less exemption of subsidiaries' profits from taxation in the headquarters country. If firms' start–up decisions are sensitive to future after–tax profits, the equilibrium treatment of subsidiaries' income may not be generous enough.

Keywords tax competition, territoriality, separate accounting

JEL Classification H73 · F23 · E61

1 Introduction

National governments seem to care about attracting, and keeping, head offices of multinational corporations. Two observations, one direct, and the other implicit, seem to support this claim.

The implicit observation is that most of the larger, developed countries provide very generous tax treatment for the profits of subsidiaries of multinational firms incorporated in their jurisdictions. Something close to complete exemption, or separate accounting, is common in most western European countries. Even in the United States, where worldwide income is officially the basis of taxation, the effective tax rate on foreign subsidiary income seems to be quite low.

Now an extensive literature exists on why and how countries compete in effective tax rates in order to attract more investment. But exempting parent firms from paying domestic taxes on offshore subsidiaries' earnings does not necessarily attract much investment ; it makes it attractive to incorporate in a country, not to build factories there. If profits can be shifted to tax havens (through transfer pricing or thin capitalization), separate accounting for firms headquartered in country A enables the firm to do its physical investing in

country B, shift the profits from country B to a tax haven, and thus face a low effective tax rate on physical investment in country B.

Imputing rationality to governments' decisions : if countries voluntarily abandon the chance to tax subsidiaries' income, in order to attract headquarters, then there must be some benefit perceived in attracting those headquarters.

The direct observation on the importance of headquarter location is the behaviour of the American government in recent years. The American government has implemented guidelines which restrict severely the ability of American–based firms to move their headquarters. This seems a strong indication that the government cares about where firms locate their headquarters.

There may be direct benefits (apart from tax revenue) to a country from hosting a multinational firm's headquarters. But location of headquarters seem mostly a formality. The input demands for headquarters functions cannot be very large. The recent experience of one of the larger shifts in headquarters location may be instructive. In August 2014, an American based fast food chain, Burger King, merged with a Canadian firm, Tim Horton Donuts. The new entity is controlled by a Brazilian private–equity firm. The worldwide headquarters of the new merged firm are located in Canada (despite the fact that the American party to the merger had a much larger number of outlets, and a somewhat larger market capitalization). The fact that this shift of headquarters was acceptable under current American law was viewed by many financial analysts as the principal rationale for the merger. But this shift of official headquarters does not seem to have induced any expansion of employment or investment in Canada. In January 2015, the merged firm confirmed[1] massive layoffs of employees at its corporate offices — in Canada.

So if hosting headquarters does not generate large rents to local factor owners, why do countries want to attract (and keep) headquarters? One obvious rationale is the tax revenue. But the only tax revenue which matters is the extra tax revenue which the country collects from being the host of the parent company, over and above any tax revenue it would collect even if the company had headquarters elsewhere.

In the simple formal model developed here, I consider a fairly large array of possible benefits from hosting headquarters : tax revenues, direct rents from hosting, and benefits from profits earned by the firm's owners[2].

The one strategic variable chosen by countries' governments in the model is how generously to treat subsidiaries' income. The example motivating this choice is the policy in some countries, which choose the territorial principal "95 percent of the time". In these countries[3], 95% of the dividends remitted by foreign subsidiaries is exempt from domestic taxes[4]. The remaining 5% is subject to domestic taxation.

This departure from pure territoriality is sometimes justified as "an admin-

[1] http://www.cbc.ca/news/business/tim-hortons-confirms-layoffs-at-headquarters-regional-offices-1.2933704

[2] who may or may not reside in the headquarters country

[3] Belgium, France, Germany, Italy, Japan, Slovenia, and Switzerland, as of 2012

[4] the fraction is 97% in Norway

istratively simple proxy that serves in lieu of expense allocation"[5]. But it is a departure from territoriality, and it is one which each of the countries in question has adapted unilaterally. Some European policy makers have proposed coordination of further reductions in the exempt fraction of subsidiary income, as a corrective measure for tax competition. Here, I examine the choice of the exemption fraction, when countries make this choice non–cooperatively. In other words, how much will competition for headquarters undercut attempts to recoup the losses from profit shifting when profits are repatriated?

One question addressed is how the equilibrium exemption fraction varies with the large list of features which are treated as exogenous : the different benefits from hosting ; the statutory tax rates ; the extent to which firms transfer subsidiaries' profits to tax havens.

A second question addressed briefly is how different country characteristics affect the exemption fraction. As in a wide variety of tax competition models, in this model there will be a tendency for smaller countries to choose more generous treatment.

A third issue is the effect of exemption competition on firm formation. It has long been recognized[6] that the incidence of a tax on corporate profits may fall on the return to entrepreneurial activity, and thus may discourage such activity. Here I assume that entrepreneurs have perfect foresight : they consider all future tax considerations in making an initial choice of where to locate their firm's headquarters. If there are (heterogeneous) costs of establishing new firms, a higher exemption fraction in one country will increase more new start-ups in that country from two sources : a change in location of headquarters of new firms which would have been established elsewhere, and an increase in new start–ups which otherwise would not have been profitable enough. This second source leads to the possibility of efficiency–enhancing exemption competition. If a higher exemption level in one country induces more entrepreneurs to start up firms, there may be benefits from those start–ups which accrue to other countries, than the one in which the firm's headquarters get located.

In assuming perfect foresight, I am not addressing an issue which may be particularly important to the recent American experience : dynamic inconsistency. In the current American system, firms with headquarters in the US benefit from indefinite postponement of remittance of profits earned by foreign subsidiaries. Firms which have accumulated foreign profits have a strong incentive to shift their headquarters location, to enable remittance of those profits at a low tax rate. At the same time, the American government has a strong incentive to change its rules, so as to prevent the tax loss from inversions. Dynamic inconsistency is thus a problem for both firms and governments. I use a static model, in which firms commit to a headquarters location, after governments have committed to a tax regime.

[5] Price, Waterhouse and Coopers (2013), page 3

[6] Stiglitz (1976) is perhaps the clearest reference.

2 The Advantages of Territoriality

The question considered here is how lenient countries will be towards income earned by subsidiaries of firms which have world headquarters in that country. So I assume that countries operate under the territorial system, in which only a fraction of foreign income is exempt from taxation in the parent firm's country. The fraction of foreign subsidiary income which is exempt, if the company's headquarters are in country i, will be denoted e_i. (So that $e_i = 1$ implies a purely territorial system, and $e_i = 0$ would imply a worldwide system, with no relief at all for foreign taxes paid by subsidiaries.) Let t_j be the statutory corporate income tax in country j. Then a multinational headquartered in country i would have total tax liabilities of $t_j + (1 - e_i)t_i$ euros on one euro of profits reported by a subsidiary incorporated in country $j \neq i$.

Here the exemption rate e_i is the strategic variable chosen by a country's government. Raising the exemption rate lowers a country's tax collections on any firm with headquarters there, but makes the country a more attractive location for firms to establish headquarters.

In practice, the nominal exemption rate is very high in countries which use the territorial principle : 100% in most countries, and 95% or more in those countries which choose not to exempt all income. In addition, the exemption applies to **dividends** remitted by the foreign subsidiaries, not to the reported profits. As well, the United States, the main holdout against the territorial principle, uses the credit system, so that the effective tax rate on dividends remitted from a subsidiary in which $t_j < t_i$ is t_i, not $t_i + t_j$.

There are many other complications, of course. Most European countries' tax codes list many departures from the territorial principle, if subsidiaries are deemed to be used for tax shifting (outside of the EU). The US system, by taxing foreign earnings only when they are repatriated, is much more generous to American multinationals than it would be if the "true" worldwide credit principle were used.

But reducing a country's tax relief rules for foreign subsidiaries to a single parameter e_i yields a much more tractable model. And this formulation preserves two essential features. First, countries have a fiscal instrument to attract headquarters operations of multinationals, at the potential cost of lost tax revenue. Second, a firm's susceptibility to increases in e_i will increase with the magnitude of taxable profits earned by subsidiaries outside of country i.

