Dynamic Inconsistency and Preferential Taxation of Foreign Capital

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Abstract

In a two-period dynamic model in which, a single country attempts to attract two 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 a dynamic inconsistency problem does not hold. The tax revenue of the government may be higher under a preferential regime compared to a non-preferential regime.

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Keywords: Tax Competition; Non-preferential regime; Preferential regime; Dynamic Inconsistency.

1 Introduction

With increasing globalization, regional markets are being integrated into a single global market. Moreover, the presence of a contributing labor force around the world and the falling cost of capital relocation have further increased competition for mobile capital[1]. Governments offer preferential tax incentives depending on different vintages of capital to attract capital from other jurisdictions[2]. Al-

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

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

though tax incentives are one of the primary determinants of FDI (foreign direct investments), they can also deter investments in a multi-period setting where investors may wait for more lucrative tax deals in the future. When investors are heterogeneous, the government faces a scenario similar to a durable good monopoly describe by Coase (1972)[3]. There are two aspects of this problem. First, invested capital may be sunk once investments are made (hold up problem) and second, investors may wait for better deals in the future. Whereas the solution to the first problem is extensively analyzed in the literature[4], the 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 (an equal tax rate on domestic and foreign capital) in each period even if it does not commit to future tax rates. The result is important because the Organization of Economic Co-operation and Development (OECD) imposes restrictions on preferential taxation based on different vintages of capital[5]. Under a non-preferential regime, a government must also offer a tax rebate to the old capital (domestic) to offer discounts to attract more foreign capital in future. Hence, a government can commit to not offering larger tax discounts in future by committing to a non-preferential tax regime. This paper is similar to Kishore and Roy (2014). While Kishore and Roy (2014) consider small investors, I consider investors who are large (strategic). Bagnoli et al.(1989) show that when buyers are large 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 in which a single country wishes to attract two large investors who differ in their opportunity cost of relocating to the host country, and in which capital is sunk once it is invested. I compare the equilibrium tax revenues under different commitment abilities of the host government. First, we consider a "full commitment" outcome, where the host government commits to tax rates in present and future time periods and is applicable on domestic and foreign capital. Second, we also look at the outcomes without commitment, where the government cannot commit to future tax rates and is free to set different tax rates on capital of different vintages. Third, we look at the outcome when the government is not able to commit to future tax rates but is committed to setting an equal tax rate on capital of different vintages (non-preferential taxation). We find that

[3] See, for example, 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) offer an excellent survey on international tax competition and 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] The OECD (2000) report on Progress in Identifying and Eliminating Harmful Tax Practices lists many countries that still practice a preferential taxation scheme.

the tax revenue may be larger when the host government adopts a preferential taxation scheme that allows it to set different tax rates for different vintages of capital. Tax revenue under "full commitment" is equal to what the government can obtain under a "non-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 that are labeled H and L. Outside the host country, the net returns on the capital of an investor i is denoted as R_i, where $i = H,\ L$. Outside the host country, the investor H obtains a higher return on his investment, e.g., $R_H = \alpha R$, $R_L = R$, $\alpha \geq 1$ and $0 \leq \alpha R \leq 1$. Once invested in the host country, the gross return to capital is (before taxes) equal to 1 for both investors. In the basic model, we assume that the capital is fully sunk once invested. The cost of capital relocation to the host country is equal to 0 for both investors. In section 6, we relax these assumptions and analyze a scenario when invested capital is only partially sunk, and there is 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 the strategic interaction between the government and investors as a non-cooperative two-period dynamic game with perfect information. The outcome is a set of strategies that forms a subgame perfect Nash equilibrium of the game.

The history of the game prior to the period t is described by a list of the government's tax offers in period t through $t-1$ and investors who invest untill that period. A pure strategy is a function that specify 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 period t. The pure strategy of an investor in time period t is the investment decision in period t as a function of the tax rates in period t and the history of the game until 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 the other players. In this paper, we restrict the analysis to subgame-perfect equilibria in pure strategies[7].

We model the outcome of a two-period game under different commitment abilities of the government. In the next section, we analyze the outcome when the government can fully commit to future tax rates.

[7] See Bagnoli, et al. (1989) for an 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.

3 Outcome with full commitment

We begin with the benchmark case where the government can fully commit to future tax rates. The government announces the tax rate in period 1 (t_1), the tax rate on domestic capital in period 2 (t_2) and the tax rate on foreign capital in period 2 $\left(t^N\right)$. The government can commit to different tax rates on domestic and foreign capital in period 2. Lemma 1 describes the equilibrium outcome under full commitment.

