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Abstract

In a two-period dynamic model, where a single country is trying to attract large investors endowed with capital with varying rate of returns, we show that the result of Kishore and Roy (2014), that a country has incentives to commit to a non-preferential regime to circumvent dynamic inconsistency problem does not hold. Tax revenue of the government may be higher under a preferential regime compared to a non-preferential regime.

JEL classification: F21; H21; H25; H87
Keywords: Tax Competition; Non-preferential regime; Dynamic Inconsistency, Rational Expectations.

1 Introduction

With increasing globalization regional markets are being integrated into a single global market. Moreover, the presence of contributive labor force around the world along with the falling cost of capital relocation have further increased competition for mobile capital[1]. Governments offer preferential tax incentives

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[1] There is a large literature on tax competition: see for example: Janeba and Smart (2003), Janeba and Peters (1999) and Haupt and Peters (2005).

depending on different vintages of capital to attract capital from other jurisdictions[2]. While, tax incentives are one of the primary determinants of FDI (foreign direct investments), it can also deter investments in a multi-period setting where investors may wait for more lucrative tax deals in future. When investors are heterogeneous, the government faces a scenario similar to a durable good monopolist describe by Coase[3]. There are two aspects of the problem. Firstly, once invested capital may be sunk once investments are made (hold up problem) and secondly, investors may wait for better deals at a future time period. While, the solution of the first problem is extensive analyzed in the literature[4], solution to the second problem is not yet fully understood.

Kishore and Roy (2014) find that this dynamic inconsistency problem is resolved if the host government commits to "non-preferential" taxation in each period even if it does not commit to future tax rates. The result is of significant importance as OECD does impose restrictions on preferential taxation based on different vintages of capital[5]. Under a non-preferential regime which restricts government to set an equal tax rate for capital of different vintages, a government also has to offer tax rebate to old capital to offer discounts to attract new capital. Hence, a government can commit not to offer bigger tax discounts in future by committing to a non-preferential tax regime. This paper is similar to Kishore and Roy (2014), except that investors are strategic. Bagnoli, Salant and Swierzbinski (1989) shows that when buyers are discrete the Coase conjecture does not hold. Hence, it is not clear whether a non-preferential regime generates higher tax revenues compared to a preferential regime[6].

To answer this question, I consider a dynamic two-period model, where a single country wants to attract two large investors who differ in their opportunity cost of relocating to the host country and capital is sunk once it is invested. I compare the equilibrium tax revenues under different commitment abilities of the host government. We find that tax revenue may be larger when the host government adopts a preferential taxation scheme where he is free to set different tax rates depending on different vintages of capital. Tax revenue under full commitment is equal to what the government can obtain under "non-preferential" taxation scheme (where the government is committed not to set different tax rates depending on different vintages of capital).

[2] The analysis can also be extended to a state within a nation.

[3] See, for instance, Coase (1972) and Stokey (1982).

[4] For example, see, Eaton and Gersovitz (1983), Thomas and Worrall (1994), Doyle and van Wijnbergen (1994) and Schnitzer (1999)). Keen and Konard (2013) offers an excellent survey on international tax competition and it also contains a section on dynamic inconsistency.

[5] OECD(2004) reports that among 47 preferential regimes identified among the OECD member countries in 2000, 18 countries chose to adopt non-preferential regimes and 14 countries accepted amendments in their treatment of foreign capital. The number of non-member countries agreeing to cooperate on the principle of non-preferential taxation had increased to 33.

[6] OECD (2000) report on Progress in Identifying and Eliminating Harmful Tax Practices lists many countries who still practice preferential taxation scheme.

2 Model

The economy consists of two-period indexed by $t = 1, 2$. The government of a single country (host country) is trying to attract two investors (labeled as H and L). Outside the host country the net returns on capital of investor i is denoted as R_i, where $i = H,\ L$. Outside the host country the investor H obtains a higher return on his capital, $R_H = \alpha R$, $R_L = R$, $\alpha \geq 1$ and $0 \leq \alpha R \leq 1$. In the host country, the gross return to capital is (before taxes) is equal to 1 for both investors. In a basic model we assume that capital is fully sunk once invested and the cost of capital relocation is equal to 0. In section 6 we analyze a scenario when invested capital is only partially sunk and there is an equal cost of capital relocation for both investors. The objective of the government is to maximize tax revenue and investors maximize net after tax returns on their capital. For simplicity we assume that neither the government, nor investors discount future income. At the beginning of period 1, the host country has no domestic capital. We model strategic interaction between the government and investors as non-cooperative two-period dynamic game with perfect information. The outcome is a set of strategies which forms subgame perfect Nash equilibrium of the game.