A simple explanation of why the territorial principle is so prevalent may be that new firms are very footloose. Assume, as will be done throughout this paper, that a firm's subsidiaries' earnings do not depend at all on the location of headquarters. That is, each firm will have a vector $\mathbf{r} = (r_1, r_2, \ldots, r_I)$ of taxable income from operations in the I different countries, and this vector does not depend on where the firm locates its headquarters.

Since r_j is the **taxable** income of the firm's operating subsidiary in country j, it will be affected by the firm's tax planning. If $t_j > t_k$, the firm will want to transfer taxable income from subsidiaries in country j to subsidiaries in country k. The usual suspects can be used : thin capitalization, transfer pricing, transfer

of intellectual property ownership. I am assuming that how much transferring occurs does not depend on the location of its headquarters. That would not be the case in a "standard" model of profit–shifting, in which the firm faces some cost function for income shifted, with costs an increasing, convex function of the amount shifted. Were this the case, an increase in e_i would increase the benefit of cost shifting, and lead to a higher r_k and a lower r_j.

Instead, I assume that the amount of profit shifting among subsidiaries is determined by exogenous features : the "true" value of a firm's intellectual property, the ceiling imposed by country j on the extent of thin capitalization, the maximum transfer price that can be upheld by the courts.[7]

Here I treat the statutory tax rate t_i in a country as exogenous. Having the countries choices of exemption level e_i occur **after** statutory tax rates are determined may seem a peculiar choice of timing. Chisik and Davies (2004), for example, model countries as choosing (non–cooperatively) tax treatment[8] of foreign subsidiary income prior to their choice of statutory tax rates, and as anticipating the effects these first stage decisions have on tax rate determination in the subsequent stage.

The main reason for ignoring here the effects of multinational relief regime on statutory tax rates is that these effects have already been analyzed. Much of the tax competition literature analyzes the effects of (exogenous) rules on non–cooperative tax rate determination. Despite the proliferation of tax treaties, many administrative rules for taxation of multinationals seem to be chosen unilaterally. These rules are changed very frequently, perhaps with greater frequency than statutory rates.

Finally, the statutory tax rate on income of subsidiaries in country i is not very important if the firm's parent has done its tax planning successfully. I distinguish in the model below between countries which are competing to host a new firm's headquarters, and outside tax havens in which the new firm will establish subsidiaries. I assume that only old, "respectable" countries have the institutions and infrastructure needed for a new firm's world headquarters. The new firm's founder is doing her tax planning before the firm is established. She is setting up a structure in which operating profits will (nearly) all be transferred to subsidiaries in tax havens. But she wants her headquarters in an OECD country. If this is her plan, then statutory tax rates in OECD countries matter only in the headquarters country, and only if that country chooses to exempt less than 100% of foreign subsidiaries' dividends.[9]

If firms were completely footloose, and if countries' governments cared only about their tax revenue, then a pure territorial system would be the outcome. That is, $(e_1, \ldots, e_I) = (1, 1, 1, \ldots, 1)$ would be a Nash equilibrium, if country

[7] Alternatively, if the costs of profit shifting were tax deductible, then an increase in e_i would shift up the benefits and costs of tax shifting proportionately, and so would not change the firm's preferred level.

[8] in their model, countries choose amount discreet alternative rules : exemption, credit, or deduction

[9] Of course, the exemption rate in a country should still influence its choice of statutory tax rate. But if the exemption rate is high, then its influence on any subsequent rate choice may be small.

i chose e_i so as to maximize its total tax revenues, given that each firm would locate its headquarters so as to minimize its total tax burden. No matter what is the vector $\mathbf{r}$[10], no firm would choose to locate in country i if $e_i < 1$ and if every other r_j were 1.

And the usual Bertrand argument shows that complete territoriality is the only Nash equilibrium if firms were completely footloose, and if countries cared only about tax revenue. Suppose to the contrary that some country or countries exempted less than 100% of foreign subsidiary earnings. If a non–zero measure of firms were indifferent among 2 or more countries as their choice for headquarters, then the usual incentive to undercut means that the vector of exxemption rates cannot be a Nash equilibrium. If no firm (or a set of measure zero of firms) were indifferent between any countries, then each country would want to lower its exemption rate a little.

Of course, we do observe many large countries choosing an exemption rate of 100%. But there may be several reasons to consider a model in which firms are not perfectly footloose. First of all, it seems implausible that all proprietors of new firms would be indifferent among all countries as locations for headquarters. Second, the US is a large country which does not use a pure exemption system. Although the American tax code treats offshore subsidiaries' profits very generously, these profits do not escape completely American taxation. Third, given the attempts by OECD countries to coordinate action to reduce the use of tax havens, it may be worthwhile to see how successful these attempts might be, in a slightly more realistic model of firm location.

And fourth, establishing a new firm is a costly undertaking. The tax treatment of the future stream of profits from a new firm will affect the supply of new start–ups. The impact of such changes in supply of new firms may cross borders when firms' founders can choose the location of their nascent enterprises' headquarters. Even when these founders are less than perfectly mobile, one country's exemption decisions may affect other countries' levels of economic activity.

3 Firms' Payoffs

In the previous section 2, each firm was assumed to have an exogenous vector of subsidiaries' taxable operating profits $(r_1, r_2, \ldots, r_I)$ in countries $1, 2, \ldots, I$. If it chooses to locate its headquarters in country i, then it will pay additional taxes of

$$(1 - e_i)t_i \sum_{j \neq i} r_j$$

to country i's tax authority. Here, of course, I am assuming that all countries use the territorial principle, and their only instrument for taxing offshore profits is to set an exemption rate e_i less than 100%.

[10] as long as at least two of the components of $\mathbf{r}$ are strictly positive

Notice as well that the headquarters country is not giving any credit or deduction for foreign taxes paid by the subsidiaries. Since I will assume that countries treat the statutory tax rates $(t_1, t_2, \ldots, t_I)$ as exogenous when choosing exemption rates, nothing of substance would change if, instead, a credit (or deduction) were allowed for foreign taxes already paid by subsidiaries.

As argued in the previous section 2, if total after–tax profits were all that mattered to firms, then Bertrand–like competition should drive countries to exempt all offshore profits. But notice that, if somehow exemption rates were less than 100%, then firms would prefer to locate headquarters in countries in which they did not earn high operating profits. The firm's maximand is

$$\sum_{j=1}^{I}[1 - t_j - t_i(1 - e_i)]r_j + (1 - e_i)t_i r_i \tag{1}$$

So, if two countries were otherwise identical, $t_i = t_k$ and $e_i = e_k < 1$, expression (1) says that the firm would be better off locating the firm's headquarters in the country in which its operating profits were greater.

In other words, expression (1) implies that allowing tax shifting makes a country less attractive as a headquarters location, when exemption is less than complete. If a company is headquartered in country i, transferring operating profits from country j to a third tax haven k will not change the taxes on worldwide subsidiary income paid in the headquarters country i. But transferring operating profits from i to k will **increase** worldwide subsidiary income, and thus will increase taxes paid to country i on those profits, if $e_i < 1$.

This simple model does indicate a positive relationship between a country's generosity in allowing tax shifting, and firms' incentive to locate their worldwide headquarters in that country. But there are two huge gaps in using this model to explain this generosity as a consequence of competition for headquarters. First, the incentive arises only if countries' adherence to the territoriality principle is less than 100% — and this less–than–complete exemption will not emerge if firms are footloose. Second, no indication has been provided about why a country should want to host headquarters activity.

Both of these gaps can be filled using obvious (and adhoc) modifications : make firms less footloose, and assume some benefits from hosting headquarters. Although many of the consequences of these modifications are obvious, incorporating them does provide some implications for the nature of competition for headquarters.

For the firms, assume now that each firm is characterized by a vector $\mathbf{c} >> \mathbf{0}$ of set–up costs : c_i is the cost to the founder of setting up a new firm with headquarters in country i. Firms are no longer footloose : if $c_i > c_j$, then the founder would prefer, other things equal, to set up the firm with headquarters in country j.