Lemma 1 *Suppose the government can fully commit to future tax rates and, moreover, can commit to different tax rates based on different vintages of capital. The tax revenue of the government is*

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

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 commits to tax rates t^N and t_2 respectively, on foreign and domestic capital in period 2. Note that the government is free to set different tax rates on domestic and foreign capital in period 2. To maximize its tax revenue, the government must consider the following strategies that may not be dominated by other strategies: (1) attract both investors in period 1, (2) attract investor L in period 1 and set a high tax rate on foreign capital in period 2 to prevent investor L from waiting until period 2 (investor H stays out in both periods), (3) attract investor L in period 1 and set a tax rate low enough on foreign capital in period 2 to attract investor H, and (4) attract investor H in period 1 and set a tax rate low enough on foreign capital to attract investor L in period 2. We also show that it is never beneficial for the government to not attract any investors in period 1.

First, let us 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. Because the same investors pay taxes in both periods, only t_1+t_2 matters. Therefore, we assume that the government sets $t_2=1$. The maximum tax rate the government can set in period 1 if he wishes to attract both investors in period 1 is $1-2\alpha R$. Investors are also compensated for their loss of returns in period 2, and investor H can obtain $2\alpha R$ by staying out in both periods. The government receives $2\left(1-2\alpha R\right)$ and 2, respectively, in period 1 and period 2. Hence, the total tax revenue of the government is equal to

$$G^C = 4\left(1-\alpha R\right). \tag{1}$$

Let us consider scenario 2. In this case, the government receives taxes only from investor L. Because, the government does not want to attract investor H

in period 2 as well, it is optimal to set $t^N = t_2 = 1$. Given $t_2 = 1$, the maximum tax rate the government can set in period 1 to induce investment from investor L is $1-2R$ because investor L can obtain $2R$ as a return by staying out in both periods. Therefore, the total tax revenue of the government is

$$G^C = 2\left(1-R\right). \tag{2}$$

Let us consider scenario 3. This scenario may arise when αR is considerably higher than R, which makes it costly for the government to set a low tax rate in period 1 to attract both investors. The maximum tax rate the government can set on foreign capital in period 2 to induce investment from investor H is $t^N = 1-\alpha R$. If the government lowers t^N further, investor H pays lower taxes and investor L has more incentives to wait until period 2. Hence, the government sets $t^N = 1-\alpha R$. Given $t^N = 1-\alpha R$, if investor L decides to invest in period 2, his gain is equal to $\left(\alpha-1\right)R$. As before, let us assume that the government sets $t_2 = 1$. The maximum tax rate the government can set in period 1 to induce investment from investor L is $t_1 = 1-2R-\left(\alpha-1\right)R$. The government compensates investor L for his loss of returns and the tax rebate he can obtain by waiting until period 2 to make an investment. The government receives $1-2R-\left(\alpha-1\right)R$, 1 and $1-\alpha R$ respectively, as tax revenue from foreign capital in period 1, domestic capital and foreign capital in period 2. Hence, the total tax revenue of the government is equal to

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

Let us consider scenario 4. As before, let $t_2 = 1$. The maximum tax rate the government can set in period 1 in to induce investment from investor H is $1-2\alpha R$. If investor L decides to invest in period 1 itself, his gain is equal to $2\left(\alpha-1\right)R$. Hence, the maximum tax rate the government can set on foreign capital in period 2 to induce investment from investor L is $1-R-2\left(\alpha-1\right)R$. In this case, it is evident that it is better for the government to set $t^N > 1-R-2\left(\alpha-1\right)R$, and attract investor L in period 1 itself. Hence, the strategy for attracting investor H in period 1 and investor L in period 2 is strictly dominated by the strategy of attracting both investors in period 1 and set a forbiddingly high tax rate on foreign capital in period 2.

