Government policy towards multi−national corporations

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Abstract

We analyze an environment with asymmetric information where a country tries to attract a multi−national corporation. The country can use both taxes and grants to meet its objective of maximizing net revenues. We show that when the country has private information it can often convey it via its choice of a tax−grant pair. When the tax rates are unbounded the country is able to extract the full surplus. The existence of an upper bound can in some cases reduce the payoff to a stronger country.

1 Introduction

Governments at local and national levels are vigorously pursuing large corporations for the purpose of having them set up headquarters or plants in their respective jurisdictions: In 1995 Intel received a grant of $608 million (spread over several years) to build a $1.6 billion plant in southern Israel. The Toyota corporation secured a grant of $125 million from the State of Kentucky in return for locating an $800 million plant employing 3000 workers.

Success in attracting these ventures is likely to generate employment gains, increased tax revenues and possible stimulation of local production through beneficial spillover effects. The magnitude of these factors depends on the characteristics of the corporations relocating into the region in question.

A major difficulty in attracting suitable corporations stems from asymmetries of information between the possible incoming corporations and the different regions. Bond and Samuelson [1986] focus on the role played by private information on part of the countries and study conditions under which different countries offer different tax schedules resulting in tax holidays that in effect reveal their private information.

Other scenarios of competition to attract firms have been studied: Black and Hoyt [1989] focus on tax burden considerations. King, McAfee and Welling [1993] analyze an uncertain environment with sunk costs. Haaprante [1996] considers environments where firms decided upon the percentage of firm activity to be carried out in each location and countries use a menu auction to attract firms (see Bernheim and Whinston [1986]).

We analyze an environment similar to the Bond and Samuelson [1986] model. The country is assumed to have private information on its productivity. We analyze the impact of introducing grants in addition to the taxes studied by Bond and Samuelson as a policy tool to attract multi-national corporations. The country's objective is to maximize tax revenues net of any grants and the firm's objective is profit maximization. We analyze the resulting game and show that in the presence of grants, tax holidays disappear. We also show that grants generate the appropriate payoffs to coincide with the firm's reservation value.

Finally, we consider the case where the tax rates used are bounded from above due to either political or incentive considerations. We analyze the resulting equilibria and reach conclusions similar to those without tax rate restrictions.

2   A privately informed country

We build upon the Bond and Samuelson [1986] model by adding the policy tool of grants in addition to *ad valorem* taxes. This environment consists of one firm and two countries (home and foreign) and extends over two periods. The firm chooses to locate its plant in either of the two countries. If the firm chooses to locate in the foreign country, it incurs a fixed cost K. If the firm stays in the home country for both periods, it will earn profits of V_1 – its reservation value. If the firm chooses the foreign country in period 1 it can relocate back to the home country in period 2 and earn profits of V_2 for period 2. The firm's profits in the foreign country depend on the productivity of the foreign country and the schedule of taxes and grants offered. The foreign country's productivity (type) is either H (high) with probability p or L (low) with probability $(1-p)$, and is privately known to the foreign country. Before-tax, per-period profits are R_H in an H country and R_L in an L country. At the beginning of period 2, a firm that chose the foreign country learns the country's type and may relocate back to the home country. Both country and firm discount second period income by a factor of δ. We say it is *efficient* for a firm to enter a country of type i if $R_i - K + \delta \cdot Max\{R_i, V_2\} \geq V_1$.

We assume the foreign country can commit to a given schedule of taxes and grants for only one period. Hence, being a net revenue maximizer, it will extract all the surplus in the second period, leaving the firm at its reservation value V_2.

2.1   Equilibria

An equilibrium consists of the strategies adopted by each type of foreign country, the beliefs held by the firm, and the firm's strategy. Potential equilibria are either separating or pooling.

Bond and Samuelson found that there exist separating equilibria where tax holidays (lower first period tax rates) are used as a signal by a country to indicate that it is an H country. Let us now examine our model to see if this result holds when we introduce the possibility of grants.