Given these costs, a founder will set up a firm with headquarters in country i if and only if the payoff from doing so is positive, and this payoff is greater than the payoff from setting up the firm elsewhere. That is, a firm, characterized by

$(\mathbf{r}, \mathbf{c})$ will set up its headquarters in country i if

$$\sum_{j=1}^{I}[1 - t_j - t_i(1 - e_i)]r_j + (1 - e_i)t_i r_i \geq c_i \tag{2}$$

and if

$$\sum_{j=1}^{I}[1 - t_j - t_i(1 - e_i)]r_j + (1 - e_i)t_i r_i \geq \max_k \sum_{j=1}^{I}[1 - t_j - t_k(1 - e_k)]r_j + (1 - e_k)t_k r_k \tag{3}$$

Here the countries' strategic variable of interest is their exemption rate e_i : the statutory tax rates t_i certainly matter in firms' choice, as does the distribution r of net operating profits of different subsidiaries. These are set, or influenced, by countries' policies, such as their statutory tax rates and the extent to which they allow profit shifting.

But at this stage, I assume countries' governments take the vectors of net–of–domestic–tax profits, and the statutory tax rates, as given, and choose their exemption rates given the firms' behavior defined in (2) and (3) above.

If the left side of inequality (2) is denoted π_i[11], then the measure of the set of firms which choose to establish headquarters in country 1 will be

$$n_1 \equiv \int_0^{\pi_1} \int_{c_1-\pi_1+\pi_2}^{\infty} \cdots \int_{c_1-\pi_1+\pi_I}^{\infty} h(c_1, c_2, \ldots, c_I) dc_I \cdots dc_2 dc_1 \tag{4}$$

where $h(c_1, c_2, \ldots, c_I)$ is the density function associated with the distribution function $H(c_1, c_2, \ldots, c_I)$ associated with founders' costs of establishing firms in the different countries.

If there are no atoms to the distribution $H(c_1, c_2, \ldots, c_I)$, then n_1 will vary continuously with π_1 : small increases in the profitability of location in country i will attract new business in a continuous fashion from I sources : founders whose previous best option was to locate in one of the other $I - 1$ countries, and founders whose previous best option was not to set up a firm at all.

4 The Benefits from Hosting Headquarters

As is implicit in equation (2), it is assumed here that entrepreneurs are choosing whether or not to establish new firms, influenced by countries' tax policies. Higher effective tax rates will discourage creation of new firms. As indicated in this equation (2), these effective tax rates depend on the statutory tax rates t_j on operating profits in each jurisdiction, on the extent of profit shifting among

[11] which will depend on the exemption rate e_i chosen by the country

subsidiaries (which determines the r_j's), and on the exemption rate e_i in the best location for the firm's headquarters. It is this last variable which is being decided by countries.

Lower exemption rates have real effects here, by discouraging entrepreneurial activity. These effects will be represented here by 2 variables, a vector $\mathbf{z}$ of benefits to governments from the creation of a new firm — anywhere —, and a scalar h of benefits from hosting the headquarters.

So the vector $\mathbf{z}$ represents benefits which are **not** associated with the location of the firm's headquarters. For example, suppose an entrepreneur living in country j chooses to establish a firm with its official world headquarters in country $i \neq j$. If the entrepreneur herself continues to live in country j, and if most of the firm's research is actually conducted in country j, then z_j might be fairly large, and h fairly small.

These benefits would include the profits earned by entrepreneurs who are citizens or residents of a country, if these people's benefits are included in the welfare measure used by decision makers in that country. They would include the value of the extra tax revenue from residence–based income taxes that will be collected from the entrepreneurs, and the value of any spillovers from the firm's research, and other, activity, to the extent that this activity is **not** associated with the firm's headquarters choice.

At this level of generality[12] the vector $\mathbf{z}$ is assumed to be specific to each potential firm. Just as there is an arbitrary distribution for the vector of each entrepreneur's headquarters–specific setup costs $\mathbf{c}$, there is an arbitrary distribution to the vector of the benefits $\mathbf{z}$ this entrepreneur's firm will provide to the different countries' decision–makers. The one substantive restriction is that a particular entrepreneur's $\mathbf{z}$ does not vary with the entrepreneur's choice of headquarters location.

Under this formulation, there are four types of government benefit associated with each new firm which is established : the tax revenue $t_i r_i$ collected from the operations of the firm (wherever the firm's headquarters are located) ; the added tax revenues $(1 - e_i)t_i(\sum_{j \neq i} r_j)$ if the firm's headquarters are in country i ; the spillovers z_i the firm provides to the country ; the extra spillovers h provided if the firm's headquarters are located in country i.

There is, in a sense, an endogenous supply of capital here. Entrepreneurial activity anywhere is an increasing function of the overall net–of–domestic–tax profits $\sum_j (1-t_j)r_j$ earned by the firm. The "conventional" effect of taxes at the operating level occurs here : the measure of entrepreneurs who establish firms will increase if the effective domestic tax rates fall, either through reductions in statutory rates t_j, or through more tolerance of profit–shifting. But this activity increases as well with the level of exemption e_i of subsidiaries' profits if the firm's headquarters are in country i.

[12] to be abandonned abruptly in the subsequent section

5 Benefits from Competition for Headquarters

A simple example may illustrate why competition for headquarters may actually be beneficial, when there is some heterogeneity among firms, and when firms' start–up decisions depend on their net–of–tax profits.

This example is a simplified version of the Janeba–Peters (1999) model[13], which demonstrates the potential benefits from fiscal competition, when it enables countries to better discriminate among different types of investment.

In my example, each of the two countries contains two distinct types of entrepreneur. Each entrepreneur's vector of start–up costs $\mathbf{c}$ is of the form $(c, c+a)$, or $(c+a, c)$, depending in which of the two countries the entrepreneur resides. This formulation of the vector of start–up costs will be retained throughout the paper : each entrepreneur resides somehwere, has a cost of $c > 0$ of establishing a firm with headquarters where she resides, and has a higher cost $c + a$ (with $a > 0$) of establishing the firm elsewhere. I will refer to c as the "set–up cost", and a as the "attachment to home".

Type M (for "mobile") entrepreneurs have an entry cost $c = 3$, and a relocation cost $a = 1$. Type I entrepreneurs are less mobile, but can enter more cheaply : for type I entrepreneurs, $c = 2$ and $a = 5$.

In each country, 80% of the entrepreneurs are of type I, and 20% of type M.

For simplicity, assume that each entrepreneur will be able to shift all her profits to a subsidiary in a tax haven, regardless of where the firm's headquarters are located. For each firm, this total net subsidiaries' profit equals 5. If country i chooses some exemption level e_i, then an entrepreneur based in the country will be willing to establish a firm headquartered in that country if $5(1-t_i(1-e_i)) > c$ (and if $t_i(1-e_i) - t_j(1-e_j) < c/5$).

If entrepreneurs could establish firms only in their home countries, their governments face a choice between setting taxes so low that all entrepreneurs choose to enter, or setting somewhat higher taxes, which induce immobile entrepreneurs to enter but not mobile ones. Since 80% of the firms are immobile, each country's tax revenues are maximized by setting $t_i(1-e_i) = 0.6$, leaving the mobile entrepreneurs unwilling to enter, and the immobile entrepreneurs on the margin of entering. Tax revenues under this policy[14], 2.4, are 20% higher than those under the next–best option, setting $t_i(1-e_i) = 0.4$, and having all prospective firms established.

So even if there were other benefits from headquarters (in addition to the tax revenue), isolated countries would prefer this high–tax policy to one which induced more entry, if these other benefits were not too large.

With 2 countries, and the potential for location of headquarters in a foreign country, the smaller country 2 realizes that it can attract the headquarters of mobile entrepreneurs from country 1, if it chooses a sufficiently lenient tax policy. With $t_1(1-e_1) = 0.6$, mobile entrepreneurs will be willing to establish headquarters in country 2 provided that $t_2(1-e_2) \leq 0.2$. [By construction, it will

[13] see also Marceau, Mongrain and Wilson (2010)

[14] where the total number of prospective firms in the country is normalized to 1

be impossible to attract the less–mobile firms from the other country, without subsidizing them.] If country 1 is N times larger than country 2, country 2's tax revenue from this latter policy, of $t_2(1-e_2) = 0.2$, will equal $\frac{4+N}{5}$. This will be higher than what it was in isolation, when $N \geq 8$.