From the above discussion, it is evident that depending on the parameter values, the maximum tax revenue of the government is given by (1), (2) or (3). From (1) and (2), we can see that $4\left(1-\alpha R\right) \geq 2\left(1-R\right)$ when $\alpha \leq \frac{1}{2}+\frac{1}{2R}$. From (2) and (3), we have $2\left(1-R\right) \geq 3-R-2\alpha R$ when $\alpha \geq \frac{1}{2}+\frac{1}{2R}$. If there is no investment in period 1 then the maximum tax revenue that the government can earn in period 2 is $\max\left\{2\left(1-\alpha R\right),\ 1-R\right\}$, where $2\left(1-\alpha R\right)$ is the tax revenue when the government attracts both investors and $1-R$ is the tax revenue when the government attracts only investor L. Note that $2\left(1-\alpha R\right) < 4\left(1-\alpha R\right)$ and $2\left(1-\alpha R\right) \geq 1-R$ when $\alpha \leq \frac{1}{2}+\frac{1}{2R}$. Hence, the proof is complete. $\blacksquare$

When returns on capital outside the host country are similar, it is beneficial for the government to attract both investors in period 1. When investors opportunity cost of moving to the host country are very distinct, then it is beneficial for the government to receive taxes only from the investor with a lower opportunity cost of capital relocation. If the government offers a lower tax rate in period 2 to attract investor H, it also offers an incentive for investor L to wait until period 2. Hence, investor L needs to be compensated up-front in period 1 itself, which lowers the government's tax revenue.

4 Outcome with no commitment

We now look at a scenario in which the government cannot commit to future tax rates. In the literature, this scenario is described as a preferential regime. The government has the flexibility to set different tax rates depending on different vintages of capital, i.e., in period 2 the government set different tax rates on domestic capital (investment in period 1) and foreign capital (new investment). Proposition 1 describes the equilibrium outcome under a preferential regime.

Proposition 1. *Suppose the government cannot make any credible commitment about future taxes and, in particular, can engage in preferential taxation to attract new investors. 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 full commitment solution,* $G^C = G^{NC}$*. On the other hand, when* $\alpha > \frac{1}{2R}+\frac{1}{2}$*, the tax revenue of the government is larger than the full commitment solution,* $G^{NC} > G^C$*.*

Proof. First, consider the problem at the beginning period 2. The government has to consider four possible scenarios in period 2 : (1) none of the investors invests in period 1, (2) only investor L invests in period 1, (3) only investor H invests in period 1 and (4) both investors invest in period 1.

First, let us consider scenario 1. If both investors did not invest in period 1, then the government will either set $t^N = 1-\alpha R$ and attract both investors in period 2 or set a relatively higher tax rate $t^N = 1-R$ and attract only investor L. It is beneficial for the government to attract both investors in period 2 when

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

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

$$t^N = 1-\alpha R\ if\ \alpha \leq \frac{1}{2R}+\frac{1}{2}. \tag{5}$$

$$t^N = 1-R\ if\ \alpha > \frac{1}{2R}+\frac{1}{2}. \tag{6}$$

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

$$G_2^{NC} = 2(1-\alpha R) \ if \ \alpha \leq \frac{1}{2R} + \frac{1}{2}. \tag{7}$$

$$G_2^{NC} = 1 - R \ if \ \alpha > \frac{1}{2R} + \frac{1}{2}. \tag{8}$$

Let us consider scenario 2. Suppose only investor L invests in period 1. In this case, the decision of the government is simple; he sets $t_2 = 1$ and

$$t^N = 1 - \alpha R. \tag{9}$$

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

$$G_2^{NC} = 2 - \alpha R. \tag{10}$$

Let us consider scenario 3. Suppose only investor H invests in period 1. In period 2 it is optimal for the government to set $t_2 = 1$ and

$$t^N = 1 - R. \tag{11}$$

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

$$G_2^{NC} = 2 - R. \tag{12}$$

Let us consider scenario 4. If both investors invest in period 1, then the tax rate on foreign investment is irrelevant. Because investments are fully sunk, it is optimal for the government to set $t_2 \equiv 1$. The government's tax revenue in period 2 is equal to

$$G_2^{NC} = 2. \tag{13}$$

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, its tax revenue is equal to 2. Investor H can earn $2\alpha R$ by staying out in both periods. Hence, the maximum tax rate the government can set to attract both investors in period 1 is equal to $1 - 2\alpha R$. The government receives $2(1 - 2\alpha R)$ and 2, respectively, from the taxes in period 1 and period 2. From (9) and (11), it is evident that when one of the investors remains outside the host country, he does not gain from making an investment in period 2. Therefore, none of the investors has an incentive not to invest in period 1 when $t_1 = 1 - 2\alpha R$. The total tax revenue of the government is equal to

$$G^{NC} = 4(1 - \alpha R). \tag{14}$$

Let us consider the case when the government only wishes to attract investor L in period 1. In this case, the return of investor L is fully expropriated in period