The history of the game prior to period t is described by a list of the government's tax offers in period t through $t-1$ and investors who invest till that period. A pure strategy is a function specifying a player's choice at each stage for each history of the game prior to that stage. Hence, a pure strategy for the government specifies its tax offer in each period t as a function of the game's history up to t. The pure strategy of an investor in time period t is the investment decision in the period t as a function of the tax rates in period t and the history of the game until time period t. A subgame perfect equilibrium strategy combination is such that the strategy for each player is a sequential best reply, that is, optimal at each stage and every history given the strategies of other players. In this paper we restrict to subgame perfect equilibria in pure strategies[7].

We model the outcome of two periods game under different commitment ability of the government. In the next section we analyze the outcome when the government can fully commit to future tax rates.

3 Outcome with full commitment

We begin with the benchmark case where the government can fully commit to future tax rates. The government's problem is to incentivize investors not to wait for period 2 to make investment. Lemma 1 describes the equilibrium outcome under under full commitment.

[7] See Bagnoli, Salant and Swierzbinski (1989) for intuitive explanation: Any strategy combination that forms a subgame-perfect equilibrium when players are restricted to pure strategies will remain a subgame-perfect equilibrium if players are allowed to play behavioral (mixed) strategies.

Lemma 1 *When the government can fully commit to future tax rates then the equilibrium tax revenue of the government is:*

$$G^C = \begin{cases} 4\,(1-\alpha R) \;\; if \;\; \alpha \leq \frac{1}{2R} + \frac{1}{2} \\ 2\,(1-R) \;\; if \;\; \alpha > \frac{1}{2R} + \frac{1}{2} \end{cases}$$

When $\alpha \leq \frac{1}{2R} + \frac{1}{2}$, the government attracts both investors in period 1. When $\alpha > \frac{1}{2R} + \frac{1}{2}$, the investor L invests in period 1 and investor H remains outside the host country in both periods.

Proof. The government sets tax rate t_1 in period 1, and also commit to tax rates t_2 and t_N on foreign and domestic capital in period 2. Because the government can fully commit to future tax rates, investors only care about the joint value of $t_1 + t_N$. Hence, we can assume that the government commit to $t^N = 1$. To maximize his tax revenue the government has to consider following strategies; (1) provide incentive to both investors to invest in period 1, (2) attract investor L in period 1 and set a high tax rate in period 2, (3) provide incentive to investor L to invest in period 1 and to investor H in period 2, (4) provide incentive to investor H in period 1 and investor L in period 2. Lets consider scenario 1. When investors are similar it is better for the government to attract both investors in period 1 and commit to a high tax rate in period 2 to dissuade them from waiting until period 2. The maximum tax rate the government can set in period 1 if he wishes to attract both investors in period 1 is $1 - 2\alpha R$, because investors are also compensated for loss of revenue in period 2. The government receives $2\,(1 - 2\alpha R)$ and 2 respectively, in period 1 and period 2, hence, the total tax revenue of the government is equal to

$$4\,(1-\alpha R)\,. \tag{1}$$

In this case investor H is indifferent between making investment in period 1 and waiting until period 2 while gain to investor L is equal to $2\alpha R$. No investor can be better off from not making an investment because the tax rate in period 2 is high. Scenario 2 is more relevant when αR is significantly larger than R (that will be the case when either R is large or α is large), the government may only want to attract investor L in period 1 and commit to very high tax rate in period 2 to dissuade him from waiting until period 2. If the government attracts investor H in period 2, the maximum he can charge is $1 - \alpha R$ and tax rebate has to be provided to investor L to invest in period 1. In this case the maximum tax rate the government can set in period 1 is equal to $1 - 2R$ and set the tax rate equal to 1 in period 2. The total tax revenue of the government is equal to

$$2\,(1-R)\,. \tag{2}$$

In this case investor L is indifferent between making investment in period 1 and staying outside in both periods. Scenario 3 becomes relevant when the difference between αR and R is significant but not very large. In this case the maximum tax rate the government can set in period 2 is $1 - \alpha R$. The maximum tax rate the government can set in period 1 to attract investor L in period 1 is $1-2R$. In this case if investor L decides to wait until period 2 then the government has to decide whether to set the tax rate equal to $1-\alpha R$ and attract both investor or set the tax rate equal to $1-R$ and only attract investor L. It is beneficial for the government to attract both investors in period 2 if

$$2\,(1-\alpha R) \geq 1-R \Rightarrow \alpha \leq \frac{1}{2R}+\frac{1}{2}. \tag{3}$$