So if the countries differ enough in population (if country 1 has at least 8/9 of the total population), then country 2 gets a higher payoff under tax competition, by choosing a high enough exemption rate so as to attract headquarters of firms of country 1's mobile entrepreneurs. Country 1's best reaction to $t_2(1-e_2) = 0.2$ is to maintain its tax rate at the closed–economy optimum of $t_1(1-e_1) = 0.6$. But country 1's payoff would also goes up under tax competition, if there were any benefits — however small — to country 1 from having a native of country 1 set up a new firm headquartered in country 2.

The same Pareto improvement, through competition for new firms, would occur if there were many identical countries. In this example, if there were 10 identical countries, one Nash equilibrium has one country catering to the mobile firms by setting $t_i(1-e_i) = 0.2$, with the other 9 countries continuing to set $t_j(1-e_j) = 0.6$.

So in this example, competition for headquarters represents a Pareto improvement on the outcome when no movement of firms is possible.

6 A Formal Model

If there are only 2 countries competing for headquarters, then a firm will locate in country 1 if

$$(1-t_1)r_1 + (1-t_2)r_2 + (1-\bar{t})\bar{r} - (1-e_1)t_1[r_2+\bar{r}] \geq c_1 \tag{5}$$

$$(1-e_1)t_1(r_2+\bar{r}) - (1-e_2)t_2(r_1+\bar{r}) \leq c_1 - c_2 \tag{6}$$

where $\bar{r}$ are total subsidiary profits in other countries (other than countries 1 and 2, which are competing for the headquarters), and $\bar{t}$ is the profit–weighted tax rate in those other countries.

If the net payoff from headquarters location in country i, the left side of inequality (5) is denoted by

$$\Phi_1(e_1; t_1, t_2, r_1, r_2, \bar{t}, \bar{r}) \equiv (1-t_1)r_1 + (1-t_2)r_2 + (1-\bar{t})\bar{r} - (1-e_1)t_1[r_2+\bar{r}] \tag{7}$$

and if $\Phi_2(e_2; t_1, t_2, r_1, r_2, \bar{t}, \bar{r})$ is defined analogously, then a firm will establish headquarters in country 1 if $\Phi_1 > c_1$ and if $\Phi_1 - \Phi_2 > c_1 - c_2$.

I now assume that all potential firms are identical, except in their set–up costs c_i.

Further, I assume that a firm can be identified with the home country of its founder. All firms for which $c_1 < c_2$ will be identified as firms owned by residents of country 1.

Firms owned by residents of country 1 can be characterized by the cost c_1 of establishing the firm in country 1, and the added cost $c_2 - c_1 > 0$ of establishing the firm instead in country 2.

Figure 1 depicts the choice of a firm owned by a resident of country 1, when $\Phi_1 < \Phi_2$. The cost of entry c_1 is graphed along the vertical axis, and the "attachment to home" $a \equiv c_2 - c_1 \geq 0$ is graphed along the horizontal. Only if the attachment to home $a > \Phi_2 - \Phi_1$ will the firm's owner choose to establish headquarters in her native country 1. The set of firms establishing headquarters in country 1 (when $\Phi_1 < \Phi_2$) are those with a (c, a) combination to the right of the vertical black line $a = \Phi_2 - \Phi_1$, whose entry costs c are sufficiently low (below the red horizontal line).

To the left of the vertical black line, relatively footloose firms' owners will either establish headquarters in the lower–tax country 2 (if $c + a < \Phi_2$: below the downward–sloping red line), or choose not to establish firms (if $c + a > \Phi_2$).

Increases in country 1's exemption level e_1 increase Φ_1, by t_1 times the increase in e_1. That shifts up the horizontal segment of the red curve in figure 1, by t_1 times the increase in the exemption, and shifts left the vertical black line by the same amount.[15]

I assume that there is a continuum of potential firms, and each of them is the result of an independent draw from two distributions : $F(c_1)$ is the probability that a firm's set–up cost in country 1 is c_1 or less, and $G(c_2 - c_1)$ is the probability that the firm's home country cost advantage is $c_2 - c_1$ or less. Each of the two distributions $F(\cdot)$ and $G(\cdot)$ has no mass points[16]. The density functions associated with the two distributions are denoted $f(\cdot)$ and $g(\cdot)$.

Therefore, the proportion of firms whose founders live in country 1 which choose to set up headquarters in country 1 is (from equations (5) and (6)) $F[\Phi_1](1 - G[\Phi_2 - \Phi_1])$ if $\Phi_1 < \Phi_2$, and is $F(\Phi_1)$ if $\Phi_1 > \Phi_2$.

I assume that the distribution of home country set–up cost c_2, and home country advantage $c_1 - c_2$ for country–2–based entrepreneurs is exactly the same as among country–1–based firms, except for a scale factor n, measuring the relative size of the two countries.

That means that the number of firms establishing headquarters in country 1 will be proportional to

$$F[\Phi_1](1 - G[\Phi_2 - \Phi_1]) \tag{8}$$

if $\Phi_1 < \Phi_2$. All these firms' owners are residents of country 1. (That is, for all these firms, $c_1 < c_2$.) If $\Phi_1 > \Phi_2$, then country 1 will attract

$$F[\Phi_1] \tag{9}$$

firms which are owned by its own residents, and

$$n \int_0^{\Phi_1 - \Phi_2} F[\Phi_1 - a] g(a) da \tag{10}$$

[15]The downward–sloping segment of the red curve, with equation $c + a = \Phi_2$, is unaffected by unilateral change in e_1.

[16]The support of each distribution is some subset of $(0, \infty)$.

firms owned by country–2 residents.

If N_{ij} denotes the number of firms owned by residents of country i, with headquarters in country j, expressions (8)–(10) imply that

$$\frac{\partial N_{11}}{\partial \Phi_1} = f(\Phi_1)(1 - G[\Phi_2 - \Phi_1]) + F(\Phi_1)g(\Phi_2 - \Phi_1) \tag{11}$$

if $\Phi_1 < \Phi_2$, and

$$\frac{\partial N_{11}}{\partial \Phi_1} = f(\Phi_1) \tag{12}$$

if $\Phi_1 > \Phi_2$. $N_{21} > 0$ only if country 1 is an overall more attractive location for firms' headquarters, and then, if $\Phi_1 > \Phi_2$

$$\frac{\partial N_{21}}{\partial \Phi_1} = nF[\Phi_2]g(\Phi_1 - \Phi_2) + n\int_0^{\Phi_1 - \Phi_2} f(\Phi_1 - a)g(a)da \tag{13}$$

Country 1's policies also affect the number of firms with headquarters in country 2. If $\Phi_1 < \Phi_2$, then

$$\frac{\partial N_{12}}{\partial \Phi_1} = -F[\Phi_1]g(\Phi_2 - \Phi_1) \tag{14}$$

and if $\Phi_1 > \Phi_2$, then

$$\frac{\partial N_{22}}{\partial \Phi_1} = -nF[\Phi_2]g(\Phi_1 - \Phi_2) \tag{15}$$

In keeping with the notion that firm's entrepreneurs live in some country, each firm whose owner lives in country 1 provides a spillover vector $(z_1, z_2) = (z, \zeta)$, with $z > \zeta \geq 0$. And firms whose owner lives in country 2[17] provide the reverse spillovers, $(z_1, z_2) = (\zeta, z)$. I assume z and ζ do not vary across firms, and the extra benefits h from headquarters do not vary across firms.

So each firm established by a country–1 resident, with headquarters in country 1, provides benefits of

$$w_{11} \equiv z + h + t_1 r_1 + (1 - e_1)t_1(r_2 + \bar{r}) \tag{16}$$

to the government of country 1.

Each firm established by a country–2 resident, with headquarters in country 1, provides benefits of

$$w_{21} \equiv \zeta + h + t_1 r_1 + (1 - e_1)t_1(r_2 + \bar{r}) \tag{17}$$

to the government of country 1.

