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TAXATION OF FOREIGN MULTINATIONALS:
A SEQUENTIAL BARGAINING APPROACH TO TAX HOLIDAYS

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ABSTRACT

In this paper we view the tax schedule applied to the profits of a Multinational Enterprise (MNE) as the outcome of a sequential bargaining process and show, using modern game theory developments (the "perfect equilibrium" solution concept) that tax holidays will emerge from such a process if a MNE incurs fixed costs upon entry. At the core of our results is the recognition that the existence of sunk costs creates an ex post (entry) bilateral monopoly situation.

We show that the tax rate emerging from this form of bargaining has a dynamic structure. We obtain results on the length and discounted value of the tax holiday, its precise form and the way all this responds to changes in fixed costs.

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SUMMARY

A tax holiday is a limited period of time during which a Multinational Enterprise (MNE) receives tax concessions, typically immediately following entry. Tax holidays have long puzzled economists: are host countries giving away the most valuable contribution of MNE's, tax revenues? Competition with other countries may explain tax concessions, but does not explain why they are temporary. The economic literature has made little progress in explaining their occurrence.

In this paper we view the tax schedule applied to the MNE's profits as the outcome of a sequential bargaining process and show using modern game theory developments (the "perfect equilibrium" solution concept) that tax holidays will emerge from such a process if a MNE incurs fixed costs upon entry. At the core of our results is the recognition that the existence of sunk costs creates an ex post (entry) bilateral monopoly situation.

Bargaining emerges because of the existence of sunk costs. Sunk costs are those costs which are independent of the current rate of output and are irreversible once made. Examples are the installation of a factory, training of a work force etcetera. A host country and the MNE bargain over the tax rate applied to the MNE's profits during the coming period; this is repeated in each consecutive period.

Furthermore we suppose that bargaining is costly: if the host country does not fully obtain the tax rate increase it demands, it becomes "disgruntled", which the MNE dislikes as it leads to higher operating costs: we suppose the MNE prefers to remain on good terms with the host country, since goodwill facilitates access, reaching agreement on practical procedures etc.

We show that a host country will seek to exploit the MNE's commitment, manifested by the initial capital outlays, by pushing for higher tax rates. The MNE may acquiesce; it may reject the

(ii)

demand and suggest an alternative, lower tax rate, or it may decide to leave the country altogether, moving to another country which offers a tax rate the MNE prefers. The second option is costly because the government becomes "disgruntled"; the third because if the MNE moves, it must incur sunk costs again at its new location.

We show that the tax rate emerging from this kind of bargaining has a dynamic structure. The host country, aware that the MNE would have to incur fixed costs again if it would transfer production to another country, and aware of the costs of protracted tax negotiations, exploits this gradually by obtaining higher and higher tax rates until an upper limit is reached. After that the tax rate remains constant, ie the tax schedule includes a tax holiday, an initial period of tax concessions.

We obtain results on the length and discounted value of the tax holiday, its precise form and the way all this responds to changes in fixed costs.

1. INTRODUCTION

Tax holidays for foreign Multi National Enterprises (MNE) are tax concessions or even straight subsidies granted for a limited period after entry. Their widespread occurrence in practice (cf. Caves (1984)) has presented economists with a puzzle ever since Musgrave (1969) remarked that by granting tax concessions developing countries may well be giving away the most valuable contribution of MNE's (i. e. tax revenues).

The literature on taxation of multinationals has to our knowledge not made any progress on this problem since Musgrave's observation; it deals almost exclusively with quite a different issue, the allocative and distributional consequences of various types of double taxation agreements between home and host countries (for an excellent survey and further references see the chapter on taxation in Caves (1983)). Of course the structure of double taxation agreements has important implications for the rationality of tax holidays.

In practice double taxation agreements use either exemption or a tax credit system (although other tax arrangements are conceivable). A tax credit system allows a MNE to use taxes paid abroad over foreign earned income as a credit against tax liabilities incurred under the domestic tax code over that foreign earned income. Typically that liability provides an upper limit to the allowable tax credit. Under such an asymmetric tax credit system (asymmetric because domestic tax authorities do not subsidize when credits taken because of taxes paid abroad exceed

domestic liabilities) the MNE in effect pays the higher of the foreign and domestic profit tax. More importantly, there is no conceivable rationale for tax holidays under such an agreement since the MNE will not profit from them: they would imply a simple cash transfer from the host country to the tax authorities of the home country. No such problem arises under a tax exemption system, under which foreign earned income is tax exempt at home if foreign tax has been paid over it.

The U.S. officially uses an asymmetric tax credit system, which however is effectively transformed into a tax exemption system by a deferral provision allowing firms to report foreign earned income when repatriating what is left after foreign taxes have been paid rather than when it is earned. If firms do not repatriate at all, rewarding domestic shareholders via capital gains rather than paid out dividends (at least for their foreign earned income), no U.S. tax will be paid at all by the MNE over its foreign earned income, turning this system effectively into a tax exemption system.^{1/}

Recently the literature on taxation of MNE's has progressed beyond describing the consequences of specific arrangements on double taxation to an analysis of which system is likely to emerge by treating a double taxation agreement as the outcome of a static bargaining game between home and host country governments

1/ If for some non-tax reason the MNE would prefer repatriation, the U.S. system is not quite the same as an exemption system since that would allow repatriation; that difference is irrelevant for our purposes however.

(Feldstein and Hartman (1979), Hartman (1980)). No attention was paid to the bargaining game that will arise between the MNE and the host country for any given double taxation agreement.

What we will do in this paper fills that gap: we will focus on the bargaining game between a MNE and a host country. Such negotiations of course take place much more frequently than negotiations between governments over double taxation agreements, providing a rationale for our analysis of a MNE versus host country game given a double taxation agreement between home and host country. We will assume a tax exemption system in place in the home country so that MNE's do in fact benefit from tax concessions granted to them by host countries. Since the U.S.A. effectively operates such a system, our analysis is relevant for a large number of actual cases.