When $\alpha > \frac{1}{2R}+\frac{1}{2}$, investor L can not gain from waiting until period 2 and the government does not have to offer him tax rebate. Hence, the tax rate is equal to $1-2R$ in period 1 and $1-\alpha R$ in period 2. The tax revenue of the government in this case is equal to

$$2\,(1-R)+1-\alpha R \tag{4}$$

When $\alpha > \frac{1}{2R}+\frac{1}{2}$, if the government sets the tax rate equal to $1-\alpha R$ in period 2 and set $1-2R$ in period 1, investor L has incentive to wait until period 2. The gain to investor L if he invests in period 2 is $(\alpha-1)\,R$. To incentivize investor L to invest in period 1 the government has to lower the tax rate in period 1 by $(\alpha-1)\,R$. The maximum tax rate the government can set in period 1 is $1-2R-(\alpha-1)\,R$. Hence, the government obtains $1-R-\alpha R$ in period 1 and $2-\alpha R$ in period 2. The total tax revenue is equal to

$$3-R-2\alpha R. \tag{5}$$

Strategy described in scenario 4 is dominated by scenario 3 because, although the government can set a higher tax rate in period 2 on foreign investments, he has to reduce the tax rate in period 1 by a large amount. Hence, the equilibrium outcome can be obtained by comparing tax revenue given by eq(1), eq(2), eq(4) and eq(5). From eq(1) and eq(2) we have

$$4\,(1-\alpha R) \geq 2\,(1-R) \Rightarrow \alpha \leq \frac{1}{2R}+\frac{1}{2} \tag{6}$$

Note that $\frac{1}{2R}+\frac{1}{2} < \frac{1}{R} \Rightarrow R < 1$. Similarly, from eq(2) and (3) we have

$$2\,(1-R) \geq 3-R-2\alpha R \Rightarrow \alpha \geq \frac{1}{2R}+\frac{1}{2}. \tag{7}$$

From eq(1) and eq(3) we have

$$4\,(1-\alpha R) \geq 3-R-2\alpha R \Rightarrow \alpha \leq \frac{1}{2R}+\frac{1}{2} \tag{8}$$

From eq(6), eq(7) and eq(8) it is clear that when $\alpha \leq \frac{1}{2R}+\frac{1}{2}$ the maximum tax revenue the government can earn is equal to $4\,(1-\alpha R)$. When $\alpha > \frac{1}{2R}+\frac{1}{2}$ then the government can obtain $3-2R-\alpha R$. Comparing the outcome described in eq(2) and eq(4) we have

$$3-2R-\alpha R \geq 2\,(1-R) \Rightarrow \alpha R \leq 1 \tag{9}$$

Similarly, comparing outcome from eq(1), and eq(4) we get

$$4\,(1-\alpha R) \geq 3-2R-\alpha R \Rightarrow \alpha \leq \frac{1}{3R}+\frac{2}{3}. \tag{10}$$

Knowing that the government can only obtain the tax revenue equal to $3-2R-\alpha R$ when $\alpha > \frac{1}{2R}+\frac{1}{2}$, the proof is complete. ■

When returns on capital outside the host country is similar, it is best for the government to attract both investors in period 1. When investor's opportunity cost of moving to the host country is very distinct then it is not beneficial for the government to offer a low tax rate to attract both investors in period 1. This scenario also allows the government to fully expropriate the return on investment of both investors because the government sets the tax rate in period 1 such that the investor with a lower opportunity cost is indifferent between making investment in period 1 and waiting until period 2 and he sets a lower tax rate in period 2 to attract the investor with a higher opportunity cost. The investor

4 Outcome with no commitment

Now we look at the scenario when the government can not commit to future tax rates. When αR and R are not significantly different then it is still possible to attract both investors in period 1. The government faces problem when αR and R are significantly different and it only wants to attract type L investor in period 1. Because the government can not commit to not offer a tax rebates to type H investor once type L investor has made its investment decision, the government has to compensate type L investor up-front. Preposition 1 describes the equilibrium outcome under a preferential regime.