Each firm established by a country–1 resident, with headquarters in country 2, provides benefits of

$$w_{12} \equiv z + t_1 r_1 \tag{18}$$

to the government of country 1.

[17] that is firms for which $c_1 > c_2$

And each firm established by a country–2 resident, with headquarters in country 2, provides benefits of

$$w_{22} \equiv \zeta + t_1 r_1 \tag{19}$$

to the government of country 1.

Equations (18) and (19) show the spillovers to country from firms with headquarters elsewhere : the (nebulous) externalities from firm activity per se, z or ζ, and the tax revenue from subsidiary operations of the firm.

Equation (7) shows that the payoff Φ_1 to a firm from location in country 1 is an increasing linear function of the fraction e_1 of foreign subsidiary income which is exempt from taxation in the parent company's home jurisdiction 1.

So, for given statutory tax rates $t_1, t_2, \bar{t}$, and a given revenue pattern $r_1, r_2, \bar{r}$, Φ_i can be regarded as country i's strategic variable.

If countries 1 and 2 choose their exemption levels e_1 and e_2 non–cooperatively, taking their own statutory tax rates as given, this can be treated as a game in which Φ_1 and Φ_2 are the strategic variables, in which country 1's payoff is

$$W_1 = w_{11}N_{11} + w_{21}N_{21} + w_{12}N_{22} + w_{22}N_{22} \tag{20}$$

and country 2's payoff is defined analogously.

7 Symmetry

As in the Kanbur–Keen model, and other "attachment to home" models, there is a discontinuity in the effects of policy at the point where $\Phi_1 = \Phi_2$: when $\Phi_1 < \Phi_2$ increases in Φ_1 reduce the outflow of firms set up by local entrepreneurs, and when $\Phi_1 > \Phi_2$ increases in Φ_1 increase the inflow of firms set up by foreigners.

Let Δ indicate the increase in a variable, from the limit as $\Phi_1 - \Phi_2 \to 0$ from below, to the limit as $\Phi_1 - \Phi_2 \to 0$ from above.

From equations (11) and (12),

$$\Delta[\frac{\partial N_{11}}{\partial \Phi_1}] = -F(\Phi_1)g(0) \tag{21}$$

from equation (13),

$$\Delta[\frac{\partial N_{21}}{\partial \Phi_1}] = nF[\Phi_1]g(0) \tag{22}$$

from equation (14)

$$\Delta[\frac{\partial N_{12}}{\partial \Phi_1}] = F(\Phi_1)g(0) \tag{23}$$

and from equation (15),

$$\Delta[\frac{\partial N_{22}}{\partial \Phi_1}] = -nF[\Phi_1]g(0) \tag{24}$$

Therefore, the jump in the derivative (with respect to its strategic variable, the exemption fraction e_1) of country 1's payoff, as it moves from source to destination for firms, is proportional to

$$\Delta[\frac{\partial W_1}{\partial \Phi_1}] = (n-1)[h + (1-e_1)t_1(r_2+\bar{r})]F[\Phi_1]g(0) \tag{25}$$

As long as the spillovers from hosting a headquarters h are positive, or the exemption rate e_1 is less than 100%, expression (25) has the same sign as $n-1$[18].

That means that a symmetric equilibrium, in which $\Phi_1 = \Phi_2$, is possible only when countries are identical in scale : $n = 1$.

Equation (25) also implies that the reaction functions of the two countries are, in some respects, similar to those in Figure 2 of Kanbur and Keen : the reaction function of the smaller country ($n > 1$) must be discontinuous, since it cannot cross the 45–degree line in Φ_1–Φ_2 space.

If countries were identical in every respect, in particular if $n = 1$, then an outcome in which each country were equally attractive would be a Nash equilibrium only if

$$\frac{\partial W_1}{\partial e_1} = [w_{11}\frac{\partial N_{11}}{\partial \Phi_1} + w_{12}\frac{\partial N_{12}}{\partial \Phi_1}]\frac{\partial \Phi_1}{\partial e_1} - t(r_2+\bar{r})N_{11} = 0 \tag{26}$$

where these derivatives are evaluated at $\Phi_1 = \Phi_2$[19]. The rightmost term in expression (26) shows the direct revenue loss from increasing Φ_1 by raising the exemption level.

Equation (7) implies that

$$\frac{\partial \Phi_1}{\partial e_1} = t_1(r_2+\bar{r})$$

so that, when $n = 1$, and when $\Phi_1 = \Phi_2$, equation (26) can be written

$$\frac{\partial W_1}{\partial e_1} \sim (z + t_1 r_1)f(\Phi) + [h + (1-e_1)t_1(r_2+\bar{r})][f(\Phi) + g(0)F(\Phi)] - F(\Phi) \tag{27}$$

The first term on the right side of equation (27) is the added benefits from the operation of a firm started up by a resident of country 1, wherever that firm's headquarters are located[20] ; the second term is the added benefits from a firm choosing its headquarters in country 1, rather than in country 2 ; the third term is the direct tax revenue loss from more generous exemption.

From equation (27) a symmetric equilibrium, at which $\frac{\partial W_1}{\partial e_1} = 0$ and $\Phi_1 = \Phi_2$, can be characterized by the equation

$$\frac{f(\Phi^N)}{F(\Phi^N)} = \frac{1 - g(0)[h + (1-e_1)t_1(r_2+\bar{r})]}{z + t_1 r_1 + h + (1-e_1)t_1(r_2+\bar{r})} \tag{28}$$

[18] when the density function $g(0)$ for attraction to home is positive

[19] I have taken the limit as $\Phi_1 \to \Phi_2$ from below. When $\Phi_1 < \Phi_2$, $N_{21} = 0$, and N_{22} is independent of country 1's strategic variable e_1. Equation (25) shows that, when $n = 1$, it does not matter from which side the limit is taken.

[20] When $\Phi_1 < \Phi_2$, country 1's exemption level e_1 has no impact on firms started up by country–2 residents, since all these firms' headquarters are located in country 2.

where Φ^N is the common value of the firms' net world profits, in the symmetric equilibrium.

If the distribution function $F(\cdot)$ for set–up costs for new firms has a decreasing hazard rate, then increases in any of the following variables will increase the countries' equilibrium exemption rate :

1. The statutory tax rate $t_1 = t_2$ on domestic profits.
2. The benefits h to a country from hosting a firm's headquarters.
3. The spillovers z accruing when a resident of the country sets up a new firm (anywhere).
4. The density function $g(0)$, measuring how "many" new firms are completely footloose between countries.
5. Holding constant a firm's total pre–tax profits $r_1 + r_2 + \bar{r}$, the fraction of those profits reported by subsidiaries in countries 1 and 2.

So there is a sort of complementarity between taxation of operating subsidiaries and taxation of headquarters profits. Suppose that, in an earlier stage, countries 1 and 2 coordinate on taxing more heavily the profits of subsidiaries operating within their borders. This coordination could be an equal increase in the statutory rates t_1 and t_2. Or it could be a reduction in tax shifting (when $\bar{t} < t_1 = t_2$), in which $\bar{r}$ falls and r_1 and r_2 both increase. The impact of such changes on the symmetric Nash equilibrium to the subsequent stage will be a decrease in the exemption level e_i chosen by each country.

8 The Effects of Headquarters Competition

Suppose that there were no choice among countries for a firm's headquarters. That is, each entrepreneur in a country is restricted in her choice : either set up a multinational firm with headquarters in her home country, or don't set up a firm at all. Here I am restricting only competition for headquarters : should a firm be set up, with headquarters in country 1, it will have subsidiaries in other countries, and will have a vector of taxable operating profits of $(r_1, r_2, \bar{r})$ distributed across countries.

In such a situation, all entrepreneurs with setup costs of Φ_1 or less will choose to establish firms with headquarters in their home country. The payoff to country 1, if its choice of exemption level e_1 leads to a net profit of Φ_1 for firms with owners from country 1, will be

$$W_1 = F(\Phi_1)[z + h + t_1 r_1 + (1 - e_1)t_1(r_2 + \bar{r})] \tag{29}$$

The country will also get a payoff from firms established with headquarters in country 2, of $nF(\Phi_2)[\zeta + t_1 r_1]$, but that payoff is not affected by the country's own choice of exemption level.