The basic point of departure of this paper is the recognition that sunk costs due to irreversible capital outlays "up front", create an ex post bilateral monopoly situation between a MNE post entry and the host country government. Monopoly power is interpreted in the game theory sense: the ability to credibly threaten to impose a costly outcome on one's adversary if he does not acquiesce. The underlined qualification is important: we will throughout our analysis require subgame perfectness. Threats are only credible if it is in fact optimal for the threatening party to carry them out when the situation arises. This implies the use of the principle of "Perfect Equilibrium" (Selten (1965)).

Our work is closely related to the ex post bilateral monopoly problem analysed by Doyle (1984) in the context of

sequential wage bargaining. The reader is referred to that paper for more extensive game-theoretic references.

In our analysis the MNE versus host country government game is played repeatedly over time with an infinite time horizon. Moreover we introduce a third player in the game, although a passive one: the MNE can threaten to break off negotiations and leave for another country. We therefore have an insider-outsider distinction, with the outsider (another country) constituting an imperfect threat to the host country government. The threat is imperfect because execution of this threat also imposes costs on the MNE: it will again have to make initial investments if it leaves for another country and settles in, without receiving compensation for the ones made in the country it leaves.

The MNE and the government bargain over the tax rate to be applied to the MNE's profits during the coming period; this is repeated each consecutive period. Bargaining is costly in a way to be made precise in the paper. We assume throughout that all parties have complete information and know that of each other.

To give away the punch line, we will show that the solution has, rather unusually for this type of game, a dynamic structure: the host country government, aware of the sunk costs the MNE has incurred and would have to incur again if it packed its bags and started anew somewhere else, and aware of the costs of protracted negotiations, exploits this by gradually obtaining higher and higher tax rates, until an upper limit is reached. After that the tax rate stays constant forever. The starting tax rate, the

time period that elapses between entry and reaching the upper limit, and the level of that upper limit are all determined endogenously as part of the solution to the bargaining game. So the tax structure that emerges is low initially, rises over time and stays constant after a limiting level has been reached; it is characterized by a tax holiday, since it is tilted towards the future.

The paper is set up as follows: in section 2 we present the structure of the game in extensive form. In section 3 the solution (a time path for tax rates) is derived and discussed. Section 4 concludes.

2. THE GAME STRUCTURE IN EXTENSIVE FORM

The structure of the game is kept as simple as possible for clearer focus on the consequences of the ex post bilateral monopoly situation created by irreversible post entry capital outlays. For that reason we assume there exist a large number of firms that are identical ex ante (i.e. before entry in any given country) and a large number of potential host countries. Entry of any given firm in any particular country takes place if they agree on a tax rate τ , the share of profits to be paid to the host country government, for the first post entry period. Negotiations about tax treatment partitions τ_t , $1-\tau_t$ are then repeated every following period, unless they fail to reach an agreement in a given period; if that happens the firm leaves, breaking up this particular coalition. Firms do not simultaneously negotiate with more than one government; governments do not simultaneously negotiate with more than one firm.

If they reach an agreement at the beginning of a particular period, the firm proceeds to produce output, which yields one unit of profits. The agreement reached was over the division of that one unit of profits with τ_t going to the host country government (H) and $1-\tau_t$ to the MNE.

In the first period after entry takes place, the firm will have to make irreversible fixed capital outlays of F before it can actually proceed. As long as the MNE stays in that country it will not have to repeat such investment. One can think of it as installation of a factory with all the required machinery. The firm cannot take the factory with it upon departure, nor can the government use it after departure of the firm. In practice governments often also undertake some of the initial investment (construction of access roads etc.). This can easily be incorporated but will not change the qualitative nature of the solution. The size of the initial capital outlays is left exogenous, which implies that we abstract from the important issue of technology choice (cf. Magee (1980)). Future work could fruitfully extend our analysis in that direction.

Finally bargaining costs. Following much of the game theory literature we make the realistic assumption that protracted bargaining is costly. The Rubinstein (1982) device of a shrinking pie is of course satisfactory for his purposes but a bit hard to rationalise in the present context. We will therefore make a

different assumption: if a firm refuses an offer on next period's tax rate and instead decides to make a counter offer, it incurs "disgruntlement costs" with a discounted value \bar{D} . This is an attempt to incorporate that MNE's prefer to remain on good terms with host country governments since such goodwill facilitates access, reaching agreement on practical procedures etc.; protracted haggling about tax treatment will diminish the host country's goodwill with respect to the MNE. Furthermore we assume throughout that all parties have complete information, know that of each other, know that they know that of each other and so on. The equilibrium concept we use is that of "Perfect Equilibrium" (Selten (1965)), sometimes referred to as subgame perfectness. A PE is defined as a situation where the strategies chosen at the beginning of a game form an equilibrium, and the strategies planned for any possible subgame also form an equilibrium within that subgame. This implies that players are not deceived by non-credible threats made by their opponents. Credible threats are threats that are in fact optimal for the threatening party to carry out if the situation arises. Non-credible threats are threats that are not credible. The ability to make credible threats is interpreted as an exploitation of monopoly power.

The set of assumptions made so far restrict the problem in order to focus more clearly on the consequences of the bargaining problem in the presence of irreversible capital investment. Many relevant aspects of multinational corporations have therefore been excluded. We do capture however their ability to shift production across countries (although in a stylized way)

and in fact place that at the centre of the analysis. Furthermore since after tax profits one way or another go to foreigners, the government should not take them into account in calculating the welfare effects of its intervention policies. This aspect of MNE is also captured in our analysis.

With all these assumptions in place we can now describe the specific structure of the bargaining problem we model in this paper, which is illustrated in extensive form in Figure 1. It has been pointed out to us that these assumptions are very realistic for production of manufactured goods but less so for mineral producers.

