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## On generating efficiency through public-private joint ventures

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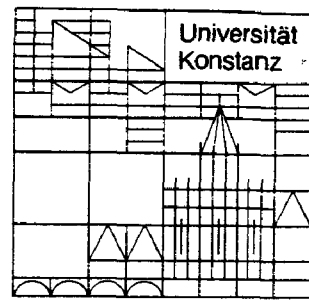
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**Sonderforschungsbereich 178  
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**Diskussionsbeiträge**



**Juristische  
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**Fakultät für Wirtschafts-  
wissenschaften und Statistik**

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**Udo Broll  
Sugata Marjit**

**On Generating Efficiency  
through Public-Private Joint Ventures**

**ON GENERATING EFFICIENCY THROUGH  
PUBLIC-PRIVATE JOINT VENTURES**

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# On Generating Efficiency through Public–Private Joint Ventures

## Abstract

International joint ventures (JV) are popular institutional forms chosen by the less developed countries (LDCs) to attract foreign investments. In this paper we describe a set up where a multinational firm (MNF) decides on the volume of investment and the LDC government offers a package specifying taxes and sharing rules by a JV contract. Such sharing rules can be designed to enhance the level of optimal investment under the presence of distortions and asymmetric information. We also provide an example where a JV contract might not work. In general, JV contracts lead to efficient outcomes.

## 1 Introduction

Joint ventures (JV), as organizational forms to attract foreign investments in the less developed countries (LDCs), are growing in numbers. Typically investment JV are of two types. One, where foreign firms collaborate with a local firm in the host country through equity participation. Two, where foreign firms join in with local governments through the sharing of investments and profits. Although empirical evidence on JVs is not difficult to find, relatively few theoretical studies have been done in this area.

Campbell (1988) discusses the importance of equity joint ventures in China by estimating that 49 % of total investments come under equity cum profit sharing ventures. This was also noted by Chan and Hoy (1991). The new liberalization schemes adopted in Indian economic policy as well as emerging changes in the eastern European political scene suggest that JV are going to assume significant importance in the near future.

The theoretical literature on JV is rather small. Svejnar and Smith (1984) discuss a tripartite joint venture scheme involving the local government, the local firm and the foreign investor by introducing a bargaining framework as a surplus sharing scheme. Gangopadhyay and Gang (1989) discuss different types of government policies for reaching different targets, particularly discussing the transfer-pricing strategy of the multinational firm. Falvey and Fried (1986) developing on Katrak (1983) discuss why equity-control can benefit the local government when the foreign investor is already engaged in optimal transfer-pricing. Marjit (1990) analyzes a situation where investment sharing by the host government establishes the credibility of government policy in the face of a potential threat of expropriation. Chan and Hoy (1991) provide an extensive analysis of the 'buy-back' arrangement between a government and a foreign firm.<sup>1</sup>

But none of the papers focuses on the incentive effects of equity JV schemes. Choice of 'joint ventures' as organizational forms is usually supported by the idea that in an economy, politically antagonistic towards foreign capital, JV is a way to ascertain partial control of the host country on a new investment project. It is a 'go-between' the full ownership of foreign investor and pure technology agreement involving no foreign equity control. We believe that there are significant economic arguments in favor of JVs and the efficiency creating effects of public-private JV can easily substitute the heuristic argument mentioned above. JVs, though observed as a surplus sharing scheme, actually help to create larger surplus. JVs also help to remove or reduce the degree of various kinds of distortions.

In this study we describe a set up where the foreign investor decides on the volume of investment and the local public authorities offer them a package specifying taxes and sharing rules. Such sharing rules can be designed to

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<sup>1</sup>For a parallel literature on licensing and direct foreign investment see Casson and Pearce (1987), Horstmann and Markusen (1987). Also see Schweinberger (1991) for production joint ventures in mixed economies.

enhance the level of optimal investment under the presence of distortions and asymmetric information between the JV parties. The gain by having a joint venture is the increased total net surplus due to the elimination of the distortion present in a non-joint venture arrangement.