Preposition 1. *When the government has no commitment power, in a unique subgame perfect equilibrium the tax revenue of the government G^{NC} is*

$$G^{NC}=\begin{cases} 4\,(1-\alpha R)\ \ if\ \alpha \leq \frac{1}{2R}+\frac{1}{2} \\ 2\,(1-R)+1-\alpha R\ if\ \alpha > \frac{1}{2R}+\frac{1}{2} \end{cases}.$$

When $\alpha \leq \frac{1}{2R}+\frac{1}{2}$, the tax revenue of the government under a preferential taxation scheme is equal to the tax revenue the government can obtain if it could fully commit to future tax rates, $G^C = G^{NC}$. On the other hand when $\alpha > \frac{1}{2R}+\frac{1}{2}$, the tax revenue under a preferential taxation scheme is strictly larger, $G^{NC} > G^C$.

Proof. Let t_1, t^N and t_2 respectively, be the tax rate on foreign capital in period 1, domestic and foreign capital in period 2. Because the government is free to set different tax rates for domestic and foreign capital in period 2, he will fully expropriate return on domestic capital ($t_N = 1$) and he will lower the tax rate when there is a possibility of attracting more investments in period 2. Firstly, we look at the outcome in period 2. If both investors did not invest in period 1, then the government will either set $t_2 = 1-\alpha R$ and attract both investors in period 2 or set a relatively higher tax rate $t_2 = 1 - R$ and attract only investor L. It is beneficial for the government to attract both investors in period 2 when

$$2(1 - \alpha R) \geq 1 - R \Rightarrow \alpha \leq \frac{1}{2R} + \frac{1}{2}. \tag{11}$$

Hence, if there is no investment in period 1 then the tax rate in period 2 is

$$t_2 = 1 - \alpha R \text{ if } \alpha \leq \frac{1}{2R} + \frac{1}{2}. \tag{12}$$

$$t_2 = 1 - R \text{ if } \alpha > \frac{1}{2R} + \frac{1}{2}. \tag{13}$$

The tax revenue of the government in period 2 when there is no investment in period 1 is

$$G_2^{NC} = 2(1 - \alpha R) \ if \ \alpha \leq \frac{1}{2R} + \frac{1}{2}. \tag{14}$$

$$G_2^{NC} = 1 - R \ if \ \alpha > \frac{1}{2R} + \frac{1}{2}. \tag{15}$$

Suppose only investor L invests in period 1. In this case the decision of the government is simple, he sets

$$t_2 = 1 - \alpha R. \tag{16}$$

The government receives $1 - \alpha R$ from new investment in period 2 and 1 from taxes on domestic capital. The total tax revenue of the government in period 2 is

$$G_2^{NC} = 2 - \alpha R. \tag{17}$$

Suppose only investor H invests in period 1. In period 2 it is optimal for the government to set

$$t_2 = 1 - R. \tag{18}$$

The government receives 1 and $1 - R$ in period 2 from taxes on domestic capital and new foreign investment, respectively. The total tax revenue of the government is equal to

$$G_2^{NC} = 2 - R. \tag{19}$$

If both investors invest in period 1 then the tax rate on foreign investment is irrelevant and he only receive taxes from domestic capital. The government's tax revenue in period 2 is equal to

$$G_2^{NC} = 2. \tag{20}$$

In period 1 the government maximizes the sum of tax revenues from period 1 and period 2. If the government attracts both investors in period 1 then in period 2 his tax revenue is equal to 2. The maximum tax rate the government can set in order to attract both investors in period 1 is equal to $1 - 2\alpha R$. The tax rate is low in period 1 because return on capital is fully expropriated and investors are compensated for their loss in period 2. The government receives $2(1-2\alpha R)$ and 2 respectively, from taxes in period 1 and period 2. The total tax revenue of the government is equal to