Consider now the game in extensive form (Figure 1). Assume (since we have to begin the description of the game somewhere) that the MNE is already in the country and that last period's tax rate was τ_0 (left hand top corner of Figure 1). In the beginning of period 1 subgame G_I starts. The host country government (H) makes an offer for the tax rate to be applied in the coming period; it offers the partition $(\tau', 1-\tau')$.

The MNE can either accept or reject this partition. If it accepts, this subgame ends, the MNE proceeds to produce, earning one unit of profit of which τ' is paid as tax to the government. Next period they are again in the situation we started with, i.e. G_I is replayed. This implies the pay-offs given in Figure 1, $\Pi_t = 1-\tau' + \delta \Pi_{t+1}$ for the MNE and $R_t = \tau' + \delta R_{t+1}$ for H. δ is a common discount factor and Π_t is the discounted value of all profits from the beginning of the period onwards.

8a.

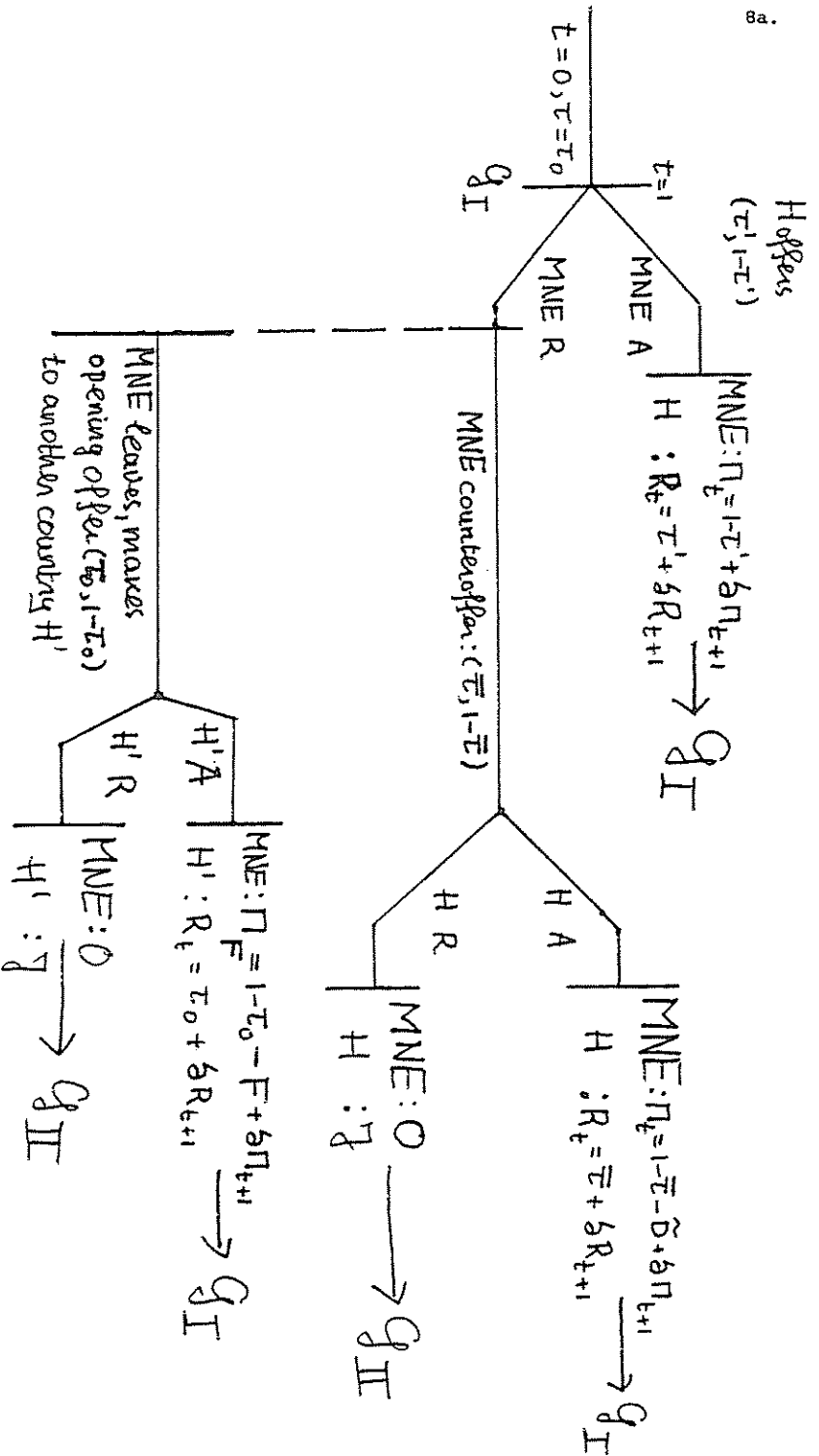


Figure 1: The game structure in extensive form.

R is similarly defined: it equals the discounted future tax revenues from the beginning of the period onwards.

If the MNE rejects it faces two options. It can either make a counter-offer or break off negotiations and leave the country altogether. In that case it ends subgame G_I and starts G_{II} . Assume it does not do that but makes a counter-offer, $(\bar{\tau}, 1-\bar{\tau})$, i.e. follow the game tree to the top right hand corner of Figure 1. The government can either accept or reject this counter-offer. If it accepts (branch A in the relevant part of Figure 1), the firm proceeds to produce and earns a unit of pre-tax profits, leading to pay-offs, $1-\bar{\tau} - \bar{D} + \delta \Pi_{t+1}$ for the MNE and $\bar{\tau} + \delta R_{t+1}$ for H. Next period G_I is replayed. The pay off incorporates the fact that once the firm decided to reject the opening offer by H, it incurred disgruntlement costs \bar{D} in terms of lost goodwill, the discounted cost of which amounts to \bar{D} . Of course if H rejects the counter-offer and the MNE leaves the country, disgruntlement costs are not relevant any more.