The paper is divided into four sections. In *section 2* we discuss the basic model and introduce the mechanism of the JV contract. We then show how the model can be altered to incorporate asymmetric information between the venture parties as well as uncertain tax environment. We also discuss the case of a risk-averse MNF and the efficiency of a possible JV contract. In *section 3* we highlight a possibility where JV scheme might cease to be feasible. In *section 4* we conclude the paper after some general remarks.

## 2 The model

In this section we study the arrangement the multinational firm (MNF) and the host country government will enter into and how a public-private joint venture (JV) can influence the outcome. JVs are contractual relationships as they involve binding commitments on the amount of investment and the division of the net surplus between the host country government and the MNF. For the basic model and the extensions of the model the important question is whether a pareto-superior JV contract is feasible.

To build up the basic model we shall use the following notations:

- $I$  investment
- $R$  gross future profits
- $s$  gross profit tax rate
- $r$  the common rate of discount
- $\theta_1$  share of gross profits accrued to the MNF

- $\theta_2$  share of investment borne of the MNF.

We assume that there is a MNF which is interested in making an investment in the host country concerned. In the initial period it invests  $I$  and gets  $R(I)/(1+r)$  in the next period. The benchmark case is the one where the government charges  $s$  as a tax on  $R(I)$  and the MNF chooses  $I$  to maximize:<sup>2</sup>

$$\frac{(1-s)R(I)}{1+r} - I. \quad (1)$$

This yields

$$\frac{R'(I^s)}{1+r} = \frac{1}{1-s}. \quad (2)$$

For any given  $s$ , the MNF undertakes  $I^s$ , earning  $(1-s)R(I^s)/(1+r) - I^s$  and we assume that  $s$  is such that the firm at least earns a higher profit than the one obtainable from the same level of investment in the rest of the world. The non-joint venture (NJV) contract will be referred to this benchmark case where the government earns  $sR(I^s)/(1+r)$ .

Now we introduce the JV contract in the following way. For any given  $s$  the government offers a sharing rule  $C(\theta_1, \theta_2 | s)$  where  $\theta_1$  is the share of gross profits and  $\theta_2$  is the share of investment of the MNF. Obviously the shares of the host country government are  $(1 - \theta_1, 1 - \theta_2)$ . The question is whether  $C(\theta_1, \theta_2 | s)$  exists such that the system generates greater surplus than the benchmark case. We assume that if a JV contract creates greater surplus than  $R(I^s)/(1+r) - I^s$ , the government gets the whole additional gain and the MNF's reservation pay-off is determined by the NJV case. This is a simplifying assumption and does not affect the qualitative results we derive in this study.

The government's problem is to choose  $C(\theta_1, \theta_2 | s)$  such that

$$\frac{R(I)}{1+r} - I - \left[ \frac{(1-s)\theta_1 R(I)}{1+r} - \theta_2 I \right] \geq \frac{sR(I^s)}{1+r}, \quad (3)$$

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<sup>2</sup>We focus on the foreign capital income taxation which has been extensively discussed in the literature, such as Hartman (1985). This is the most common form of taxation observed.



subject to the participation constraint by the MNF:

$$\frac{(1-s)\theta_1 R(I)}{1+r} - \theta_2 I = \frac{(1-s)R(I^s)}{1+r} - I^s. \quad (4)$$

Substitution of (4) into (3) tells us that for the JV contract to be *feasible* the new level of investment  $I(\theta_1, \theta_2, s)$  generated through the JV contract must satisfy the following condition:

$$\frac{R(I)}{1+r} - I \geq \frac{R(I^s)}{1+r} - I^s.$$

Note that  $R(I)/(1+r) - I$  reaches a maximum value for  $I = I^0$ , where  $R'(I^0)/(1+r) = 1$  and

$$\frac{R(I^0)}{1+r} - I^0 > \frac{R(I^s)}{1+r} - I^s.$$

Now we are in a position to write down the following proposition:

**Proposition 1** *For  $\theta_1 = \theta_2/(1-s)$ , a JV contract pareto-dominates the NJV contract.*

*Proof.* As the MNF maximizes the LHS of the participation constraint (4) to find out the optimal investment level, it must choose  $I = I^0$ , as  $(1-s)\theta_1 = \theta_2$  and by definition of  $I^0$  we know  $R(I^0)/(1+r) - I^0 > R(I^s)/(1+r) - I^s$ . Hence, although the MNF gets its NJV pay-off, the government obtains a greater pay-off than  $sR(I^s)/(1+r)$ . *QED*