In a separating equilibrium an H country offers a tax rate t_H and a grant G_H, while an L country offers t_L and G_L with $(t_H, G_H) \neq (t_L, G_L)$. On the equilibrium path of a separating equilibrium, the firm knows the country's productivity with certainty. Thus, we should examine what happens under complete information. We begin by considering the case where under complete information each country type would have a positive payoff when offering the firm its reservation value and in equilibrium the firm chooses to

enter each type of country. The payoff for a country of type i that uses a tax-grant policy of type j is given by the function: $U_{ij} = U(t_j, G_j, R_i) = t_j R_i - G_j + Max\{\delta(R_i - V_2), 0\}$ where i and j can be either H or L

The analysis of such an equilibrium proceeds through the following series of lemmata.

Lemma 1 *In a separating equilibrium when entry occurs for both types of countries, an H country offers both a higher tax rate and a higher grant, $t_L \leq t_H$ and $G_L \leq G_H$.*

Proof. It must be that neither type of country could gain by imitating the other type. Hence (since the firm enters in either case): $U_{ii} \geq U_{ij}$ for all i and j. Thus, type L should not gain by using the strategy of type H:

$$t_H R_L - G_H + Max\{\delta(R_L - V_2), 0\} \quad \leq \quad t_L R_L - G_L + Max\{\delta(R_L - V_2), 0\}$$
$$\implies \quad t_H R_L - G_H \leq t_L R_L - G_L$$

Similarly type H should not gain by using the strategy of type L:

$$t_L R_H - G_L \leq t_H R_H - G_H$$

These two conditions imply that

$$t_L(R_H - R_L) \leq t_H(R_H - R_L) \Rightarrow t_L \leq t_H \text{ (since } R_L < R_H)$$

Since the first condition implies

$$(t_H - t_L)R_L \leq G_H - G_L$$

We have, $G_L \leq G_H$. ∎

The intuition for this lemma is the following. The revenue difference by choosing a higher tax rate for an H country is greater than that for an L country. Thus, a higher grant in an H country will give proper incentive for each type of country to choose the appropriate policy. This is a similar result to that of screening contracts.

Lemma 2 *Whenever entry occurs, the firm's payoff in a separating equilibrium equals its reservation value.*

Proof. Assume by way of contradiction that the firm enters an L country and its payoff exceeds its reservation value so that $(1-t_L)R_L + G_L + \delta V_2 - K >$

V_1. Using this inequality, an L country's equilibrium payoff satisfies the following inequality

$$U_{LL} = t_L R_L - G_L + Max\{\delta(R_L - V_2), 0\} < R_L - V_1 + \delta V_2 - K + Max\{\delta(R_L - V_2), 0\}$$

In such a case an L country could deviate and offer $t_L = 1$ and $G_L = V_1 + K - \delta V_2 + \epsilon$. Under this offer the firm would enter the foreign country since it would make profits of $V_1 + K + \epsilon$ (regardless of country type) which exceed its reservation value. This leads to a contradiction since an L country's payoff would be $R_L - (V_1 + K - \delta V_2) + Max\{\delta(R_L - V_2), 0\} - \epsilon$ which exceeds its equilibrium payoff for a small enough ϵ. Similarly we can show that with an H country the firm's payoff must coincide with its reservation value as well. ■

Lemma 3 *In a separating equilibrium when entry occurs for both types of countries, the tax rate offered by an H country equals 1.*

Proof. By Lemma 2, if a firm enters for both types of countries, we have:

$$(1 - t_L)R_L + G_L + \delta V_2 - K = V_1$$

and

$$(1 - t_H)R_H + G_H + \delta V_2 - K = V_1$$

Combining we get:

$$(1 - t_L)R_L + G_L = (1 - t_H)R_H + G_H$$

In order for an L country to not have incentive to imitate an H country (derived in the proof of Lemma 1), we have

$$t_L R_L - G_L \geq t_H R_L - G_H$$

Adding we get:

$$R_L \geq R_H + t_H(R_L - R_H) = (1 - t_H)R_H + t_H R_L$$

Therefore, $t_H = 1$. ■

So far we have provided several conditions a separating equilibrium must satisfy. We now proceed to show (by construction) that an equilibrium exists.