$$G^{NC} = 4(1-\alpha R). \tag{21}$$

We need to show that an investor can not gain from unilateral deviation. If investor H does not invest in period 1 then from eq(16) the tax rate in period 2 is equal to $1-\alpha R$ which makes him indifferent between making investment in period 1 and waiting until period 2. It is easy to observe that investor L also has no incentive to not invest in period 1. If the government wants to attract only investor L in period 1 then the maximum tax rate he can set in period 1 is equal to $1-2R$. The tax rate is not low enough to induce investment from investor H in period 1. Investor L is indifferent between making investment in period 1 and waiting until period 2. From eq(12) and eq(13) we know that if investor L decides against making investment in period 1 then the tax rate in period 2 will be $1-R$ when $\alpha > \frac{1}{2R}+\frac{1}{2}$. Hence, the government sets $t_1 = 1-2R$. The government receives $1-2R$, 1 and $1-\alpha R$ respectively, from taxes in period 1 on foreign capital, domestic and foreign investment in period 2. The total tax revenue of the government is equal to

$$G^{NC} = 3-2R-\alpha R. \tag{22}$$

When $\alpha > \frac{1}{2R}+\frac{1}{2}$, if both investors do not invest in period 1 then the tax rate in period 2 is $1-\alpha R$. If investor L decides to make investment in period 2 then his gain is equal to $(\alpha-1)R$. To induce investment in period 1 from investor L the government must lower the tax rate in period 1. Hence, the government sets $t_1 = 1-2R-(\alpha-1)R$. The tax rate is now low enough to induce investment from investor H in period 1. In this case the government receives $1-R-\alpha R$, 1 and $1-\alpha R$ respectively, from taxes on investment in period 1, domestic and foreign investment in period 2. The total tax revenue of the government is equal to

$$G^{NC} = 3-R-2\alpha R. \tag{23}$$

If the government does not wish to attract foreign investment in period 1 then he sets $t_1 = 1$. Using eq(12) and eq(13), the total tax revenue of the government is equal to

$$G^{NC} = \begin{cases} 2(1-\alpha R)\ if\ \alpha \leq \frac{1}{2R}+\frac{1}{2} \\ 1-R\ if\ \alpha > \frac{1}{2R}+\frac{1}{2} \end{cases}. \tag{24}$$

From comparison of tax revenues given by eq(22), eq(23) and eq(24) it is obvious whether $\alpha \gtrless \frac{1}{2R}+\frac{1}{2}$, the government is better off providing incentive to induce investment from investor L in period 1. From eq(21), eq(23) and eq(8) we know that when $\alpha \leq \frac{1}{2R}+\frac{1}{2}$, the maximum tax revenue the government can obtain is equal to $4(1-\alpha R)$. Taking note of the fact that the government can obtain $3-2R-\alpha R$ when $\alpha > \frac{1}{2R}+\frac{1}{2}$, the proof is obvious. Uniqueness of the equilibriums is obvious from the fact that equilibrium strategies strictly dominate all other strategies. ■

Under preferential taxation scheme the government can make future tax rate dependent on investor's investment decision. When $\alpha > \frac{1}{2R} + \frac{1}{2}$, if investor L invests in period 1 then the tax rate in period 2 is $1 - \alpha R$. But the government can credibly threat that if investor L does not invest in period 1 then the tax rate in period 2 will be $1 - R$. When the government commits to the tax rate in period 2 in period 1 itself, such threat is not possible which reduces his tax revenue.

5 Outcome with partial commitment

Finally, consider the situation where the government commits not to extend any preferential treatment to new investors i.e.,not to discriminate between sunk (immobile) capital and new investors (mobile capital). Note that the government does not pre-commit to future tax rates or to not lower its taxes over time. Equilibrium tax revenue of the government is equal to full commitment outcome. Similar to the outcome under full commitment, the government is not able to set the tax rate in period 2 based on their investment decision in period 1. Once initial investments are made it is very costly for the government to lower the tax rate to attract less willing investors and loses tax revenue. Proposition 2 describes the equilibrium outcome.

Proposition 2. *Under a non-preferential taxation scheme the tax revenue of the government is*

$$G^{PC} = \begin{cases} 4\left(1-\alpha R\right) \ if \ \alpha \leq \frac{1}{2R}+\frac{1}{2} \\ 2\left(1-R\right) \ if \ \alpha > \frac{1}{2R}+\frac{1}{2} \end{cases}.$$

If $\alpha > \frac{1}{2R} + \frac{1}{2}$, the tax revenue of the government under non-preferential taxation scheme is lower than the tax revenue the government can obtain if it could fully commit to future tax rates or without any commitment, i.e. $G^{PC} = G^{C} < G^{NC}$.