The intuition behind the result is simple to follow. By choosing  $\theta_1 = \theta_2/(1-s)$ , the JV contract eliminates the distorting effect of a gross profit tax. The MNF is then induced to choose  $I^0$ , leading to a larger surplus both parties can share. By choosing the principal-agent relationship between the government and the firm, we highlight one of the many possible bargaining solutions. But designed this way a JV contract is pareto-superior to a NJV contract. Interestingly if in the NJV case the tax rate  $s$  was chosen to maximize tax revenue (assuming such  $s$  exists), the government can do better by offering a JV contract and earn more just by inducing the MNF to invest more given such a tax rate.

## Asymmetric Information

Suppose that MNF does not report the true profits to the government but hides a part of it. This might be due to informational problems or the phenomenon of transfer-pricing.

Let  $\tilde{R}(I)$  be the true profit and  $R(I) = \tilde{R}(I) - F$  is the reported profit ( $F > 0$  and  $\tilde{R}' > 0, \tilde{R}'' < 0$ ).  $F$  is unknown to the government. Without a sharing scheme, the MNF maximizes

$$\frac{\tilde{R}(I)}{1+r} - \frac{sR(I)}{1+r} - I \quad (5)$$

or

$$\frac{\tilde{R}(I)(1-s)}{1+r} + \frac{sF}{1+r} - I.$$

This yields,

$$\tilde{R}'(I^s) = \frac{1+r}{1-s}. \quad (6)$$

Note that since the government knows  $s, r$  and the MNF's objective function,  $I^s$  must satisfy  $R'(I^s)/(1+r) = 1/(1-s)$  which is satisfied given (6) and the definition of  $R(I)$ .<sup>3</sup>

The problem of the government is to choose  $C(\theta_1, \theta_2 | s)$  such that:

$$\frac{R(I)}{1+r} - I - \left[ \frac{(1-s)\theta_1 R(I)}{1+r} - \theta_2 I \right] \geq \frac{sR(I^s)}{1+r}, \quad (7)$$

subject to the MNF's participation constraint

$$\frac{\theta_1(\tilde{R}(I) - R(I))}{1+r} + \frac{(1-s)\theta_1 R(I)}{1+r} - \theta_2 I \geq \frac{\tilde{R}(I^s) - R(I^s)}{1+r} + \frac{(1-s)R(I^s)}{1+r} - I^s. \quad (8)$$

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<sup>3</sup>Otherwise the firm can not misreport its profits. If the government knows  $s, r$  and  $R(I)$ , it also knows that  $I^s$  is the optimal investment by the firm.

Also note that given  $(\theta_1, \theta_2)$  the MNF maximizes the following objective function:

$$\frac{\theta_1 \tilde{R}(I)}{1+r} - \frac{s\theta_1 \tilde{R}(I)}{1+r} + \frac{s\theta_1 F}{1+r} - \theta_2 I \quad (9)$$

which yields,

$$\tilde{R}'(I) = \frac{1+r}{1-s} \cdot \frac{\theta_2}{\theta_1} \quad (10)$$

**Corollary 1** *In the case where the host country government does not know the true income of the foreign firm,  $\exists$  a JV contract which pareto-dominates the NJV contract.*

*Proof.* Suppose  $(\theta_1, \theta_2)$  are so chosen that (8) is satisfied with equality. Rewriting (9) one gets

$$\frac{(1-s)\theta_1 R(I)}{1+r} - \theta_2 I - \frac{(1-s)R(I^s)}{1+r} + I^s = \frac{F(1-\theta_1)}{1+r}. \quad (11)$$

Using (7) and (11) we can rewrite the incentive compatibility condition for the government as

$$\frac{R(I)}{1+r} - I - \frac{F(1-\theta_1)}{1+r} > \frac{R(I^s)}{1+r} - I^s. \quad (12)$$