Proposition 1 *If it is efficient for a firm to enter an L country, then a separating equilibrium exists where the firm enters for both types of countries and where: $t_H = 1$ and $G_H = V_1 - \delta \cdot V_2 + K$ and (t_L, G_L) satisfy $(1 - t_L)R_L + G_L = V_1 - \delta \cdot V_2 + K$ with $t_L < 1$.*

Proof. Since an H country pays a firm its reservation value it has no incentive to deviate. Thus, it is reasonable to assume that a firm believes any offer that deviates comes from an L country. Hence, an L country also has no incentive to deviate. These payoffs ensure that the firm earns its reservation value for entering and countries have incentive to offer these payments since we assumed each country has a positive payoff when offering the reservation value. ∎

We now analyze the case of a pooling equilibrium. In a pooling equilibrium both types of countries offer the same pair (t, G) and the firm believes it faces an H country with probability p.

Lemma 4 *In a pooling equilibrium, $t = 1$.*

Proof. The equilibrium payoff for an H country is: $tR_H - G + \delta(R_H - V_2)$. Assume by way of contradiction that $t \neq 1$, an H country can deviate to $t' = 1$ and $G' = G + (1 - t)[(1 - p)R_L + pR_H]$. The firm when faced with such an offer would enter since it gets the same as in the pooling equilibrium regardless of the country's type. An H country's payoff will then be:

$$R_H - G - (1 - t)[(1 - p)R_L + pR_H] + \delta(R_H - V_2)$$

Since $t, p < 1$ and $R_H > R_L$, we have $(1 - t)R_H > (1 - t)[(1 - p)R_L + pR_H]$. Rewriting gives us,

$$R_H - (1 - t)[(1 - p)R_L + pR_H] > tR_H$$

and hence an H country's payoff is then

$$R_H - G - (1 - t)[(1 - p)R_L + pR_H] + \delta(R_H - V_2) > tR_H - G + \delta(R_H - V_2)$$

Thus, an H country has an incentive to deviate which is a contradiction; hence, the tax rate in a pooling equilibrium must equal 1. ∎

Since the tax rate is 1, the firm's payoff is independent of the country's type. The optimal action of the country is then to offer the minimal grant necessary to attract the firm which leads to the following result.

Proposition 2 *If it is efficient for a firm to enter an L country, then a pooling equilibrium exists and is given by $t = 1$ and $G = V_1 - \delta V_2 + K$ for both types of countries.*

Proof. As before an H country cannot gain by deviating, therefore it is reasonable to assume any deviation is by an L country. However, with such beliefs an L country cannot gain by deviating either. Note that the firm wants to enter independent of country type and efficiency for an L country ensures that for both types of countries it would be worthwhile to offer this contract. ∎

While for a given environment there may exist multiple equilibria, across any of these equilibria the profits for either the firm or the country do not vary. In contrast to the Bond and Samuelson analysis tax holidays are not used as a signal, and furthermore signalling if done at all is with higher tax rates.

2.2 A Maximum Tax Rate

Imposing high tax rates may not be viable due to a host of reasons. Hence it is of interest to examine our findings in an environment where tax rates cannot exceed a maximum denoted by $t_{\max} < 1$. Such environments allow as before both for separating and pooling equilibria, both of which are analyzed in the following propositions.

Proposition 3 *In a separating equilibrium when entry occurs for both types of countries, $t_H = t_{\max}$*

Proof. One can show in a similar method to Lemma 2 that in a separating equilibrium an L country will extract all the surplus (since the firm already thinks the country is of type L the country can just lower the grant until no surplus is left). However, the same cannot be done for an H country.

Assume that the beliefs are such that with any deviation, the firm believes the country is of type L. An H country can always deviate to the maximum tax rate and give a grant G' that would induce the firm to enter with the beliefs that it is an L country.

$$(1 - t_{\max})R_L + G' + \delta V_2 - K = V_1$$

The firm will actually receive

$$(1 - t_{\max})R_H + G' + \delta V_2 - K = V_1 + (1 - t_{\max})(R_H - R_L)$$

6

The firm thus may have a surplus as high as $(1-t_{\max})(R_H-R_L)$ when entering an H country. Therefore, the payment a firm receives when entering an H country is such that

$$
\begin{aligned}
(1-t_H)R_H + G_H + \delta V_2 - K &\leq V_1 + (1-t_{\max})(R_H - R_L) \\
&\leq (1-t_L)R_L + G_L + \delta V_2 - K + (1-t_{\max})(R_H - R_L)
\end{aligned}
$$