Proof. Suppose the government sets the tax rate t_1 and t_2 respectively, in period 1 and period 2. Firstly, we look at the outcome in period 2. The government has to lower the tax rate on both domestic and foreign capital to attract more investments in period 2. As before, if both investors do not invest in period 1 then the tax rate in period 2 is given by eq(12) and eq(13). The tax revenue of the government is given by eq(14) and eq(15). If only investor L invests in period 1 then the government can set the tax rate equal to 1 in period 2 and receive taxes only from domestic capital. If the government wants to attract investor H in period 2 then the maximum tax rate he can set is equal to

$$t_2 = 1 - \alpha R. \tag{25}$$

The tax revenue of the government is

$$G_2^{PC} = \begin{cases} 2\left(1-\alpha R\right) \ if \ \alpha \leq \frac{1}{2R} \\ 1 \ if \ \ \alpha > \frac{1}{2R} \end{cases}. \tag{26}$$

Suppose only investor H invests in period 1. The government attracts investor L in period 2 when $2(1-R) \geq 1$, because $1-R$ is the maximum tax rate he can set to induce investment from investor L. Hence, in this scenario

$$t_2 = \begin{cases} 1-R \; if \; R \leq \frac{1}{2} \\ 1 \; if \; R > \frac{1}{2} \end{cases} \tag{27}$$

$$G_2^{PC} = \begin{cases} 2(1-R) \; if \; R \leq \frac{1}{2} \\ 1 \; if \; R > \frac{1}{2} \end{cases} \tag{28}$$

If both investors invest in period 1 then the tax rate in period 2 is equal to 1 and the tax revenue of the government is equal to 2.

In period 1, the government maximizes the sum of tax revenues from period 1 and period 2. If the government attracts both investors in period 1, then the total tax revenue if given by eq(21). If the government does not want to attract investors in period 1 then he sets $t_1 = 1$ and receive tax revenue only in period 2. The tax revenue of the government in this case is given by eq(26). Now, let us consider the scenario when the government wants to attract investor L in period 1. When $\alpha \leq \frac{1}{2R}$ the tax rate in period 2 is given by eq(25). If investor L invests in period 2 then his gain is equal to $(\alpha - 1)R$. If the government sets $1-2R$ then investor is indifferent between making investment in period 1 and not making investment in either periods. Hence, the government has to offer a tax rebate equal to $(\alpha-1)R$ to induce investment in period 1 from investor L. On the other hand when $\alpha > \frac{1}{2R}$, the government does not reduce the tax rate in period 2 to attract more investments, hence, investor L invests as long as $t_1 \leq 1-2R$. Hence, the tax rate in period 1 is

$$t_1 = \begin{cases} 1-R-\alpha R \; if \; \alpha \leq \frac{1}{2R} \\ 1-2R \; if \; \alpha > \frac{1}{2R} \end{cases} \tag{29}$$

When $\alpha \leq \frac{1}{2R}$, the government receives $1-R-\alpha R$ and $2(1-\alpha R)$ respectively, in period 1 and period 2. When $\alpha > \frac{1}{2R}$, the government receives $1-2R$ and 1 respectively, in period 1 and period 2. The total tax revenue of the government is

$$G^{PC} = \begin{cases} 3(1-\alpha R) - R \; if \; \alpha \leq \frac{1}{2R} \\ 2(1-R) \; if \; \alpha > \frac{1}{2R} \end{cases}. \tag{30}$$

If the government wishes to attract investor H in period 1 then the maximum tax rate he can set in period 1 is $1-2\alpha R$. It is clear from eq(27) that investor H can not gain from waiting until period 2, because the minimum tax rate in period 2 is $1-R$. When $R \leq \frac{1}{2}$ the government receives $1-2\alpha R$ in period 1 and $2(1-R)$ in period 2. When $R > \frac{1}{2}$ the government receives $1-2\alpha R$ and 1 respectively, in period 1 and period 2. The total tax revenue of the government is

$$G^{PC} = \begin{cases} 3-2\alpha R-2R \; if \; R \leq \frac{1}{2} \\ 2(1-\alpha R) \; if \; R > \frac{1}{2} \end{cases}. \tag{31}$$

It is obvious that it is not beneficial for the government not to attract any investor in period 2. From eq(21), eq(30) and eq(31) it is clear that as long as