2. Therefore, the maximum tax rate the government can set in period 1 to possibly induce investment from investor L is $1-2R$. However, if $t_1 = 1-2R$, from (7) and (8), it is evident that investor L will invest in period 1 only when $\alpha > \frac{1}{2}+\frac{1}{2R}$. When $\alpha \leq \frac{1}{2}+\frac{1}{2R}$, the gain for investor L from waiting until period 2 to make an investment is equal to $(\alpha-1)R$. Investor L will invest in period 1 if $t_1 \leq 1-2R-(\alpha-1)R \equiv 1-R-\alpha R$. In period 2, the tax revenue of the government is equal to $2-\alpha R$. In period 1, the tax revenue of the government is $1-2R$ and $1-2R-(\alpha-1)R$, respectively, when $\alpha > \frac{1}{2}+\frac{1}{2R}$ and $\alpha \leq \frac{1}{2}+\frac{1}{2R}$. Hence, the maximum tax revenue of the government is

$$G^{NC} = \begin{cases} 2(1-R)+1-\alpha R \; if \; \alpha > \frac{1}{2}+\frac{1}{2R} \\ 3-R-2\alpha R \; if \; \alpha \leq \frac{1}{2}+\frac{1}{2R} \end{cases} \tag{15}$$

Now let us consider the case when the government wants to attract only investor H in period 1. In this case, the return of investor H is fully expropriated in period 2. Therefore, the maximum tax rate the government can set in period 1 to induce investment from investor H is $1-2\alpha R$. If investor L also decides to invest when $t_1 = 1-2\alpha R$, his gain is equal to $2(\alpha-1)R$. Therefore, to keep investor L outside the country and attract him in period 2, the maximum rate the government can set on foreign capital in period 2 is $t^N = 1-R-2(\alpha-1)R \equiv 1+R-2\alpha R$. Note that $1+R-2\alpha R < 1-\alpha R$. Hence, if $t_1 = 1-2\alpha R$ and $t^N = 1-R-2\alpha R$, then investor H will also wait until period 2 to make investment. If the government reduces the tax rate in period 1, then he has to offer a lower tax rate in period 2 to attract investor L in period 2. Hence, the outcome where only investor H invests in period 1 and investor L invests in period 2 is not possible. If the government does not wish to attract foreign investment in period 1, he sets $t_1 = 1$. Using (5) and (6), the total tax revenue of the government is equal to

$$G^{NC} = \begin{cases} 2(1-\alpha R) \; if \; \alpha \leq \frac{1}{2R}+\frac{1}{2} \\ 1-R \; if \; \alpha > \frac{1}{2R}+\frac{1}{2} \end{cases} . \tag{16}$$

Comparing the tax revenues from (14) and (15), we can see that $4(1-\alpha R) \geq 2(1-R)+1-\alpha R$ when $\alpha \leq \frac{1}{3}+\frac{1}{3R}$. Given $\frac{1}{2}+\frac{1}{2R} > \frac{1}{3}+\frac{1}{3R}$, the proof is evident. Depending on the parameter values, the equilibrium strategies are dominant strategies. Hence, the equilibria are unique. ■

Under a preferential taxation scheme, the government can make the future tax rate dependent on the investor's investment decision in period 1. When $\alpha > \frac{1}{2R}+\frac{1}{2}$, if investor L invests in period 1, the tax rate in period 2 is $1-\alpha R$. However, the government can credibly convey 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 threats are not credible, which reduces the government's tax revenue.

5 Outcome with partial commitment

Finally, in this section, we consider a scenario where the government is committed not to extending any preferential treatment to new investors, i.e., to not 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 lowering the tax rates over time. Proposition 2 describes the equilibrium outcome.

Proposition 2. *Suppose the government is committed to a non-preferential taxation scheme. In a unique subgame-perfect equilibrium, the tax revenue of the government is*

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

The tax revenue of the government is equal to the full commitment solution. If $\alpha > \frac{1}{2R} + \frac{1}{2}$*, the tax revenue of the government under a non-preferential taxation scheme is lower than what it can obtain under a preferential taxation scheme,* $G^{PC} < G^{NC}$.