If H does that, if it rejects the counter-offer $(\bar{\tau}, 1-\bar{\tau})$, the subgame G_I ends and the coalition breaks up. The government then invites an offer from an outside firm. It does not matter which firm since all firms are identical ex ante (i.e. before entry). It will, if a new coalition results, obtain tax revenues from that new firm with a discounted value equal to R_0 . The MNE with which negotiations just failed leaves this host country and will start negotiations with an alternative host country. This constitutes the start of subgame G_{II} . It is no real restriction that we do not allow the government to make a second offer to the old MNE at this stage of the game since it would not choose to do so

even if allowed in the complete information context we employ here. This is a general feature of complete information games (Rubinstein (1982)).

If the MNE leaves, either after rejecting H's opening offer or after its own counter-offer has been rejected, it starts subgame G_{II} at the bottom of Figure 1. The subgame G_{II} starts with the MNE making an opening offer $(\tau_0, 1-\tau_0)$ to a new potential host country, H', before entry actually takes place. H' can either accept or reject this partition. If it accepts, the firm enters the country, makes the necessary initial irreversible investment at cost F and proceeds with production, earning one unit of pre-tax profits. Of course $F < \frac{1}{1-\delta}$ otherwise entry would never be profitable, not even without any taxation at all. This leads to a post-tax pay-off $1-\tau_0 + \delta\Pi_1 - F$ for the MNE and pay-off $\tau_0 + \delta R_1$ for the new host country H'. At the beginning of next period they proceed as in G_I .

If the government rejects the partition $(\tau_0, 1-\tau_0)$, the firm does not enter that country and simply restarts G_{II} with another potential host country and so on. This completes the description of the game.

Before we go to the next section to present the solution of the game we just described, two further assumptions need mentioning. Both are on D , the disinvestment cost:

$$F > \tilde{D} > 0 \quad \text{for all } \bar{\tau}_t \geq \tau_{t-1} \quad (\text{A.1})$$

and

$$F < \tilde{D} \rightarrow \infty \quad \text{for all } \bar{\tau}_t < \tau_{t-1} \quad (\text{A.2})$$

The first assumption, (A.1), is entirely reasonable and needs little comment. It states that if the MNE rejects H's offer in subgame G_t , it incurs "disgruntlement" costs \tilde{D} that are positive but in discounted valued terms less than the (discounted) total cost of the initial post-entry investment in fixed capital, as long as $\bar{\tau}_t \geq \tau_{t-1}$. If that were not the case it would never make such a counter-offer and the game would collapse as can easily be seen by inspecting Figure 1. It is anyhow a sensible assumption to make on the relative magnitudes of \tilde{D} and F .

Assumption (A.2) implies that the MNE will only counter-offer to accept a smaller increment than proposed by H (it will of course never want to counter-offer a larger increment) or counter-offer a zero increment but never a rate strictly lower than the one prevailing in the previous period. (A.2) therefore allows a flat tax schedule but it rules out schedules that slope downward over time. We can show that the structure of the results will come out with less extreme assumptions about \tilde{D} . What is essential is that a high discrepancy between rejected offer and counter-offer leads to more lost goodwill than a small discrepancy, which seems an entirely reasonable assumption to us. We have merely taken an extreme case of such a schedule which has the convenient property that it leads to piecewise linear tax schedules.

3. CHARACTERIZATION OF EQUILIBRIUM STRATEGIES

In this section we provide a solution to the game presented in Section 2. We do this by first solving various subgames and then piecing them together to arrive at the final outcome. This procedure is heuristic, although the solution is correct. We choose this approach because it brings out the intuition behind the solution more clearly than the standard procedures usually followed when solving for perfect equilibrium outcomes. In the same vein we only sketch the formal arguments establishing existence and uniqueness of the solution, concentrating most of our attention on characterizing it. Doyle (1984) gives an entirely rigorous presentation of the solution to a structurally similar game, adhering strictly to the backward induction strategy typically followed in such problems, and presents formal existence and uniqueness proofs.

Consider first, purely as an artificial device of use in constructing the equilibrium solution, a restricted version of the subgame G_I , call it RG_I , where the threat of the outsider is removed. RG_I is shown in extensive form in Figure 2.

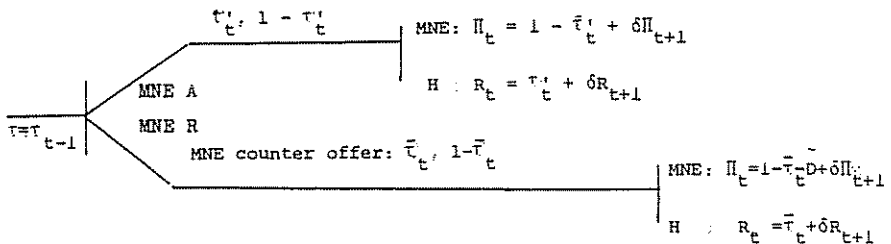


FIGURE 2 : Subgame RG_I in extensive form

In the previous period the tax rate was τ_{t-1} . The host country, H, restarts RG_I in period t by making an opening offer suggesting a partition $(\tau_t^1, 1-\tau_t^1)$. This would lead to pay-offs for both actors given in the upper branch of Figure 2. The MNE can either accept or reject. In RG_I it can after rejection only make a counter-offer (in G_I it can also choose to leave instead), by suggesting an alternative partition $(\bar{\tau}_t, 1-\bar{\tau}_t)$:

It should be clear that for any given opening offer τ_t^1 , the counter offer $\bar{\tau}_t$ will be lower than τ_t^1 , i.e. the counter-offer will be less favourable to H than the rejected offer τ_t^1 to which it is a response. This can be seen from the pay-off structure given in Figure 2 :

$$\bar{\tau}_t \geq \tau_t^1 \Rightarrow 1-\bar{\tau}_t - \bar{D} + \delta \Pi_{t+1} < 1-\tau_t^1 + \delta \Pi_{t+1} \leq 1-\tau_t^1 + \delta \Pi_{t+1}$$

The first strict inequality obtains because $\bar{D} > 0$; and the second weak inequality follows directly from $\bar{\tau}_t \geq \tau_t^1$. Therefore a counter offer at equal or higher tax rate than the rejected offer would be strictly less profitable for the MNE than acceptance of the opening offer. Therefore no such offer can be part of an equilibrium strategy. Accordingly, if there is a counter offer at all it will imply a less profitable outcome for H than τ_t^1 would lead to.