$R \leq \frac{1}{2}$ it is beneficial for the government to attract both investors in period 1. Proof is complete once we observe that $4(1-\alpha R) \geq 2(1-R)$ when $\alpha \leq \frac{1}{2R}+\frac{1}{2}$. Uniqueness of the equilibriums is obvious from the fact that equilibrium strategies strictly dominate all other strategies. ■

6 Conclusion

We show that the result of Roy and Kishore (2014) does not hold when investors are large (strategic). When investors does not differ considerably, a preferential and a non-preferential regime generate an equal tax revenue. But, when returns on capital are significantly different, the government earns strictly higher under a preferential regime compared to a non-preferential regime. The reason for the reversal of the result is that - even under a preferential regime the government can credibly threat that if an investor does not invest in period one then the tax rate in the second period will be higher. Such strategies are not possible when there are continuum of investors. We also show that the result holds even when the capital is only partially sunk and there is a uniform cost of capital relocation for both investors.

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7 Appendix

This section analyzes the scenario when investments are only partially sunk and there is a uniform non-negative cost of capital relocation. A fraction $1-\lambda$ of capital is sunk once the investment is made in the host country, that is, if an investor invests in the host country at period 1 and wants to move the invested capital outside the country at period 2, he can only take away a fraction λ of the invested capital and receive a return $\lambda R_i,\ i = H, L$ and $0 \leq \lambda \leq 1$. Here, $(1-\lambda) R_i$ captures the sunk cost and other expenditures associated with the capital relocation. The cost of capital relocation to the host country is $C \geq 0$ for both investors. Preposition 3, 4 and 5 describes the outcome under full commitment, preferential and non-preferential taxation scheme, respectively. Proofs are included in the appendix.

Lemma 2 *If the government can fully commit to future tax rates, when* $\alpha \leq \frac{1}{2R} + \frac{1}{2} - \frac{C}{4R}$*, in a unique subgame perfect Nash equilibrium the government's tax revenue is equal to* $G_C \equiv 2(2-2\alpha R - C)$*. When* $\alpha > \frac{1}{2R} + \frac{1}{2} - \frac{C}{4R}$*, the government's tax revenues is equal to* $G_C \equiv 2 - 2R - C$*.*

Proof. At the beginning of period 1, the government commits to t_1, t^N and t_2 respectively, the tax rate in period 1, domestic and foreign capital in period 2. Because the government can fully commit to future tax rates for investors who are willing to invest in period 1 only $t_1 + t_N$ matters. Suppose the government sets $t_N = 1 - \alpha R$. As before, suppose the government wants to attract both investors in period 1. The maximum tax rate the government can set in period 1 is

$$t_2 = 1 - 2\alpha R + \lambda\alpha R - C$$

The total tax revenue of the government in this case is equal to

$$\begin{aligned} G_C^2 &= 2\left(1 - 2\alpha R + \lambda\alpha R - C\right) + 2\left(1 - \lambda\alpha R\right) \\ &= 4\left(1 - \alpha R\right) - 2C \end{aligned} \tag{32}$$

We can see that the total tax revenue of the government does not change because of no change in outside option. Secondly, let us look at the case when the government wants to attract investor L in period 1 and investor H in period 2. To induce investment from investor H in period 2 the maximum tax rate the government can set in period 2 is equal to $1 - \alpha R - C$. The gain to investor L from waiting until period 2 to make investment is

$$\left(\alpha - 1\right) R.$$

Hence, the maximum tax rate the government can set in period 1 is

$$t_1 = 1 - 2R + \lambda R - \left(\alpha - 1\right) R - C.$$

The total tax revenue of the government is equal to

$$G_C^2 = 3 - R - 2\alpha R - 2C. \tag{33}$$

Now lets consider the case when the government wish to attract investor L in period 1 and commit not to lower the tax rate in period 2 to induce investment from investor H. In this case the maximum tax rate the government can set is equal to

$$t_1 = 1 - 2R + \lambda R - C.$$

The total tax revenue of the government in this case is equal to

$$2 - 2R - C. \tag{34}$$

From eq(32) and eq(34) we have

$$\begin{aligned} 4\left(1 - \alpha R\right) - 2C &\geq 2 - 2R - C \\ &\Rightarrow \alpha \leq \frac{1}{2R} + \frac{1}{2} - \frac{C}{4R}. \end{aligned} \tag{35}$$