Proof. Suppose that the government sets the tax rate t_1 and t_2, respectively, in period 1 and period 2. First, 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 (5) and (6). The tax revenue of the government is given by (7) and (8). If only investor L invests in period 1, then the government can set the tax rate equal to 1 in period 2 and only receive taxes from domestic capital. If the government wants to attract investor H in period 2, then the maximum tax rate is equal to

$$t_2 = 1 - \alpha R. \tag{17}$$

The tax revenue of the government is

$$G_2^{PC} = \begin{cases} 2(1-\alpha R) \ if \ \alpha \leq \frac{1}{2R} \\ 1 \ if \ \ \alpha > \frac{1}{2R} \end{cases}. \tag{18}$$

Suppose that 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 it can set to induce investment from investor L. Hence, in this scenario

$$t_2 = \begin{cases} 1 - R \ if \ R \leq \frac{1}{2} \\ 1 \ if \ R > \frac{1}{2} \end{cases} \tag{19}$$

$$G_2^{PC} = \begin{cases} 2(1-R) \ if \ R \leq \frac{1}{2} \\ 1 \ if \ R > \frac{1}{2} \end{cases} \tag{20}$$

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 is given by (14). If the government does not want to attract investors in period 1, then he sets $t_1 = 1$ and receives tax revenue only in period 2. The tax revenue of the government, in this case, is given by (18). Now let us consider the scenario in which the government wants to attract investor L in period 1. When $\alpha \leq \frac{1}{2R}$, (17) gives the tax rate in period 2. If investor L invests in period 2, then his gain is equal to $(\alpha - 1) R$. If the government sets $t_1 = 1 - 2R$, then investor L is indifferent between making an investment in period 1 and not making investment in either period. 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. Therefore, investor L invests as long as $t_1 \leq 1 - 2R$. Hence, the tax rate in period 1 is

$$t_1 = \begin{cases} 1 - R - \alpha R \ if \ \alpha \leq \frac{1}{2R} \\ 1 - 2R \ if \ \alpha > \frac{1}{2R} \end{cases} \tag{21}$$

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

$$G^{PC} = \begin{cases} 3(1 - \alpha R) - R \ if \ \ \alpha \leq \frac{1}{2R} \\ 2(1 - R) \ \ if \ \alpha > \frac{1}{2R} \end{cases} . \tag{22}$$

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 (19) that investor H cannot 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

$$G^{PC} = \begin{cases} 3 - 2\alpha R - 2R \ if \ R \leq \frac{1}{2} \\ 2(1 - \alpha R) \ \ if \ R > \frac{1}{2} \end{cases} . \tag{23}$$

It is obvious that it is not beneficial for the government to not attract any investor in period 2. From (14), (22) and (23), it is evident that as long as $R \leq \frac{1}{2}$, it is beneficial for the government to attract both investors in period 1. The proof is complete once we observe that $4(1 - \alpha R) \geq 2(1 - R)$ when $\alpha \leq \frac{1}{2R} + \frac{1}{2}$. The uniqueness of the equilibria is evident from the fact that, depending on the parameter values, the equilibrium strategies are dominant strategies. ■

When the outside options (returns outside the host country) are similar, the government receives equal tax revenue under three taxation schemes discussed in this paper. When the outside options are considerably different, the government receives less tax revenue under a full commitment (non-preferential) solution compared to the preferential taxation scheme. When it is costly to attract both investors in period 1, under a preferential taxation scheme, the government can attract less willing investors in period 2 without providing equivalent tax relief to a more willing investor in period 1. Under a preferential taxation scheme, the government can credibly convey that if investor L does not invest in period 1, then in period 2, the tax rate will be considerably higher, which forbids investor L from waiting until period 2 without receiving tax relief in period 1. The government cannot follow this strategy under a non-preferential taxation scheme because it has to lower the tax rates on both domestic and foreign capital to induce foreign investment in period 2. In full commitment solution, when the government wishes to attract investor H in period 2, it commits to a low tax rate in period 2. A lower tax rate in period 2 provides an incentive to investor L to wait until period 2. Therefore, investor L has to be given an equivalent tax relief in period 1 or commit to a high tax rate in period 2 and forgo taxes from investor H in period 2, which reduces the tax revenue of the government.

6 Conclusion

We show that the result of Kishore and Roy (2014) does not hold when investors are large (strategic). When investors do not differ considerably, a preferential and a non-preferential regime generate equal tax revenue. However, when returns on capital are significantly different, the government earns strictly higher tax revenue 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 convey that if an investor does not invest in period one, the tax rate in the second period will be higher. Such strategies are not possible when there is a 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.