This leads to an intermediate result. Given what we have just established it is clearly in H's interest to formulate its opening offer at a level which will just leave the MNE indifferent between acceptance and rejection (in which case we will assume it

accepts to avoid the tedious task of carrying along "small" ϵ 's as a wedge between that level for τ'_t and the actual one made etc.) That requirement defines τ'_t as a function of $\bar{\tau}_t$:

$$1 - \tau'_t + \delta\bar{\Pi}_{t+1} = 1 - \bar{\tau}_t + \delta\bar{\Pi}_{t+1} - \bar{D} \quad (2)$$

or the MNE's current and (discounted) future profits upon acceptance of τ'_t must just equal those it would obtain after rejecting τ'_t and making a counter-offer $\bar{\tau}_t$, incurring disgruntlement costs \bar{D} in the process.

Of course in this full information context the MNE is aware of the strategic interdependence between τ'_t and $\bar{\tau}_t$ embodied in (2) and will formulate its counter-offer to exploit it. (2) implies that a higher $\bar{\tau}_t$ will allow a higher opening bid τ'_t ; it therefore has an incentive to counter-offer the lowest feasible $\bar{\tau}_t$. From (A.2) we know that this lower bound equals τ'_{t-1} in period t . Inserting that in (2) gives us our first result:

$$1 - \tau'_t + \delta\bar{\Pi}_{t+1} = 1 - \tau'_{t-1} + \delta\bar{\Pi}_{t+1} - \bar{D} \quad (3)$$

It is straightforward to show that for any τ_0 there is a linear sequence τ'_t that satisfies (3). Consider

$$\tau'_t = \tau_0 + tD \quad (4)$$

where D is defined by $\bar{D} = D/(1-\delta)$. We can explicitly calculate $\bar{\Pi}_t$ for this sequence:

$$\begin{aligned}
 \Pi_t^{RG} &= 1 - \tau_t^i + \delta(1 - \tau_t^i - D) + \dots & (5) \\
 &= (1 - \tau_t^i) \sum_{i=0}^{\infty} \delta^i - D \sum_{i=0}^{\infty} \delta^i \\
 &= \frac{1 - \tau_t^i}{1 - \delta} - \frac{D\delta}{(1 - \delta)^2}
 \end{aligned}$$

If we insert (5) into (3) for unknown increment in τ_t^i , say η , we get

$$1 - \tau_{t-1} - \eta + \delta \left(\frac{(1 - \tau_{t-1} - 2\eta)}{1 - \delta} - \frac{D\delta}{(1 - \delta)^2} \right) = \quad (3')$$

$$1 - \tau_{t-1} + \delta \left(\frac{(1 - \tau_{t-1} - \eta)}{1 - \delta} - \frac{D\delta}{(1 - \delta)^2} \right) - \frac{D}{1 - \delta}$$

Simple rearranging shows that (3') implies $\eta = D$, which in turn implies that the linear sequence $\tau_t^i = \tau_0 + tD$ satisfies the recurrence relation (3), and therefore is a solution to RG_I :

$$\left\{ \begin{array}{l} \tau \\ t \end{array} \right\}_{t=0, \dots, \infty}^{RG_I} = \tau_0 + tD \quad (6)$$

Let us return now to the unrestricted subgame G_I , where the firm, after rejecting τ_t^i , not only has the option to make a counter-offer, but can also choose to leave, losing its fixed capital F .

Before we can go further however we need some preliminary characteristics that must hold for any perfect equilibrium solution. First because all MNE's are identical ex ante, H cannot expect more discounted tax revenues from one firm than from another. If the number of firms is large, that value will be market determined

and out of control of H; call it R_0 .

Clearly that implies ex ante profits for a MNE about to enter

$$\begin{aligned}\bar{\Pi}_F &= \frac{1}{1-\delta} - R - F \\ &= \bar{\Pi}_O - F - R\end{aligned}\quad (7)$$

In a competitive equilibrium $\bar{\Pi}_F$ will be driven to zero.

Introducing the possibility of quitting (with value $\bar{\Pi}_F$) as an alternative to making a counter-offer means that after each offer the MNE will compare the value of making a counter-offer with $\bar{\Pi}_F$; if $\bar{\Pi}_F$ is lower the MNE is better off making a counter-offer and, following the same line of reasoning as before, will counter-offer τ_{t-1} . Therefore a counter-offer will be made if

$$1 - \tau_{t-1} - D + \delta \bar{\Pi}_{t+1} > \bar{\Pi}_F \quad (8)$$

Working backwards we can once again see that if (8) holds, H can preempt a counter-offer by opening with $\tau'_t = \tau_{t-1} + D$.

Now the left hand side of (8) is obviously declining in τ_{t-1} . Accordingly we can define a $\bar{\tau}$ implicitly by requiring (8) to hold with equality:

$$1 - \bar{\tau} - D + \delta \bar{\Pi}_{t+1} = \bar{\Pi}_F \quad (8)$$

We can, using this definition of $\bar{\tau}$, restate the comparison between making the counter-offer or quitting. It should be clear after the analysis just presented and the definition of $\bar{\tau}$ that the decision to leave or make a counter-offer will hinge on whether $\tau_{t-1} \leq \bar{\tau}$. If $\tau_{t-1} > \bar{\tau}$ quitting will lead to higher profits than counter-offering and vice versa. Now since $\tau_{t-1} = \tau_0 + (t-1)D$ we can define T as the time period in which RG_I ceases to be relevant:

$$\tau_0 + (t-2)D < \bar{\tau} \leq \tau_0 + (t-1)D \quad (9)$$

For any τ_0 , by construction of T , the MNE will choose to counter-offer until $T-1$ (inclusive); at T it would be more profitable to quit than play RG_I , i.e. an opening offer by H of $\tau'_T = \tau_0 + T.D (= \tau'_{T-1} + D)$ would drive the MNE out.