Consider a contract  $C(\theta_1, \theta_2 | s)$  which specifies  $\theta_1 = 1$ . Then, as (12) has to be satisfied, one can find out

$$\theta_2 = \left( \frac{(1-s)R(I)}{1+r} - I - \left[ \frac{(1-s)R(I^s)}{1+r} - I^s \right] \right) / I.$$

Observe that  $\theta_2$  is less than 1

$$\theta_2 - 1 = \left( \frac{(1-s)R(I)}{1+r} - I - \left[ \frac{(1-s)R(I^s)}{1+r} - I^s \right] \right) / I < 0 \quad (13)$$

as  $I^s$  maximizes  $(1-s)R(I)/(1+r) - I$ . Also note that  $\theta_2 > 1-s$ . Suppose  $\theta_2 = 1-s$ , then we know that  $\tilde{R}'(I^0)/(1+r) = 1$  (from (11)) which determines the optimal investment level  $I^0$ . Hence,  $R(I^0)/(1+r) - I^0 > R(I^s)/(1+r) - I^s$ .

Also note that given  $(\theta_1, \theta_2)$  the MNF maximizes the following objective function:

$$\frac{\theta_1 \tilde{R}(I)}{1+r} - \frac{s\theta_1 \tilde{R}(I)}{1+r} + \frac{s\theta_1 F}{1+r} - \theta_2 I \quad (9)$$

which yields,

$$\tilde{R}'(I) = \frac{1+r}{1-s} \cdot \frac{\theta_2}{\theta_1} \quad (10)$$

**Corollary 1** *In the case where the host country government does not know the true income of the foreign firm,  $\exists$  a JV contract which pareto-dominates the NJV contract.*

*Proof.* Suppose  $(\theta_1, \theta_2)$  are so chosen that (8) is satisfied with equality. Rewriting (9) one gets

$$\frac{(1-s)\theta_1 R(I)}{1+r} - \theta_2 I - \frac{(1-s)R(I^s)}{1+r} + I^s = \frac{F(1-\theta_1)}{1+r}. \quad (11)$$

Using (7) and (11) we can rewrite the incentive compatibility condition for the government as

$$\frac{R(I)}{1+r} - I - \frac{F(1-\theta_1)}{1+r} > \frac{R(I^s)}{1+r} - I^s. \quad (12)$$

Consider a contract  $C(\theta_1, \theta_2 | s)$  which specifies  $\theta_1 = 1$ . Then, as (12) has to be satisfied, one can find out

$$\theta_2 = \left( \frac{(1-s)R(I)}{1+r} - I - \left[ \frac{(1-s)R(I^s)}{1+r} - I^s \right] \right) / I.$$

Observe that  $\theta_2$  is less than 1

$$\theta_2 - 1 = \left( \frac{(1-s)R(I)}{1+r} - I - \left[ \frac{(1-s)R(I^s)}{1+r} - I^s \right] \right) / I < 0 \quad (13)$$

as  $I^s$  maximizes  $(1-s)R(I)/(1+r) - I$ . Also note that  $\theta_2 > 1-s$ . Suppose  $\theta_2 = 1-s$ , then we know that  $\tilde{R}'(I^0)/(1+r) = 1$  (from (11)) which determines the optimal investment level  $I^0$ . Hence,  $R(I^0)/(1+r) - I^0 > R(I^s)/(1+r) - I^s$ .

Hence, if  $\theta_2 = 1 - s$  (9) will not hold with equality. To show this substitute  $\theta_2 = 1 - s$  in (9) to get

$$\frac{R(I^0)}{1+r} - I^0 = \frac{R(I^s)}{1+r} - I^s - \frac{sI^s}{1+r}$$

which can not be true as  $I^0$  maximizes  $R(I)/(1+r) - I$ . Therefore,  $\theta_2 > 1 - s$ . Now,  $\tilde{R}'(I)/(1+r) = \theta_2/(1-s) < 1/(1-s)$  implies  $I > I^s$ . But  $I < I^0$  as  $\theta_2 > 1 - s$ . We know for all  $I < I^0$ ,  $\tilde{R}(I)/(1+r) - I$  is increasing (so is  $R(I)/(1+r) - I$ ) in  $I$ . Therefore,  $R(I)/(1+r) - I > R(I^s)/(1+r) - I^s$  which satisfies (13). Hence  $\exists$  a JV contract  $[\theta_1 = 1, 1 > \theta_2 > 1 - s]$  which pareto-dominates the NJV contract. *QED*