Maximization of expression (29) with respect to e_1 leads to a first–order condition

$$\frac{f(\Phi^0)}{F(\Phi^0)} = \frac{1}{z + h + t_1 r_1 + (1 - e_1)t_1(r_2 + \bar{r})} \tag{30}$$

determining the level of firm profits Φ^0 when countries do not compete for headquarters.

Comparison of equations (28) and (30) shows that

Proposition 1 *With complete symmetry, if the distribution $F(\cdot)$ of set–up costs has a declining hazard rate, then competition for headquarters will raise countries' exemption rates for foreign subsidiaries' profits if and only if $g(0) > 0$, where $g(\cdot)$ is the density function for entrepreneurs' attachment to home.*

From the point of view of countries' decision makers, this outcome $\Phi_1 = \Phi_2 = \Phi^0$ is sub–optimal. Because country i gets benefits of $\zeta + t_i r_i$ from each firm with headquarters in the other country, there are positive spillovers. Both countries would benefit from a coordinated increase in Φ_1 and Φ_2 above Φ^0.

Therefore, an immediate consequence of equations (28) and (30) is

Corollary 1 *If the density function $g(0)$ is small but positive, both countries will be better off if firms can choose their headquarters location (compared to a world in which they are restricted to their owners' home countries).*

Since the total benefit to the two countries together from each new firm set up in country 1 is $h + z + \zeta + t_1 r_1 + t_2 r_2 + t_1(1 - e_1)(r_2 + \bar{r})$, the optimal common level of Φ, if the two identical countries could coordinate on a common exemption policy, solves

$$\frac{f(\Phi^*)}{F(\Phi^*)} = \frac{1}{h + z + \zeta + 2t_1 r_1 + t_1(1 - e_1)(r_2 + \bar{r})} \tag{31}$$

where Φ^* is the common level of profits to firms when the two countries coordinate on a common exemption level[21].

Although the exemption level e_1 on the right side of equations (28)–(31) is endogenous[22], comparison of equations (28) and (31) shows that competition in exemption rates will lead to too high an exemption rate whenever

$$g(0)[h + (1 - e)t_1(r_2 + \bar{r})][z + h + \zeta + 2r_1 t_1 + t_1(1 - e)(r_2 + \bar{r})] > \zeta + t_1 r_1 \tag{32}$$

Not surprisingly, if the benefits h from hosting a firm's headquarters are large, or if the firms tend to be very footloose, so that $g(0)$ is large, then competition leads to too generous treatment of firms' offshore profits, at least from the viewpoint of the governments of the countries hosting the headquarters.

[21] And where I have used the assumption that $t_1 = t_2$ and $r_1 = r_2$.

[22] and is a linear, increasing function of Φ

9 Size Differences

The payoff to the government of country 1 can be written

$$\begin{aligned} W_1 = (1-e_1)t_1(r_2+\bar{r})(N_{11}+N_{21}) + t_1 r_1(N_{11}+N_{21}+N_{12}+N_{22}) \\ + h(N_{11}+N_{21}) + z(N_{11}+N_{12}) + \zeta(N_{21}+N_{22}) \end{aligned} \tag{33}$$

This payoff depends directly on the exemption rate e_1, and indirectly on the profit Φ_1 firms earn in country 1, with (from equation (7))

$$\frac{\partial \Phi_1}{\partial e_1} = t_1(r_2+\bar{r})$$

When countries differ in size, which one has the stronger incentive to raise the exemption in order to attract new firms' headquarters? The derivative of W_1 with respect to e_1, evaluated at $\Phi_1 = \Phi_2 \equiv \Phi$ gives some indication of this incentive. Of course, as equation (25) indicates, this derivative is discontinuous when countries differ in size. For concreteness, I evaluate the left–side derivative :

$$\begin{aligned} \frac{\partial W_1}{\partial e_1}|_- \sim f(\Phi)z + [f(\Phi)+g(0)F(\Phi)][t_1(r_1+r_2+\bar{r})+h] \\ - t_1 e_1[f(\Phi)+g(0)F(\Phi)](r_2+\bar{r}) - N_{11} \end{aligned} \tag{34}$$

where the constant of proportionality is $t_1(r_2+\bar{r})$. Country 2 has an analogous derivative.

Equation (34) indicates a tendency for smaller countries to compete more agressively for headquarters. If country 1 is smaller than country 2, then $N_{11} < N_{22}$ whenever $\Phi_1 = \Phi_2$. As in Kanbur and Keen (1993), the smaller country attracts more new firms per capita from a given increase in Φ_i than will the larger country.

Equation (34) indicates that, other things equal, the reaction curve of the smaller country crosses (from the left) the 45–degree line in e_1–e_2 space above that of the larger country. If the countries' reaction curves were continuous, then the argument in section 4 of Wilson (1991) shows that an equilibrium must exist in which the smaller country chooses to exempt a larger fraction of firms' foreign subsidiaries' profits.

However, equation (25) indicates that the reaction correspondence of the smaller of the two countries cannot be continuous when $g(0) > 0$: as in Kanbur and Keen (1993), it cannot cross the 45–degree line. If the set of entrepreneurs who are very footloose is bounded away from zero, it does then follow that

Lemma 1 *If $g(0) = 0$, and if $t_1 = t_2$ and $r_1 = r_2$, then, if countries' reaction curves are continuous, there exists an equilibrium in which the smaller country chooses a higher exemption level than the larger country.*

[If $g(0) > 0$, then the lemma could be modified (and weakened). Suppose the larger country's reaction curve is continuous, and the smaller country's

best response, conditional on its exemption rate being higher than the large country's is also continuous. Then there would exist a "local" equilibrium in which the smaller country had a higher exemption level, local in the sense that the smaller country's exemption rate need not be its overall best response to the larger country's policy, just its best resposne conditional on its offering a higher exemption level. That is, if country 2 is larger than country 1, there would be a pair of exemption levels $e_1 > e_2$, such that neither country would want to change its exemption level slightly.]

But the assumption in Lemma 1, that countries differ in size but have identical statutory tax rates, is inconsistent with the earlier literature on competition in tax rates. That literature established that $t_1 < t_2$ if country 1 is smaller than country 2. And equation (34) shows that a country with a lower statutory tax rate will be more inclined to choose lower exemption levels.

Morever, the subsidiaries' earnings r_i in different countries, which are assumed exogenous, may not be equal when countries differ in size. ther things equal, if country 1 is smaller than country 2, then the difference in market size might imply $r_2 > r_1$, which, from equation (34), suggests the smaller country will be less inclined to exempt foreign subsidiaries' income.

10 Many Countries

If there are more than two countries competing for headquarters, the principal analytic complication is in generalizing entrepreneurs' "attachment to home". In the two–country model of section 6, each entrepreneur resides in one of the two countrties, and will choose to establish headquarters in the other country only if the profit from doing so exceeds some measure of the entrepreneur's attachment to her home. This attachment is non–negative for all entrepreneurs, and varies across them.

With more than two options for headquarters, entrepreneurs may also be heterogeneous in how they view their second–best location. That is, each entrepreneur from country 1 is characterized by a vector $\mathbf{a} \equiv (a_2, a_3, \ldots, a_n) \geq 0$ indicating how much she prefers country 1 to each of the other countries $2, 3, \ldots, n$ as a location for headquarters.[23] An entrepreneur from country 1 will establish headquarters in country $j \neq 1$ if and only if three conditions all hold : (1) country j minimizes $\Phi_j - a_j$ over all countries $2 \leq k \leq n$; (2). $\Phi_j - a_j \geq \Phi_1$; (3) $\Phi_j - a_j$ is at least as large as the entrepreneur's set–up cost c_1.

To examine the significance of the number of countries, it may be helpful to consider a spatial model, in which each entrepreneur has a particular location, and her attachment to home represents this distance of that location from the border with another country. If t is the cost of moving one's headquarters one kilometre further from the owner's location, then $G(a)$ is the fraction of the

[23] I am continuing to assume, as in section 6, that the value of entrepreneurs' set–up costs is distributed independently from this vector of relative attachment to home.

country's entrepreneurs who are located within a/t kilometres of the country's borders.

