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# Competition for Natural Resources and the Hold-Up Problem\*

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## Abstract

We study the role of competition for the hold-up problem in foreign direct investment in resource-based industries. The host country government is not only unable to commit not to expropriate investment ex post, but is also unable to commit to the provision of local resources. In the case of competition for local resources this dual commitment problem triggers higher investment levels, increases host countries revenues, but hurts profits of international investors. Domestic firms can play a similar role as an alternative instrument for host country governments to generate higher foreign investment in an environment of weak property rights.

JEL classification: F21, F23, Q34.

Keywords: foreign direct investment, natural resources, hold-up problem.

## 1 Introduction

The sustained growth of emerging economies has substantially increased worldwide demand for natural resources. Countries like China, India and Brazil, alongside other Asian or Latin America economies are expected to dominate world demand for non-renewable resources such as oil in only a few years. In fact, China has recently overtaken the US as the single largest importer of oil, while in 2010 its oil imports were only little more

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than one-half of those of the US. And despite new discoveries of mostly so-called non-conventional oil and gas, the increase in demand and production costs will ensure that prices of fossil fuels will remain high for the foreseeable future (Jacks 2012). Not surprisingly, especially countries that depend on imports of such resources increasingly discuss the issue of resource security, which has also become a topic for international fora such as the G20. Increased competition for scarce resources has led to popular talk about "resource wars", a "new scramble for Africa" or a "new great game" for access to Central Asian gas and oil (Cooley 2012, Halpern 2010, Shambaugh 2013).

As a corollary of this development, multi-national corporations (MNCs) in natural resource industries from emerging economies have been seeking better access to resources and upstream integration in the form of substantially increased foreign direct investment in resource-rich host countries. The governments of host countries, in turn, have typically welcomed the arrival of these new investors and consider them as an opportunity to increase their revenues. At the same time, international companies based in traditional source countries see their profitability threatened by these new competitors as other private firms are brought in or assets are transferred to state-owned firms.<sup>1</sup>

From the point of view of investors, competition for access to resources becomes particularly problematic in the presence of weak institutions. Non-renewable resources such as oil, gas or metals are particularly vulnerable to weak property rights because they are regionally concentrated, need high expenditures for search and exploration, and take considerable time before they become marketable. This exposes investors to the risk of renegotiation, expropriation or sovereign theft. The problem is particularly severe in resource rich countries, given that many of them are characterized by weak institutions, widespread corruption, and poor protection of property rights.<sup>2</sup>

Such action was historically often justified with the argument that international firms would colonize host countries and get an "unfair" large share, if not all, of the profits from exploitation of scarce resources (Yergin 1991). Another argument that is put forward more recently by host countries is the claim that the investor has not invested enough, would thus exploit not enough resources, and thereby "betray" the host-country. A recent exam-

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<sup>1</sup>Expropriations and transfers to national oil firms have a long history especially after de-colonization (see Hogan et al. 2010, Tomz and Wright 2010, Bremmer and Johnston 2011, Maurer 2013). Famous cases of rivalry between foreign firms for access to oil resources are the US-UK conflict in the Middle East and Latin America (Venn 1986, Yergin 1991) or the Chinese-US conflict in Central Asia. Maurer (2013) describes how Peru played the US against the UK in the 1970s, and Cooley (2012) details how Kazakhstan exploited the conflict between the US and China after independence.

<sup>2</sup>This, of course, is one dimension of the resource curse (Sachs and Werner 2001). It is contested, however, whether resources really lead to poor institutions. See Deacon (2011), Humphreys et al. (2007), Jones Luong and Weinthal (2010), Ross (2012) or van der Ploeg (2011) for surveys of the literature.

ple of this is the case of Argentina which expropriated the Spanish firm Repsol's holding in the Argentinean oil firm YPF. President Fernandez de Kirchner justified the attack on foreign property with the argument that Repsol had undertaken too little investment, thus producing too little output and turning a \$6bn surplus in 2006 into a \$3bn deficit in 2011 (Financial Times, April 18, 2012).