The intuitive explanation of this result is as follows. By choosing  $\theta_1 = 1$ , the government allows the MNF to earn the same amount  $F$  through misreporting. But by choosing  $\theta_2$  appropriately it can wipe out the gap between the reported profits of NJV and JV contract. With  $\theta_2 < 1$  investment increases and the government bags the entire surplus.

## *Uncertain Taxation*

Until now we have assumed that the government can credibly precommit to a tax rate as well as to a JV sharing rule. But now consider a situation where the host country government can not credibly precommit to an announced tax rate but can write a binding JV contract.<sup>4</sup> The MNF internalizes such a possibility. Let  $s_A$  be the announced tax rate. But for the MNF the tax rate follows a distribution  $s \in [s_A, 1]$  with a density  $f(s)$  also known to

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<sup>4</sup>Although we do not explicitly prove that it is easier for the government to commit to a JV contract rather than to a tax, there might be strategic reasons for the host country government not to renege on a JV arrangement: as the government shares the sunk cost, the risk faced by the MNF of being a hostage is reduced. For a discussion on a related issue see Marjit (1990).

the government. The MNF believes that the tax can increase with certain probabilities.

The MNF chooses  $I$  to maximize (assuming that the MNF is risk-neutral):

$$\frac{(1 - \bar{s})R(I)}{1 + r} - I,$$

where  $\bar{s} = \int_{s_A}^1 s f(s) ds$  is the expected tax rate, which yields  $I = I^{\bar{s}}$ . The government gets  $s_A R(I^{\bar{s}})/(1 + r)$ .

In a JV contract the government wants to choose  $C(\theta_1, \theta_2 | s_A)$  such that

$$\frac{R(I)}{1 + r} - I - \left( \frac{(1 - \bar{s})\theta_1 R(I)}{1 + r} - \theta_2 I \right) \geq \frac{s_A R(I^{\bar{s}})}{1 + r}, \quad (14)$$

subject to the participation constraint by the MNF

$$\frac{(1 - \bar{s})\theta_1 R(I)}{1 + r} - \theta_2 I = \frac{(1 - \bar{s})R(I^{\bar{s}})}{1 + r} - I^{\bar{s}}, \quad (15)$$

If the government chooses  $\theta_1 = \theta_2/(1 - \bar{s})$ , the firm chooses  $I = I^0$ , then substituting (15) into (14) we get that the JV contract is feasible as,

$$\frac{R(I^0)}{1 + r} - I^0 > \frac{R(I^{\bar{s}})}{1 + r} - I^{\bar{s}} + \frac{(s_A - \bar{s})R(I^{\bar{s}})}{1 + r}, \quad (16)$$

with  $s_A < \bar{s}$ .

**Corollary 2** *When the host country government fails to precommit to a tax rate but can write a binding JV contract,  $\exists$  a JV scheme which pareto-dominates a NJV scheme.*

*Proof.* Follows directly from (16).

Note that in this case a JV scheme removes two types of distortions. First, it removes the distortion caused by the distortinary tax in the NJV case. Second, it removes the distortion caused by the failure of the host country government to precommit to the announced tax rate. Since the firm did not believe the government, the system initially was losing a surplus of  $(s_A - \bar{s})R(I^{\bar{s}})/(1 + r)$  which now can be revived through the JV contract.