The main implication of this spatial interpretation is :

ASSUMPTION : The larger the number of identical countries, the larger is the fraction of entrepreneurs located within any distance of the border.

For example, consider the circular location model, which used to be widely used in models of product differentiation. Entrepreneurs are associated with points on a circle, the circle, of circumference C, is divided into n identical "countries", each country an arc of length C/n. If entrepreneurs are distributed uniformly along the circumference of the circle, the fraction of a country's entrepreneurs who are within distance d of one of the country's two borders is $2dn/C$ as long as that fraction is less than 1.

Or, in a two–dimensional example, if entrepreneurs are located uniformly over the interior of a circle, and countries are identical slices of that circle, the entrepreneurs within distance d of the country's borders are all those within distance d of the sides of the slice, plus all those with distance d of the center of the circle. The latter group, a a fraction of the country's population, does not vary with the number of slices, while the former group increases. Again, the overall fraction of entrepreneurs within a distance d of the border will increase with the number of slices.

If all countries are identical, then, a symmetric equilibrium is still characterized by a slightly–modified equation (28) :

$$\frac{f(\Phi^N)}{F(\Phi^N)} = \frac{1 - g(0)[h + (1 - e_1)t_1(R - r_1)]}{z + t_1 r_1 + h + (1 - e_1)t_1(R - r_1)} \tag{35}$$

where R is the firm's total worldwide taxable profits, and where $G(\cdot)$ is the density function of a distribution function $G(\cdot)$ for attachment to home which has been modified slightly : $G(a)$ is the fraction of (any) country's entrepreneurs who would locate in some other country, if the best alternative country offered net profits which are higher by a or more than the net profits achieved by locating headquarters in country 1.

Increasing the number of countries has two effects on the right side of equation (35) : it increases $g(0)$, if $g(0) > 0$, and it increases $R - r_1$. The latter effect stems from assuming

ASSUMPTION As the number of identical countries grows larger, there is an increase in the fraction of a multinational's reported profits which are earned by foreign subsidiaries.

If the distribution function $F(\cdot)$ of set–up costs has a decreasing hazard rate, then equation (35) and the two assumptions imply that the fraction e of foreign earnings which are exempt will increase, as the number of identical countries increases.

The result in the previous paragraph holds if everything else (except for $g(0)$ and r_1) stays the same as the world is divided more finely among countries. The literature on tax competition (for investment in subsidiaries) suggests everything

else is not the same : the more countries there are, the more aggressive is tax competition, so the lower should be the statutory tax rate t_1 in equation (35).

11 Too Much Asymmetry

Section 5 provided an example of the benefits of competition for headquarters, due to the opporunities for "tax discrimination", in which a large country could extract rents from cheap–to–create, immobile firms, while a much smaller country's higher exemption rate allowed mobile entrepreneurs in the larger country to cover their higher set–up costs.

In this example, start–up costs for new firms were positively correlated with firms' mobility.

In the subsequent formal model, these two variables were assumed independent. And, when they are independent, it no longer will be the case that countries should discriminate between types of firm. In the model of section 6, countries have an incentive to choose a common exemption level if they can choose their e_i's cooperatively.

To see this, suppose that $\Phi_1 \geq \Phi_2$. In this case

$$N_{11} = F(\Phi_1) \tag{36}$$

$$N_{12} = 0 \tag{37}$$

$$N_{21} = n \int_0^{\Phi_1 - \Phi_2} F(\Phi_1 - a) g(a) da \tag{38}$$

$$N_{22} = nF(\Phi_2)[1 - G(\Phi_1 - \Phi_2)] \tag{39}$$

where numbers are measured relative to the population of country 1, and where n is the population of country 2, relative to that of country 1.

The total benefit to the governments of the two countries combined are

$$\begin{aligned} W_1 + W_2 = {} & [h + z + \zeta + t_1 r_1 + t_2 r_2][N_{11} + N_{12} + N_{21} + N_{22}] \\ & + (1 - e_1) t_1 (r_2 + \bar{r})][N_{11} + N_{21}] \\ & + (1 - e_2) t_2 (r_1 + \bar{r})][N_{12} + N_{22}] \end{aligned} \tag{40}$$

From equations (36)– (39),

$$\frac{\partial [N_{11} + N_{12} + N_{21} + N_{22}]}{\partial \Phi_1} = f(\Phi_1) + n \int_0^{\Phi_1 - \Phi_2} f(\Phi_1 - a) g(a) da \tag{41}$$

$$\frac{\partial [N_{11} + N_{12} + N_{21} + N_{22}]}{\partial \Phi_2} = nf(\Phi_2)[1 - G(\Phi_1 - \Phi_2)] \tag{42}$$

when $\Phi_1 \geq \Phi_2$.

Suppose that the two countries set the same tax rate, $t_1 = t_2 = t$. At $\Phi_1 = \Phi_2$, it then follows that

$$\frac{\partial(W_1 + W_2)}{\partial e_1} = f(\Phi_1)[h + z + \zeta + t(r_1 + r_2) + (1 - e_1)(r_2 + \bar{r})]\frac{\partial \Phi_1}{\partial e_1} - t(r_2 + \bar{r})N_{11} \tag{43}$$

$$\frac{\partial(W_1 + W_2)}{\partial e_2} = nf(\Phi_1)[h + z + \zeta + t(r_1 + r_2) + (1 - e_2)(r_1 + \bar{r})]\frac{\partial \Phi_2}{\partial e_2} - t(r_1 + \bar{r})N_{22} \tag{44}$$

Since

$$\frac{\partial \Phi_i}{\partial e_i} = t_i r_i$$

if the two countries are identical in every aspect except size, expression (43) will equal 0 exactly when expression (44) equals zero.

Since both terms in expression (44) are proportional to n, this equality will hold, regardless of whether country 1 is larger or smaller than country 2.

Therefore

Proposition 2 *If two countries of different size have coordinated on a common statutory tax rate, and if firms' operating profits r_i are the same in each country, then the first–order conditions for maximization of the sum of countries' governments' payoffs are satisfied when countries set a common exemption level.*

Notice that both terms in expressions (43) and (44) are proportional to t_i. Therefore, if there are no benefits from subsidiaries' profits, Proposition 2 would be true even if statutory tax rates differed.

In this case

$$\frac{\partial(W_1 + W_2)}{\partial e_1} = f(\Phi_1)[h + z + \zeta + (1 - e_1)t_1\bar{r}]t_1\bar{r} - t_1\bar{r}N_{11} \tag{45}$$

$$\frac{\partial(W_1 + W_2)}{\partial e_2} = nf(\Phi_1)[h + z + \zeta + (1 - e_2)t_2\bar{r}]t_2\bar{r} - t_2\bar{r}N_{22} \tag{46}$$

when $\Phi_1 = \Phi_2$ and $r_1 = r_2 = 0$. If $r - 1 = r - 2$ then $\Phi_1 = \Phi_2$ if and only if $(1 - e_1)t_1 = (1 - e_2)t_2$. Therefore

Corollary 2 *If firms can shift all subsidiaries' operating profits to tax havens, so that $r_1 = r_2 = 0$, then, regardless of the statutory tax rates t_1 and t_2, the first–order conditions for maximization of countries' governments' payoffs are satisfied when the effective tax rate $(1 - e_i)t_i$ on subsidiaries' profits is equal across countries.*

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12 Appendix : Derivations

When $\Phi_1 > \Phi_2$, so that $N_{12} = 0$, then

$$\begin{aligned} W_1 &= F(\Phi_1)[z + h + t_1 r_1 + (1 - e_1)t_1(r_2 + \bar{r})] \\ &+ n[\int_0^{\Phi_1 - \Phi_2} F(\Phi_1 - a)g(a)da][\zeta + h + t_1 r_1 + (1 - e_1)t_1(r_2 + \bar{r})] \\ &+ nF(\Phi_2)[1 - G(\Phi_1 - \Phi_2)][\zeta + t_1 r_1] \end{aligned} \tag{47}$$

and when $\Phi_1 < \Phi_2$, then

$$\begin{aligned} W_1 &= F(\Phi_1)[1 - G(\Phi_2 - \Phi_1)][z + h + t_1 r_1 + (1 - e_1)t_1(r_2 + \bar{r})] \\ &+ [\int_0^{\Phi_2 - \Phi_1} F(\Phi_2 - a)g(a)da][z + t_1 r_1] \\ &+ nF(\Phi_2)[\zeta + t_1 r_1] \end{aligned} \tag{48}$$