This would, once again working backwards, not be in the interest of the host country, since as we will see it is about to enter a period of high tax rates while starting anew with another MNE would only yield R_0 . We will show below that $R_T > R_0$, validating our claim of a change of host country strategy at T .

At T MNE would play quit in response to the RG opening offer $\tau'_T = \tau_{T-1} + D$, and the game would collapse. The gain from that for the MNE would be Π_F . To just prevent that H will have to play τ^* with τ^* defined by (10):

$$1 - \tau^* + \delta \Pi_{T+1} = \Pi_F \quad (10)$$

since that would leave the MNE just indifferent between accepting and quitting. Under our inertia assumption it will then accept and stay. From the way $\bar{\tau}$, τ^* and T have been constructed it follows that

$$\tau_0 + (T-2)D < \bar{\tau} \leq \tau_0 + (T-1)D < \tau^* \leq \tau_0 + TD \quad (11)$$

This situation will repeat itself at $T + 1$, since $\tau_T = \tau^* > \bar{\tau}$ from (14). Going through the same argument establishes that $\tau_{T+1} = \tau^*$; that in turn establishes that $\tau_{T+1} = \tau^* > \bar{\tau}$ therefore τ_{T+2} will also equal τ^* and so on via induction to infinity.

But then we get the following immediately:

$$\tau_{T+1} = \tau^* \quad \forall i > 0 \Rightarrow R_T = \frac{\tau^*}{1-\delta} \quad (12)$$

Since we already saw that $\tau_t < \tau^*$ for $t < T$, it follows that:

$$R_0 = \sum_{t=0}^{T-1} \tau_t \delta^t + \delta^T R_T < R_T \quad (13)$$

This in turn validates our claim that it was profitable for H to change strategy from T onwards.

Collecting results obtained so far we have the structure of the solution to G_I :

Proposition 1:

$$\left\{ \tau_t \right\}_{t=0, \dots, \infty}^{G_I} = \begin{cases} \tau_0 + tD & \text{if } t < T \\ \tau^* & \text{if } t \geq T \end{cases}$$

where $\tau_0 + T.D \geq \tau^* > \tau_0 + (T-1)D > \tau_0$.^{1/}

Figure 3 gives a diagrammatic representation of the solution presented in proposition 1.

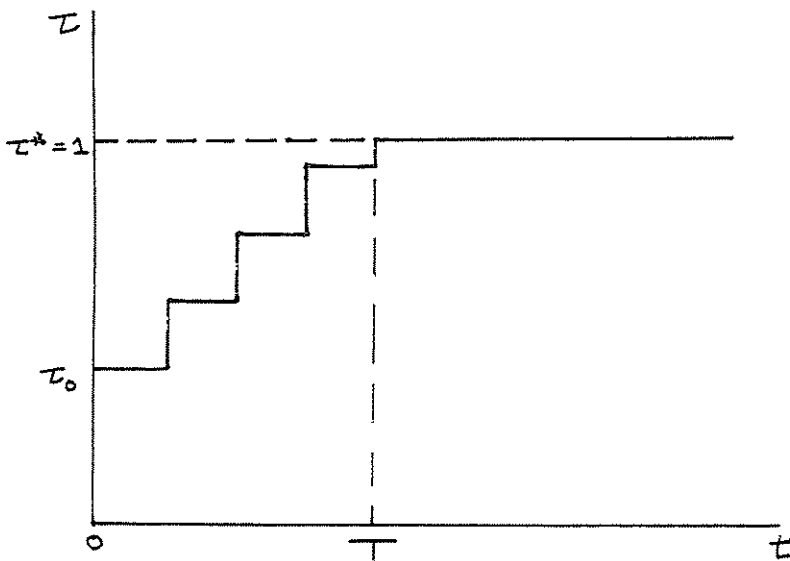


FIGURE 3 : Structural Characteristics of the Perfect Equilibrium Solution to the Sequential Tax Bargaining game between a MNE and a Host Country government

1/ Since perfect equilibrium solutions require rational strategies everywhere, also off the equilibrium path, we should for completeness also establish what happens in G_I if $\tau_0 > \tau^*$. It is easy to show that H will offer τ^* , from where the game continues as in (14). This proof is left to the interested reader.

Remain to be established the equilibrium values of τ^* , τ_0 and T . Consider first τ^* . By combining Proposition 1 and (10), the equation defining τ^* as the maximum tax rate that will just stop the MNE from leaving, we get

$$1 - \tau^* + \frac{\delta(1 - \tau^*)}{1 - \delta} = \Pi_F \quad (10a)$$

$$\text{or} \quad \tau^* = 1 - \Pi_F \cdot (1 - \delta) \quad (10b)$$

For the perfect "ex ante" competitive case, $\Pi_F = 0$ leading to

Proposition 2: If perfect "ex ante" competition drives Π_F to zero, the maximum tax rate $\tau^* = 1$.