## *Risk-averse firm*

Extending the analysis of the foregoing discussion we assume that the foreign firm not only cares about an expected tax rate such as  $\bar{s}$  but also takes into account the variability of the tax rate. So the uncertain tax rate  $\tilde{s}$  is distributed over  $[s_A, 1]$  with a mean  $\bar{s}$  and a variance  $V$ . The objective function of the MNF is given by mean-variance preference

$$U(I) = E\Pi(I) - \alpha V(\Pi(I))/2, \quad (17)$$

where  $E\Pi(I)$  denotes the expected profit from an investment  $I$ ,  $V(\Pi(I))$  denotes the variance of the pay-off and  $\alpha > 0$  is the degree of constant risk aversion. Using  $\Pi(I) = (1 - \tilde{s})R(I)/(1 + r) - I$ , one can rewrite (17) as,

$$U(I) = \frac{(1 - \bar{s})R(I)}{1 + r} - I - \frac{\alpha}{2} V\left(\frac{R(I)}{1 + r}\right)^2. \quad (18)$$

Given  $(\bar{s}, V)$  the firm chooses  $\hat{I}$  to maximize (18). The government gets  $s_A R(\hat{I})/(1 + r)$ .<sup>5</sup> When  $V$  was zero, we have already seen how a JV contract can dominate a NJV arrangement. In this case, as we shall see, there is another role of JV contract which reduces the variability of MNF's profits and induces the firm to invest more.

The government's problem is to choose  $C(\theta_1, \theta_2 | s_A)$  such that

$$\frac{R(I)}{1 + r} - I - \left( \frac{(1 - \bar{s})\theta_1 R(I)}{1 + r} - \theta_2 I \right) \geq \frac{s_A R(\hat{I})}{1 + r}, \quad (19)$$

subject to the participation by the MNF,

$$U(I, \theta_1, \theta_2) \geq U(\hat{I}). \quad (20)$$

We now show that there exists a  $C(\theta_1, \theta_2)$  where both (19) and (20) hold with strict inequality. Let  $(\theta_1, \theta_2)$  be such that

$$\frac{(1 - \bar{s})\theta_1 R(I)}{1 + r} - \theta_2 I = \frac{(1 - \bar{s})R(\hat{I})}{1 + r} - \hat{I}. \quad (21)$$

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<sup>5</sup>For the existence of a maximum, one has to assume that  $1 > \alpha V R(I)/(1 + r)(1 - \bar{s})$  for all permissible  $I$ .

From (18) and (21) we obtain

$$U(\hat{I}, \theta_1, \theta_2) = \frac{(1 - \bar{s})R(\hat{I})}{1 + r} - \hat{I} - \frac{\alpha}{2}\theta_1^2 V\left(\frac{R(\hat{I})}{1 + r}\right)^2. \quad (22)$$

Since  $\theta_1 < 1$ ,  $\partial U(\hat{I}, \theta_1, \theta_2)/\partial \hat{I} > 0$  (which follows from (18)). Hence, the new choice of investment is  $I > \hat{I}$  and  $U(I, \theta_1, \theta_2) > U(\hat{I})$  satisfying (20). Now from (19) and (21) we know that the government would be better off iff:

$$\frac{R(I)}{1 + r} - I > \frac{R(\hat{I})}{1 + r} - \hat{I} + \frac{(s_A - \bar{s})R(\hat{I})}{1 + r}. \quad (23)$$

We know that  $R'(I^0)/(1 + r) = 1$  as  $R(I)/(1 + r) - I$  reaches a maximum for  $I = I^0$ . Hence, for all  $I < I^0$ :  $R(I)/(1 + r) - I$  is increasing. We also know from (22),

$$\frac{R'(I)}{1 + r} - \frac{\alpha\theta_1^2 V R'(I) R(I)}{(1 - \bar{s})(1 + r)^2} = \frac{1}{(1 - \bar{s})}$$

or

$$\frac{R'(I)}{1 + r} = \left(\frac{1}{1 - \bar{s}}\right) \left(\frac{1}{1 - \frac{\alpha\theta_1^2 V R(I)}{(1 - \bar{s})(1 + r)}}\right) > 1,$$

implying  $I < I^0$ , but  $\hat{I} < I$ . Hence,  $R(I)/(1 + r) - I > R(\hat{I})/(1 + r) - \hat{I}$  satisfying (20).

**Corollary 3** *In the case of a risk-averse MNF facing uncertain tax rate,  $\exists$  a JV contract that pareto-dominates a NJV contract.*

*Proof.* Follows from the above discussion.