Differentiating (47) with respect to e_1, when $\Phi_1 > \Phi_2$

$$\begin{aligned} \frac{1}{t_1(r_2 + \bar{r})}\frac{\partial W_1}{\partial e_1} &= [f(\Phi_1) + nF(\Phi_2)g(\Phi_1 - \Phi_2)][h + (1 - e_1)t_1(r_2 + \bar{r})] \\ &+ f(\Phi_1)(z + t_1 r_1) \\ &+ n[\int_0^{\Phi_1 - \Phi_2} f(\Phi_1 - a)g(a)da][\zeta + h + t_1 r_1 + (1 - e_1)t_1(r_2 + \bar{r})] \\ &- F(\Phi_1) - n[\int_0^{\Phi_1 - \Phi_2} F(\Phi_1 - a)g(a)da] \end{aligned} \tag{49}$$

and when $\Phi_1 < \Phi_2$, then

$$\begin{aligned} \frac{1}{t_1(r_2 + \bar{r})}\frac{\partial W_1}{\partial e_1} &= [f(\Phi_1)(1 - G(\Phi_2 - \Phi_1)) + g(\Phi_2 - \Phi_1)F(\Phi_1)][h + (1 - e_1)t_1(r_2 + \bar{r})] \\ &+ f(\Phi_1)[1 - G(\Phi_2 - \Phi_1)](z + t_1 r_1) \\ &- F(\Phi_1)[1 - G(\Phi_2 - \Phi_1)] \end{aligned} \tag{50}$$

The second–order terms corresponding to (49) and (50) respectively are

$$\begin{aligned} \frac{\partial^2 W_1}{\partial {e_1}^2} &\sim [f'(\Phi_1) + nF(\Phi_2)g'(\Phi_1 - \Phi_2)][h + (1 - e_1)t_1(r_2 + \bar{r})] \\ &+ f'(\Phi_1)[z + t_1 r_1] \\ &+ n[\int_0^{\Phi_1 - \Phi_2} f'(\Phi_1 - a)g(a)da][\zeta + h + t_1 r_1 + (1 - e_1)t_1(r_2 + \bar{r})] \\ &+ nf(\Phi_2)g(\Phi_1 - \Phi_2)[\zeta + h + t_1 r_1 + (1 - e_1)t_1(r_2 + \bar{r})] \\ &- 2n\int_0^{\Phi_1 - \Phi_2} f(\Phi_1 - a)g(a)da \\ &- 2[f(\Phi_1) + nF(\Phi_2)g(\Phi_1 - \Phi_2)] \end{aligned} \tag{51}$$

and

$$\frac{\partial^2 W_1}{\partial {e_1}^2} \sim$$
$$\begin{aligned}
&[f'(\Phi_1)(1-G(\Phi_2-\Phi_1)) - g'(\Phi_2-\Phi_1)F(\Phi_1)][h+(1-e_1)t_1(r_2+\bar{r})] \\
&+[2f(\Phi_1)g(\Phi_2-\Phi_1)][h+(1-e_1)t_1(r_2+\bar{r})] \\
&+[f'(\Phi_1)(1-G(\Phi_2-\Phi_1)) + f(\Phi_1)g(\Phi_2-\Phi_1)][z+t_1r_1] \\
&-2[f(\Phi_1)(1-G(\Phi_2-\Phi_1)) + F(\Phi_1)g(\Phi_2-\Phi_1)]
\end{aligned} \tag{52}$$

Notice that , in some sense, the best response function of the country is better–behaved when the country is a destination for foreign–owned firms : expression (51) must be negative if f' and g' are both non–positive, whereas expression (52) has a positive term (in the second line) even when $f' = g' = 0$.

The cross–derivatives of (49) and (50) are

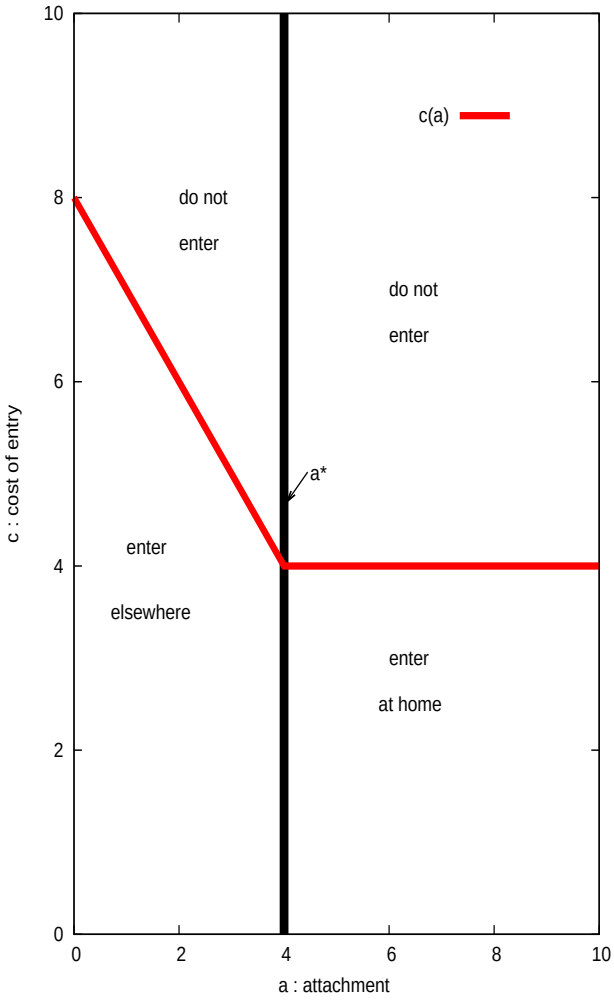
$$\begin{aligned}
\frac{\partial^2 W_1}{\partial e_1 \partial e_2} \sim & \\
& nf(\Phi_2)g(\Phi_1-\Phi_2)[h+(1-e_1)t_1(r_2+\bar{r})] \\
& -nF(\Phi_2)g'(\Phi_1-\Phi_2)[h+(1-e_1)t_1(r_2+\bar{r})] \\
& -nf(\Phi_2)g(\Phi_1-\Phi_2)[\zeta+h+t_1r_1+(1-e_1)t_1(r_2+\bar{r})] \\
& +nF(\Phi_1)g(\Phi_1-\Phi_2) \\
=& -nF(\Phi_2)g'(\Phi_1-\Phi_2)[h+(1-e_1)t_1(r_2+\bar{r})] \\
& -nf(\Phi_2)g(\Phi_1-\Phi_2)[\zeta+t_1r_1] \\
& +nF(\Phi_1)g(\Phi_1-\Phi_2)
\end{aligned} \tag{53}$$

when $\Phi_1 > \Phi_2$ and

$$\begin{aligned}
\frac{\partial^2 W_1}{\partial e_1 \partial e_2} \sim & \\
& -f(\Phi_1)g(\Phi_2-\Phi_1)[h+(1-e_1)t_1(r_2+\bar{r})] \\
& +g'(\Phi_2-\Phi_1)F(\Phi_1)[h+(1-e_1)t_1(r_2+\bar{r})] \\
& -f(\Phi_1)g(\Phi_2-\Phi_1)[z+t_1r_1] \\
& +g(\Phi_2-\Phi_1)F(\Phi_1)
\end{aligned} \tag{54}$$

when $\Phi_2 > \Phi_1$.

Figure 1


10
8
6
4
2
0
0
2
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8
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c : cost of entry
a : attachment
c(a)
do not
enter
do not
enter
a*
enter
elsewhere
enter
at home