We will from now on concentrate on the "ex ante" perfect competition case where $\Pi_F = 0$ and therefore $\tau^* = 1$. That immediately leads to a further result:

$$\text{Corollary 1:} \quad R_T = \sum_{t=T}^{\infty} \tau^* \delta^{t-T} = \frac{1}{1 - \delta} \quad \text{and}$$

$$\Pi_T = \sum_{t=T}^{\infty} (1 - \tau^*) \delta^{t-T} = 0$$

Since we also have $\Pi_P = 0$ and from the definition of Π_P

$$\Pi_P = \sum_{t=0}^{T-1} (1-\tau_t^i) \delta^t + \delta^T \Pi_T - F$$

we get by using $\tau^* = 1$:

Corollary 2: The discounted value of the tax concessions, $\sum_{t=0}^{T-1} \delta^t (\tau^* - \tau_t^i)$, granted until T , equals the value of fixed costs F .

This is a rather intuitive result. The existence of fixed costs explain why H can tax away all profits eventually ($\tau^* = 1$). However since there is "ex ante" perfect competition, and therefore a perfectly elastic supply of potential entrants around $\Pi_P = 0$, the entire fixed costs F will be shifted to the host country government. The ex post bilateral monopoly situation created by the existence of fixed costs explains why that shifting occurs in the form of tax concessions up front (during $(0, T)$), i.e. in the form of a tax holiday.

The length of the tax holiday can be derived from its "shape" and its value. Before proceeding we should draw attention to one loose end: the argument setting out the case for a switch in H's strategy at T indicates that $\tau_T - \tau_{T-1} = 1 - \tau_{T-1} \leq D$, i.e. the last increment equals D or is smaller than D (contrary to all the previous increments which equal exactly D). Since we do know that $\tau_t = \tau_0 + tD$ for all $t < T$ this is equivalent to saying that we have as yet only established a bound on τ_0 : $1 - T.D \leq \tau_0 < 1 - (T-1)D$. Define ϵ as follows

$$1 - \tau_{T-1} = D - \epsilon, \quad 0 \leq \epsilon < D \quad (14)$$

Assume first that $\epsilon = 0$, i.e. $\tau_{T-1} = 1-D$, $\tau_{T-2} = 1-2D$ etc. We can then derive an expression for T from the requirement that the discounted value of the tax holiday equals F (which in turn follows from $\Pi_T = 0$ and $\Pi_F = 0$):

$$\sum_{t=0}^{T-1} \delta^t (1 - \tau_t) = F \quad (15)$$

Substitution of $\epsilon = 0$ and the expression for τ_t that follows ($\tau_t = 1 - (T-t)D$ for $t < T$) into (15) leads after some manipulation to:

$$T + \frac{\delta^{T+1}}{1-\delta} = \frac{F(1-\delta)}{D} + \frac{\delta}{1+\delta} \quad (16)$$

1/ See the appendix

(16) is an implicit expression linking T to the parameters δ , D and F . A complication arises because T needs to be an integer. If the solution to T happens to yield an integer value for T , say T' , we have completely characterized the solution, which we can state as corollary 3:

Corollary 3: if the solution of equation (16) for T yields an integer value for T , say T' , proposition 1 gives the solution to the bargaining problem, with

$$- \tau_0 = 1 - TD \text{ and } T = T'.$$

However if T' (the solution for T of (16)) is not an integer, we cannot maintain our assumption of $\epsilon = 0$. It is straightforward to show that the solution needs only minor modification in this case. The equilibrium solution for T then is the smallest integer in excess of T' , say T'' . Of course if we maintain our assumption of a maximum increment between τ_{T-1} and $\tau_T = 1$ (i.e. $\epsilon = 0$), the value of the tax concessions will now exceed F . That would violate the zero-profit condition $\Pi_F = 0$ however, which is equivalent to saying that the implied solution for subgame G_{II} (which leads to a value for τ_0) is not subgame perfect: H could make a higher opening offer in period zero, before entry, and still induce entry. In fact the maximum opening offer that will just induce entry is of course the τ_0 that sets Π_F to zero; this gives us an implicit equation for τ_0 (or equivalently, $\epsilon = \tau_{T-1} - (1-D)$) given the value for T , T'' , already obtained:

$$\sum_{t=0}^{T''-1} (1 - \tau_0 - tD)\delta^t = F \quad (17a)$$

or, equivalently, in terms of ε instead of τ_0 :

$$\sum_{t=0}^{T''-1} (1 - (1 - \varepsilon - (T'' - 1 - t)D))\delta^t = F \quad (17b)$$

The precise expression for ε is of little interest (it is tedious but straightforward to show that the definition of T'' and (17b) indeed imply $0 \leq \varepsilon < D$). It will now be clear why the smallest integer above T' needs to be chosen, and not the largest integer below T' , say, T''' : that would lead to a value for the tax holiday below F , leading to $\Pi_F < 0$; to restore $\Pi_F = 0$ the tax schedule would have to be shifted downwards, leading to an increment between $T''' - 1$ and T''' in excess of D . That in turn would violate the restriction on $\tau_T - \tau_{T-1}$ embedded in proposition 1.

We have now completely characterized the solution for the case where equation (16) does not yield an integer value for T .

To do some comparative statics with respect to the size of the fixed cost F it is convenient to rewrite equation (17b) in slightly different form:

$$\varepsilon \frac{(1-\delta)^{T''}}{(1-\delta)} = F - \sum_{t=0}^{T''-1} (1-(1-(T''-1-t)D))\delta^t \quad (17c)$$

This immediately gives us, for given T'' :

$$\frac{\partial \varepsilon}{\partial F} = \frac{(1-\delta)}{(1-\delta)^{T''}} \quad (18)$$

or ϵ increases with F for small increases in P . We add the qualification for small increases in F because ϵ cannot exceed D . If the increase in F is small enough to keep ϵ below D , the assumption of fixed T'' is in fact legitimate since all the requirements of perfectness and their implication for ϵ and T'' will still be satisfied.

If the increase in F is so large that ϵ would be pushed above D , it should be clear that the maximum value of l cannot be reached anymore at the old value of T since subgame perfectness of G_T rules out increments in tax rates in excess of D in any period. Accordingly T'' will increase with one and a new value for ϵ will follow by inserting this new, higher value for T'' in equation (17b). A diagrammatic illustration of the differential response to small and large changes in F is given in Figures 4 A,B).