### 3 Infeasibility of JV

#### *Different discount rates*

Here we provide an example where JV contract might not be feasible. Suppose the discount rate of the government  $r_g$  is different from the private discount



rate of the MNF (i.e.  $r_g \neq r$ ).<sup>6</sup> Then it can be shown that whenever the government's discount rate  $r_g$  is greater than private discount rate  $r$  then a JV might not be feasible. Or in other words the necessary condition for a JV might not hold.

With different discount rates the government chooses  $\theta_1$  and  $\theta_2$  such that

$$\frac{R(I^0)}{1+r_g} - I^0 - \left[ \frac{(1-s)\theta_1 R(I^0)}{1+r} - \theta_2 I^0 \right] \geq \frac{sR(I^s)}{1+r_g}, \quad (24)$$

subject to the participation constraint of the MNF:

$$\frac{(1-s)\theta_1 R(I^0)}{1+r} - \theta_2 I^0 = \frac{(1-s)R(I^s)}{1+r} - I^s. \quad (25)$$

Combining (24) and (25) we obtain

$$\frac{R(I^0)}{1+r} - I^0 \geq \frac{R(I^s)}{1+r} - I^s + [sR(I^s) - R(I^0)] \frac{(r-r_g)}{(1+r_g)(1+r)}. \quad (26)$$

**Corollary 4** *When the discount rate of the host country government is greater than the private discount rate then a JV contract might not be feasible.*

*Proof.* Consider (26). If  $r_g > r$ , the second term on the RHS is positive as  $sR(I^s) < R(I^0)$ . Hence,  $I = I^0$  may not satisfy the constraint. *QED*

If  $r_g > r$ , the government is a costly partner. It can invest with a higher cost than the firm. Hence, sharing of investment by the government increases the cost of the project. Now, there is a trade-off between increasing investment and increasing cost. Therefore, the result can go either way.

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<sup>6</sup>This assumption is consistent with the general observation regarding the inability of the LDCs to raise capital in the international market. Although a MNF can raise capital at an ongoing world interest rate, a large debtor LDC would find it very hard to do the same. One can easily incorporate  $r_g$  as an increasing function of  $(1-\theta_2)I$  in this analysis. We think that  $r_g > r$  is not an unrealistic assumption.

## 4 Conclusions

In this paper we have discussed various cases where public–private joint ventures can increase the efficiency of an investment project. We argued that a joint venture contract can dominate contracts involving foreign direct investment and distortionary taxes. Although we deal with an extremely stylized model, the message of the paper can be extended in terms more complicated analytical structures. If one looks carefully at the basic sharing scheme, it would be evident that a sharing rule such as  $\theta_1 = \theta_2$  does not eliminate the distortary effect of a gross profit tax.  $\theta_1$  has to be always greater than  $\theta_2$  for  $s > 0$ .

The case with uncertain taxes assumes that the government can commit to a joint venture contract but not to a tax rate. Hence, the ability to precommit to a particular policy vis-a-vis the other becomes important. What we suggest is that if some policies are easier to precommit, then the public authorities should choose such instruments appropriately to achieve the efficient outcome.

One extension of our analysis is to consider the case where the local firm is one of the partners under the joint venture contract. If patent rights are difficult to protect, the foreign firm might not be willing to participate in such a venture for possible 'leakage' of the secret. A bunch of strategic issues can be discussed in that context. However, by the same logic a foreign investor can transfer technology more freely if the joint venture scheme gives the firm some control over the subsequent use of the technology. In that case a JV contract would be favorable to a pure technology agreement without any equity–participation by the foreign firm.

The way we have developed our structure, a joint venture contract might be used even to precommit to a particular tax rate. Consider the last part of the second section and assume that although the government has the intention of sticking to a tax  $s \neq \bar{s}$ , the firm does not believe it. Also assume

that the government can credibly precommit a JV contract but not a tax rate. Then it is easy to show that a sharing scheme that keeps the expected income of the firm intact, given the level of investment  $I^{\bar{s}}$ , will be accepted by the government only if  $s \leq \bar{s}$ . In other words if the government rejects such a scheme, the firm has all the reasons to believe that  $s > \bar{s}$ . A Bayesian analysis of this problem is a natural extension of our work.

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