As stated in the proof of Lemma 1, in order for an L country not to imitate an H country we must have

$$
t_H R_L - G_H \leq t_L R_L - G_L
$$

Combining these yields

$$
(1-t_H)R_H + t_H R_L \leq R_L + (1-t_{\max})(R_H - R_L)
$$

This simplifies to

$$
0 \leq (t_{\max} - t_H)(R_L - R_H)
$$

Since $R_H \geq R_L$, we have $t_H = t_{\max}$. ∎

Proposition 4 *In a separating equilibrium when entry occurs for both types of countries, a firm entering an H country makes a strictly positive surplus.*

Proof. Assume by contradiction that the surplus is zero. Then, the conditions of Lemma 3 are satisfied leading to the conclusion that $t_H = 1$. Violating the restriction that $t_H \leq t_{\max} < 1$. ∎

We thus see that a maximum tax rate potentially lowers the amount of surplus a high country can extract.

Proposition 5 *In a pooling equilibrium the common tax rate coincides with the maximum tax rate.*

Proof. Let t and G be the offer in the pooling equilibrium. Assume by way of contradiction that $t < t_{\max}$. In this case an H country can deviate to an offer of $t + \epsilon$ and G' that would be profitable for an H country and not profitable for an L country (assuming entry still occurs). Thus we have

$$
\begin{aligned}
(t + \epsilon)R_H - G' &> tR_H - G \\
(t + \epsilon)R_L - G' &< tR_L - G
\end{aligned}
$$

These are satisfied when

$$
\epsilon R_H + G > G' > \epsilon R_L + G
$$

(such a G' exists since $R_H > R_L$). When presented with such an offer, the firm would then realize that the country is of type H and will enter if

$$(1 - t - \epsilon)R_H + G' + \delta V_2 - K \geq V_1$$

Since $G' > \epsilon R_L + G$, we have

$$(1 - t - \epsilon)R_H + G' + \delta V_2 - K \geq (1 - t)R_H - \epsilon(R_H - R_L) + G + \delta V_2 - K$$

However, in the pooling equilibrium

$$(1 - t)[(1 - p)R_L + pR_H] + G + \delta V_2 - K \geq V_1$$

Since $R_H > (1 - p)R_L + pR_H$, for small enough ϵ, we have $(1 - t)R_H - \epsilon(R_H - R_L) + G + \delta V_2 - K \geq V_1$. Thus, the firm still wants to enter and an H country would gain from such a deviation. ∎

Notice that even though the maximum tax rate is charged in a pooling equilibrium, the firm would gain a surplus when the country is of type H (the firm will not gain if the country is of type L) since on average the firm should make its reservation value. Thus, a maximum tax rate will hurt profits of an H country in a pooling equilibrium. If it is efficient for a firm to enter an L country, then as before both types of equilibria exist.

The intuition for our results is that it is more effective for an H country to signal via grants. An H country can raise the tax rate with an accompanying change in the grant keeping its payoff constant, while making it more costly for an L country to imitate it.

3   Conclusions

We analyzed an environment where a country tries to attract a multi-national corporation. The Bond and Samuelson [1986] model was augmented by allowing the foreign country the choice of grants as well as taxes. We showed that tax holidays disappear while grants are an important part of policy.

Environments where there is private information on both sides (the firm and the country) remain to be thoroughly analyzed. It is also interesting to see how changes in the bargaining power (which may result from the introduction of more countries and firms) affect the results. Furthermore, the use of taxes and subsidies may also pose problems relating to the political viability of these measures: there might be popular opposition to grants, whereas industry lobbies might strongly object to high tax levels.

References

Bernheim, D., and M. Whinston (1986) "Menu Auctions, Resource Allocation, and Economic Influence" *Quarterly Journal of Economics* **101**, 1-31.

Black, D. A., and W. H. Hoyt (1989) "Bidding for Firms" *American Economic Review* **79**, 1249-1256.

Bond, E. W. and L. Samuelson (1986) "Tax Holidays as Signals" *American Economic Review* **76**, 820-826.

Haaprante, P. (1996) "Competition for Foreign Direct Investment" *Journal of Public Economics* **63**, 141-153.

King, I., P. R. McAfee and L. Welling (1993) "Industrial Blackmail: Dynamic Tax Competition and Public Investment" *Canadian Journal of Economics* **26**, 590-608.