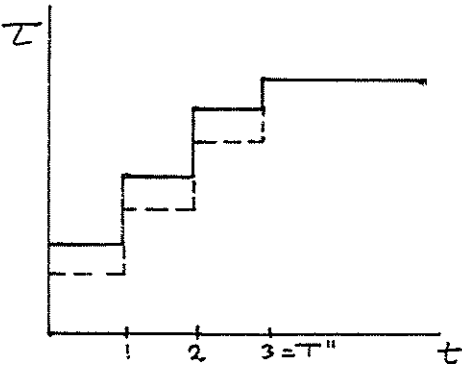


FIGURE 4A: Response to a small increase in fixed costs F

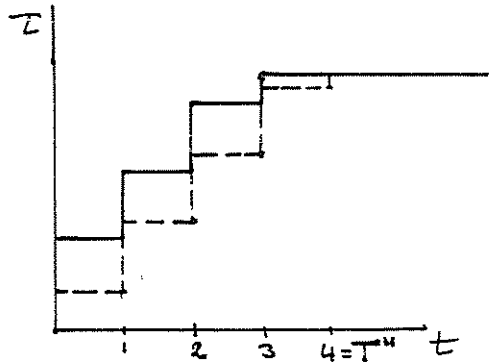


FIGURE 4B: Response to a large increase in fixed costs F

We can summarize this in Proposition 3.

Proposition 3: the length of the tax holiday T is almost always insensitive to small changes in the fixed costs F but increases in response to large increases in F .

The qualification "almost always" is needed because of the borderline case where $\varepsilon = 0$ initially: in that case T will increase in response to any increase in F .

Finally, $\tau_0 = 1 - \varepsilon - (T^{**}-1)D$. Figure 4A and 4B suggest the following proposition:

Proposition 4: the initial tax rate τ_0 always decreases in response to an increase in F .

This is in fact correct. The proof of proposition 4 is straightforward and is left to the interested reader.

Finally uniqueness. A formal proof is given in Doyle (1984), and is rather lengthy, but the intuition behind it is not difficult. Consider the solution from T onwards, conditional on τ_t for $t < T$. Perfectness of G_{II} requires $\Pi_T = 0$. Therefore any τ above or below our solution would have to be offset by a τ below or above our solution later on to maintain $\Pi_T = 0$, i.e. there has to be a crossing point, say at $T + \Delta$. If τ is below our solution between T and $T + \Delta$, $\Pi_T = 0$ implies $\Pi_{T+\Delta} < 0$. This however would induce quitting at $T + \Delta$ and therefore cannot be part of an equilibrium strategy. If τ is above our solution between T and $T + \Delta$, $\Pi_{T+\Delta} > 0$ and H would have an incentive to cheat at $T + \Delta$ since the MNE would only leave at $T + \Delta$ if $\Pi_{T+\Delta} < 0$. Therefore this example violates perfectness. Uniqueness of the entire schedule can be established following similar reasoning.

4. CONCLUSION

In this paper we look at the tax treatment of foreign MNE's by the host country as the outcome of a sequential bargaining game between the host country and the MNE. The starting point of the analysis is the recognition that sunk costs due to irreversible capital expenditure to be incurred by the MNE post entry creates an ex post bilateral monopoly situation. The outcome of the game is shown to involve an initial period of tax concessions or, in other words, a tax holiday. In particular, taxes will start low, gradually rise until a maximum rate (endogenously determined) is reached, and stay constant ever after. The starting rate, the maximum final rate and the length of time during which tax rates will be below that final rate are all determined endogenously as part of the equilibrium solution which, moreover, is unique.

The duration of the tax holiday is shown to be almost always insensitive to small changes in the size of fixed costs but to respond in an intuitive way to large changes ("small" and "large" are made precise in the text); a large increase in fixed costs will lengthen the duration of the tax holiday. An increase in fixed costs will always lower the initial tax rate.

The way the tax schedule has been constructed (using the Perfect Equilibrium concept), guarantees that neither party will have an incentive to deviate from it at any stage. It relies moreover on rational conjectures on out of equilibrium behaviour by one's opponent, and is brought about by the use of credible threats only (i.e. threats that will in fact be optimal to carry

out when the situation arises). It should be clear that no time consistency problems can arise in such a context.

Of course to bring out these results more sharply, many simplifications had to be made, and many aspects of MNE behaviour and taxation have been left undiscussed. One of the more interesting extensions would endogenize technology choice (the size of F in our context), a long-standing issue in the literature on MNE's (Magee (1980)). Entry deterrence motives (calling for large capital outlays; see Dixit (1980)) and attempts to minimize the host country's ex post monopoly power (calling for low capital expenditure) would be in conflict in such a complicated many player game.

APPENDIX 1 : Derivation of T (equation (16)) for $\varepsilon = 0$.

If $\varepsilon = 0$ proposition 1 states that $\tau_t = 1 - (T-t)D$ for $t \leq T$. Therefore equation (15) becomes :

$$\sum_{t=0}^{T-1} (T-t)\delta^t D = F \quad (\text{A.1})$$

or

$$T \sum_{t=0}^{T-1} \delta^t - \sum_{t=0}^{T-1} t\delta^t = F/D \quad (\text{A.2})$$

Using the equality $\sum_0^{\infty} \delta^t t = \delta/(1-\delta)^2$, (A.2) becomes:

$$T \frac{(1-\delta^T)}{(1-\delta)} - \frac{\delta(1-\delta^T)}{(1-\delta)^2} + \frac{\delta^T T}{(1-\delta)} = F \quad (\text{A.3})$$

which after simple manipulation yields equation (16):

$$T + \delta^{T+1}/(1-\delta) = F(1-\delta)/D + \delta/(1-\delta) \quad (\text{A.4})$$

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