Our main contribution to this debate is a new insight with respect to the hold-up problem in FDI. Existing studies of the hold-up problem have typically focussed on the fact that host governments cannot commit themselves not to take the lion's share of the returns of an investment and/or the invested capital itself after a foreign investor has irrevocably invested his capital in a host country. But host countries can not only directly increase taxes on foreign profits or expropriate foreign investors, they can also "renegotiate" contracts and revise concessions and in particular restrict (or threaten to restrict) the amount of resources that a particular investors is allowed to exploit.<sup>3</sup> In many industries, in particular in those that are based on local natural resources, we argue, the commitment problem of the host government therefore also comprises an important element of how much access to resources is given.

In a resource-based industry, a key determinant of an investor's returns to his investment is his actual access to local resources. Consider the investment in drilling equipment and transportation infrastructure in a given oil field. The profitability of this investment will not only be determined by the capital investment of the foreign investor and the technical and managerial expertise deployed in the host country, but will depend crucially on the investor's right to fully and exclusively exploit this specific field. However, while a host government may grant such rights before the investment is carried out, just as it may promise abstaining from nationalization and confiscatory taxation in the traditional formulation of the hold-up problem, such promises may not be time-consistent. After the investment has been carried out, it may be in the host country's interest to renege on the granted rights to exploit the local resources, and instead grant the rights to exploit the resource to another interested party.

Our analysis studies the nature of this additional commitment problem, and considers how it is affected by the existence of multiple international investors or, alternatively, by the alternative to exploit local resources using domestic firms. The framework allows for the traditional hold-up in the form of ex post confiscatory taxation but our focus are the

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<sup>3</sup>Notorious cases where the terms of contracts and agreements have been changed or revoked are Venezuela (Manzano and Monaldi 2010) or Russia (Gustafson 2012). For an overview, see the papers collected in Hogan and Sturzenegger (2010).

implications of host countries' incentives to renege on their concession regarding access to local resources, and in particular their interaction with the competition between foreign investors seeking access to host countries' resources.

Our analysis provides several key results. First, it demonstrates that the existence of alternative foreign investors, or the existence of a domestic alternative to exploit local resources, substantially changes the interaction between foreign investors and the host government in the presence of weak property rights. Intuitively, the presence of competing firms provides an alternative for the host government to put the natural resource to economic use. Given the host country's inability to commit, this drags international investors into overinvesting to secure the provision of local resources. We show in our analysis that this unambiguously benefits the host country and hurts foreign investors. Thus, contrary to the classic hold-up problem of taking too much *ex post*, which typically has negative consequences for the host country, the inability to commit to provide local resources can benefit host countries if there is more than a single use for local resources. Our analysis thus shows how the profits of international investors in resource-based industries are hurt by the emergence of competing investors.

Our study contributes to the vast literature on expropriation of sunk investment. The analysis of foreign direct investment in countries with weak governance and low levels of property rights protection goes back to the seminal analysis of Eaton and Gersovitz (1983). The contributions by Thomas and Worall (1994), Doyle and van Wijnbergen (1994), Schnitzer (1999), Konrad and Lommerud (2002), Kessing et al. (2007, 2008, 2009), among others, have discussed various factors affecting the interaction between foreign investors and host country governments and addressed the question how the hold-up problem may be overcome. To the best of our knowledge, however, no study has explored the insight that commitment problems not only arise with respect to *ex-post* appropriation, but also with the *ex-post* provision of local resources.

Our analysis also relates in an interesting way to the study of Janeba (2000). He shows that investors can overcome the hold-up problem by investing in access capacity in an alternative location. This threatens the host government with a shift in economic activity to the alternative location in case of *ex post* confiscatory taxation. In our analysis, an alternative possibility to put local resources to productive use serves a similar end for the host government, triggering a higher level of investment.

Moreover, our study contributes to the more policy-oriented literature on resource nationalism and the scramble for resources. It is often argued that in particular China would try to secure monopolistic access to resources, mostly in Africa. The argument

put forward for this is the simple fact that by securing a monopoly on such resources, China could improve its terms-of-trade (see Bonfatti 2009).<sup>4</sup> Not surprisingly, this idea is often expressed as neo-colonialism. We add another view to this argument by showing that restricted access would increase the profits that a monopolistic investor could make. A restriction of competition would thus directly shift more profits to the investors, independent from those effects stemming from terms-of-trade considerations.