7 Appendix

This section analyzes the scenario in which 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 in 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. Lemma 2 and propositions 3-4 describe the equilibrium outcomes under full commitment, preferential and non-preferential taxation schemes, respectively.

Lemma 2 *Suppose the government can fully commit to future tax rates and, moreover, can commit to different tax rates based on different vintages of capital. When* $\alpha \leq \frac{1}{2R} + \frac{1}{2} - \frac{C}{4R}$*, the tax revenue of the government is equal to* $G^C \equiv$

$2\left(2-2\alpha R-C\right)$. *When* $\alpha > \frac{1}{2R}+\frac{1}{2}-\frac{C}{4R}$, *the tax revenue is equal to* $G^C \equiv 2-2R-C$.

Proof. The proof is similar to lemma 1. To maximize the tax revenue, the government has to consider the following strategies: (1) attract both investors in period 1, (2) attract investor L in period 1 and set a forbiddingly high tax rate on foreign capital in period 2, (3) attract investor H in period 1 and set a forbiddingly high tax rate on foreign capital in period 2, (4) attract investor L in period 1 and investor H in period 2 and (5) attract investor H in period 1 and investor L in period 2. We show that it is always beneficial for the government to keep an investor invested in the country in period 2 if he decide invest in period 1. We also show that it is not beneficial for the government to not attract any investor in period 1.

(1) Attract both investors in period 1 : The maximum tax rate the government can set in period 2 if he wishes to keep both investors invested in period 2 is $1-\lambda\alpha R$. Because the government can fully commit to future tax rates, only t_1+t_2 matters as long as $t_2 \leq 1-\lambda\alpha R$. Given $t_2 = 1-\lambda\alpha R$, the maximum tax rate with which the government in period 1 induces investment from investor H is $1-2\alpha R-C+\lambda\alpha R$. Hence, the total tax revenue of the government in this case is equal to

$$G^C = 2\left(2-2\alpha R-C\right). \tag{24}$$

(2) Attract investor L in period 1 and set a forbiddingly high tax rate on foreign capital in period 2 : The maximum tax rate the government can commit to in period 2 is $t_2 = 1-\lambda R$. Given $t_2 = 1-\lambda R$, the maximum tax rate the government can set in period 1 to induce investor L in period 1 is equal to $1-2R-C+\lambda R$. Hence, the total tax revenue of the government is equal to

$$G^C = 2-2R-C. \tag{25}$$

(3) Attract investor H in period 1 and set a forbiddingly high tax rate on foreign capital in period 2 : Investor H has a higher outside option. Hence, if it is beneficial for investor H in period 1, it is also beneficial for investor L to invest in period 1. Hence, this outcome is not possible.

(4) Attract investor L in period 1 and investor H in period 2 : The maximum tax rate the government can set on foreign capital in period 2 to induce investment from investor H is $1-\alpha R-C$. If the government commits to $t^N = 1-\alpha R-C$, then if investor L invests in period 2 his gain from relocating to the host country is equal to $\left(\alpha-1\right)R$. Suppose, the government commits to $t_2 = 1-\lambda R$. The maximum tax rate the government can set in period 1 is $t_1 = 1-2R-C+\lambda R-\left(\alpha-1\right)R$. Hence, the total tax revenue of the government is equal to

$$G^C = 3-2C-R-2\alpha R. \tag{26}$$

(5) Attract investor H in period 1 and investor L in period 2 : Note that if it is beneficial for investor H to invest in period 1, then it is also beneficial for investor L to invest. The minimum gain to investor L if he also chooses to

invest in period 1 is $2(\alpha-1)R$. Hence, investor L will wait until period 2 only if $t^N \leq 1-R-C-2(\alpha-1)R$. However, if $t^N \leq 1-R-C-2(\alpha-1)R$, investor H can also gain from waiting until period 2. Hence, the government can earn more by attracting both investors in period 1. Note that when both investors invest in period 1, investor H is indifferent between making an investment in period 1 and staying out in both periods. Additionally, the gain to investor L is $2(\alpha-1)R$.