Similarly, from eq(33) and eq(34) we have

$$\begin{aligned} 2 - 2R - C &\geq 3 - R - 2\alpha R - 2C \\ &\Rightarrow \alpha \geq \frac{1}{2R} + \frac{1}{2} - \frac{C}{2R}. \end{aligned} \tag{36}$$

From eq(35) and eq(36) and noting that when $\alpha \leq \frac{1}{2R} + \frac{1}{2} - \frac{C}{4R}$ it is optimal for the government to keep both investors in period 2 if both invest in period 1, the proof is complete. ■

Note that $\frac{C}{4} - \frac{C}{2R} < 0$ because $R \leq 1$. Compared to the outcome with no cost of capital relocation, the government is less willing to offer a large tax discounts in period 1 to attract both investors. The outcome does not depend on λ because it does not change the outside options of investors. When investments are only partially sunk the government has to offer a lower tax discount in period 1 which compensates for a relatively lower tax rate in period 2.

Preposition 3. *When $\alpha \leq \max\left\{\frac{1}{3R} + \frac{2}{3},\ \frac{1}{2} + \frac{1}{2R} - \frac{C}{2R}\right\}$, in a unique subgame perfect Nash equilibrium the government's tax revenue is equal to $G_{NC} \equiv 2\left(2 - 2\alpha R - C\right)$, e.g, $G_{NC} = G_C$. When $\alpha > \max\left\{\frac{1}{3R} + \frac{2}{3},\ \frac{1}{2} + \frac{1}{2R} - \frac{C}{2R}\right\}$, the government's tax revenue is equal to $G_{NC} \equiv 3 - 2R - \alpha R - 2C$, e.g, $G_{NC} > G_C$.*

Proof. The proof is similar to Proposition 1. When both investors invest in period 1 then the total tax revenue of the government is given by eq(32). Now let's consider the case when there is no investment in period 1. The government has two options: either set $t_2 = 1 - \alpha R - C$ and attract both investors in period 2 or set $t_2 = 1 - R - C$ and attract only investor L. It is beneficial for the government to attract both investors in period 2 when

$$2\left(1 - \alpha R - C\right) \geq 1 - R - C \Rightarrow \alpha \leq \frac{1}{2R} + \frac{1}{2} - \frac{C}{2R}. \tag{37}$$

If the government wishes to attract only investor L in period 1 and the condition described in eq(37) does not hold, the maximum tax rate it can set to induce investment from investor L is $t_1 = 1 - 2R - C + \lambda R$. In period 2, the government's tax revenue is $1 - \lambda R$ from sunk domestic capital and $1 - \alpha R - C$ from new investments in period 2. The total tax revenue of the government is equal to

$$3 - 2R - \alpha R - 2C. \tag{38}$$

Comparing eq(37) and eq(38), we can determine that it is beneficial for the government to attract both investors in period 1 when

$$2R - 3R\alpha + 1 \geq 0 \Rightarrow \alpha \leq \frac{2}{3} + \frac{1}{3R}. \tag{39}$$

The proof is obvious from eq(37) and eq(39). The uniqueness is obvious once we realize that the equilibrium strategies are dominant strategies of all players. ■

Preposition 4. *Under a non-preferential taxation scheme, when $\alpha \leq \frac{1}{2R} + \frac{1}{2} - \frac{C}{4R}$, in a unique subgame perfect Nash equilibrium the government's tax revenue is equal to $G_{PC} \equiv 2\left(2 - 2\alpha R - C\right)$. When $\alpha > \frac{1}{2R} + \frac{1}{2} - \frac{C}{4R}$, the government's tax revenue is equal to $G_{PC} \equiv 2 - 2R - C$. The government's tax revenue is equal to what it can obtain under full commitment, e.g., $G_{PC} = G_C$.*

Proof. The proof is similar to Proposition 3. We have already observed that it is beneficial for the government to attract both investors in period 1 when

α is relatively small. Now because of a positive cost of capital relocation the government is less willing to offer a low tax rate in period 1 which can induce both investors to relocate. Also, when only one investor invests in period 1 it is less profitable for the government to offer a lucrative incentive to attract investments in period 2. Hence, we compare the tax revenues of the government when it attracts both investors in period 1 and when it only attracts investor L in period 1 and investor L remains in the host country in period 2 as well. The proof is obvious from eq(35). $\blacksquare$