Now the equilibrium outcomes can be obtained by comparing the tax revenues given by (24), (25) and (26). When $\alpha \leq \frac{1}{2R}+\frac{1}{2}-\frac{C}{4R}$, we have 2 $(2-2\alpha R-C) \geq 2-2R-C$. Additionally, $2-2R-C \geq 3-2C-R-2\alpha R$ when $\alpha \geq \frac{1}{2R}+\frac{1}{2}-\frac{C}{2R}$. Note that $\frac{1}{2R}+\frac{1}{2}-\frac{C}{2R} \leq \frac{1}{2R}+\frac{1}{2}-\frac{C}{4R}$ when $C \geq 0$ and $R > 0$. We need to show that when $\alpha \leq \frac{1}{2R}+\frac{1}{2}-\frac{C}{4R}$, it is beneficial for the government to keep both investors invested if both invest in period 1. Note that $2(1-\lambda\alpha R) \geq 1-\lambda R$ when $\alpha \leq \frac{1}{2\lambda R}+\frac{1}{2}$. Once we observe that $\frac{1}{2\lambda R}+\frac{1}{2} > \frac{1}{2R}+\frac{1}{2}-\frac{C}{4R}$, the proof is obvious. ■

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 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 the 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.

Proposition 3. Under a preferential taxation scheme, *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* $G^{NC} \equiv 2(2-2\alpha R-C)$, *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. First, let us look at the outcome in period 2. There are four different situations that the government can encounter period 2: (1) both investors invest in period 1, (2) only investor L invests in period 1, (3) only investor H invests in period 1 and (4) none of the investors invest in period 1. When both investors invest in period 1 and the government sets $t_2 = 1-\alpha\lambda R$, then both investors remain invested in period 2 as well. The total tax revenue of the government is equal to $2(1-\lambda\alpha R)$. If the government sets $t_2 = 1-\lambda R$, then only investor H remains invested in period 2 and the total tax revenue of the government is equal to $1-\lambda R$. Note that $2(1-\lambda\alpha R) \geq 1-\lambda R$ when $\alpha \leq \frac{1+\lambda R}{2\lambda R}$. Hence, the tax revenue of the government in period 2 when both investors invest in period 1 is

$$G_2^{PC} = \begin{cases} 2(1-\lambda\alpha R)\ if\ \alpha \leq \frac{1+\lambda R}{2\lambda R} \\ 1-\lambda R\ if\ \alpha > \frac{1+\lambda R}{2\lambda R} \end{cases}. \tag{27}$$

If only investor L invests in period 1, then it is optimal for the government to set $t_2 = 1-\lambda R$ and $t^N = 1-\alpha R-C$. The total tax revenue of the government in period 2 in this case is equal to

$$G_2^{PC} = 2-\lambda R-\alpha R-C. \tag{28}$$

If only investor H invests in period 1, then it is optimal for the government to set $t_2 = 1 - \lambda\alpha R$ and $t^N = 1 - R - C$. The total tax revenue of the government in period 2 in this case is equal to

$$G_2^{PC} = 2 - \lambda\alpha R - R - C. \tag{29}$$

If none of the investors invest in period 1, then the government can either set $t^N = 1 - \alpha R - C$ and attract both investors or set $t^N = 1 - R - C$ and attract only investor L. It is optimal for the government to attract both investors in period 2 when $2(1 - \alpha R - C) \geq 1 - R - C$, i.e., $\alpha \leq \frac{1+R-C}{2R}$. Hence, the total tax revenue of the government in period 2 is

$$G_2^{PC} = \begin{cases} 2(1 - \alpha R - C) \ if \ \alpha \leq \frac{1+R-C}{2R} \\ 1 - R - C \ if \ \alpha > \frac{1+R-C}{2R} \end{cases}. \tag{30}$$

Now let us look at the outcome in period 1. If the government wishes to attract both investors in period 1, the maximum tax rate it can levy depends on the outcome in period 2. In period 2, the net return on investment by investor H is $\lambda\alpha R$. To induce an investment from investor H, the government has to compensate for the cost of capital relocation C and the outside option $2\alpha R - \lambda\alpha R$. Hence, the maximum tax rate the government can levy in period 1 is equal to $1 - C - 2\alpha R + \lambda\alpha R$. Using (27), the total tax revenue of the government is equal to

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

If the government only wants to attract investor L in period 1, then the maximum tax rate it can levy in period 1 is equal to $1 - C - 2R + \lambda R$. Using (28), the total tax revenue of the government is equal to

$$G^{PC} = 3 - 2C - 2R - \alpha R. \tag{32}$$

If the government only wants to attract investor H in period 1, then the maximum tax rate it can levy in period 1 is equal to $1 - 2\alpha R - C + \lambda\alpha R$. In period 2, investor L is indifferent between making an investment in the host country and staying out. Hence, it is not possible for the government to attract only investor H in period 1. If the government sets a high tax rate so that none of the investors invests in period 1, then the total tax revenue of the government is given by (30). The equilibrium outcome can now be obtained from (31) and (32). It is obvious that the equilibrium is unique, because equilibrium strategies are dominant strategies. ■

Proposition 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* $G^{PC} \equiv 2(2 - 2\alpha R - C)$*. 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. First, we will look at the outcome in period 2. There are four different situations that the government can face in period 2: (1) both investors invest in period 1, (2) only investor L invests in period 1, (3) only investor H invests in period 1 and (4) none of the investors invest in period 1. When both investors invest in period 1, then the tax revenue of the government in period 2 is given by (27). Additionally, if none of the investors invest in period 1, then the tax revenue of the government is given by (30). If only investor L invests in period 1, then in period 2, the government can either set $t^N = 1 - \lambda R$ and obtain taxes only from investor L or set $t^N = 1 - \alpha R - C$ and attract investor H as well. Hence, the tax revenue of the government in period 2 is

$$G_2^{PC} = \begin{cases} 2\left(1 - \alpha R - C\right) \ if \ \alpha \leq \frac{1-2C+\lambda R}{2R} \\ 1 - \lambda R \ if \ \alpha > \frac{1-2C+\lambda R}{2R} \end{cases} . \tag{33}$$

Similarly, if only investor H invests in period 1, then in period 2, the government can either set $t^N = 1 - \lambda\alpha R$ and receive taxes only from investor H or set $t^N = 1 - R - C$ and attract investor L as well. Hence, the tax revenue of the government in period 2 is

$$G_2^{PC} = \begin{cases} 2\left(1 - R - C\right) \ if \ \alpha \geq \frac{2R+2C-1}{\lambda R} \\ 1 - \lambda\alpha R \ if \ \alpha < \frac{2R+2C-1}{\lambda R} \end{cases} . \tag{34}$$

Now let us look at the outcome in period 1. When both investors invest in period 1 and none of the investors invest in period 1, then the tax revenue of the government is given by (31) and (30), respectively. If the government wishes to attract only investor L in period 1, then if $\alpha > \frac{1-2C+\lambda R}{2R}$, the maximum tax rate the government can set in period 1 is equal to $1 - 2R - C + \lambda R$. Using (33), the total tax revenue of the government is

$$G^{PC} = 2 - 2R - C. \tag{35}$$

The equilibrium outcome can be obtained by comparing (31) and (35). We can see that $2\left(2 - 2\alpha R - C\right) \geq 2 - 2R - C$ when $\alpha \leq \frac{1}{2R} + \frac{1}{2} - \frac{C}{4R}$. Now we need to show that neither investor nor the government has the incentive to deviate unilaterally. When $\frac{1}{2R} + \frac{1}{2} - \frac{C}{4R}$, investor H is indifferent between making an investment in period 1 and staying out in both periods. If he decides not to invest in period 1, then in period 2, the tax rate is given by (33). Whether or not the government chooses to attract investor H in period 2, investor H cannot do better. Hence, he has no incentive to deviate. Similarly, if investor L decides against making investment in period 1, the tax rate in period 2 is given by (34). Whether or not the government chooses to attract investor L in period 2, he cannot gain from making an investment in period 2. Hence, both investors have no incentive to deviate unilaterally. We need to show that the government has no incentive to deviate unilaterally. Note that when $\alpha \leq \frac{1}{2R} + \frac{1}{2} - \frac{C}{4R}$, the tax rate in period 2 on domestic capital is $1 - \lambda\alpha R$. When $\alpha \leq \frac{1}{2} + \frac{1}{2\lambda R}$, then $2\left(1 - \lambda\alpha R\right) \geq 1 - \lambda R$, and it is better for the government to receive taxes from both investors (if both invest in period 1). Note that $\alpha \leq \frac{1}{2} + \frac{1}{2\lambda R}$ implies that $\alpha \leq \frac{1}{2R} + \frac{1}{2} - \frac{C}{4R}$. Hence, the proof is complete. ■

We can see that the tax revenue of the government does not depend on whether investments are fully or partially sunk. Investors are compensated upfront for their loss of returns in period 2. The tax revenue of the government only depends on the investor's outside option.

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