The paper is organized as follows. We first describe our basic analytical framework in Section 2.1, which allows us to study the hold-up problem with the additional facet of local natural resources as essential inputs. In Section 2.2 we consider the benchmark case of full commitment with a focus on the aggregate indifference regarding the presence of either a single or, alternatively, competing investors. We then explore the case without commitment, where we first discuss the case of a single investor and then the case of competing investors. In Section 2.4 we compare the outcome and derive our central results. In Section 3 we address the potential role of domestic firms in the competition for scarce natural resources. Section 4 concludes.

## 2 Foreign investment in natural resources

### 2.1 The basic framework

Our central aim is to study the role of increased competition for international investment in the natural resource industry in the presence of weak property rights protection in resource-rich host countries. We first analyze a full commitment benchmark before studying investment in the absence of commitment. We consider a resource-based industry which relies on foreign investors, denoted by subscript  $i$ , to bring in capital and expertise to mine and/or process the natural resource. For both scenarios - full commitment and the lack thereof - we contrast two cases. Either there is only a single foreign investor,  $i = s$ , or, alternatively, there are two competing investors  $i = 1, 2$  present in the host country. Total output of investor  $i$  is produced according to the constant returns to scale production function  $f(k_i, m_i, z_i)$ , with the usual properties  $\frac{\partial f}{\partial k} > 0$ ,  $\frac{\partial^2 f}{\partial k^2} < 0$ ,  $\frac{\partial^2 f}{\partial k \partial g} > 0$ ,  $q = k, m, z$ , and  $g = k, m, z$ , and  $q \neq g$ , where capital investment  $k_i$ , the local natural resource  $m_i$ , and technical and business expertise  $z_i$  are the factors of production. Factor costs,  $r$  (for capital) and  $w$  (for non-resource input), are given, constant and equal for

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<sup>4</sup>In particular the popular press and books claim that China aims at securing and then exploiting a monopolistic position. It is disputed, however, whether this is really the case (Moran 2010).

both investors. Output is sold in the world market at an exogenous price of one.

Capital investment is sunk once deployed in the host country and, without commitment, subject to confiscatory taxation *ex post*. However, the investor also provides his technical and business expertise, and can adjust this input depending on the tax burden levied by the host government and the amount of local resources  $m_i$  made available by the host government. The possibility to adjust the input of another factor of production does not eliminate the hold-up problem entirely, but alleviates it. We assume that taxation takes the form of a specific tax  $t$  per unit of output.<sup>5</sup> This amounts to a situation often found in many countries exporting natural resources, where the host country charges an excise on output, such as, for example, the number of barrels of oil exported.<sup>6</sup> Similar to Janeba (2000), we do not explicitly study repeated interaction, but make our argument in the simplest possible framework, where the investor has some scope of adjusting the input of technical and business expertise to affect the investment's return and thus some lever to alleviate the hold-up. Despite its simplicity, this set-up is sufficient to generate the standard hold-up result of reduced investment due to the host country's inability to commit to its policy.

The upfront investment may be interpreted narrowly to include only capital in the actual business venture. Alternatively, it may be interpreted more widely to also include other investment made by foreign investors into the local infrastructure, which is often the case with Chinese investments in Africa (Brautigam 2009). Similarly, the local resource provided by the host government may be interpreted narrowly as access to natural resources, or more widely to additionally include inputs provided by the host government such as administrative and legal support or publicly provided infrastructure. Importantly, the host government may not be able to commit *ex ante* on the level of this input, but only an exogenously given level of these resources  $m$  is available in the country. This specification captures well the situation in many resource-rich developing countries where the specific extent to which foreign investors can access local resources is often difficult to be credibly fixed *ex ante*. Treating the overall level of  $m$  as fixed can either be justified by the fact that the total amount of the available non-renewable resources is limited by nature. Alternatively, it may be interpreted as the maximum level of the natural resource that can be processed within a given time period, where the local government does not

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<sup>5</sup>This could also be interpreted as a partial expropriation.

<sup>6</sup>In many real world contracts, the pro rata payments are complemented by a lump sum up-front payment (Hogan et al. 2001). Such a payment could be easily added into our analysis without changing the results.

inter-temporally optimize the exploitation of its resource.<sup>7</sup> In the wider interpretation of the local input, it may be justified by the overall constraint the host country may have in providing services or infrastructure to the investor.

## 2.2 Full commitment

As our benchmark, we first analyze the case in which the host government can fully commit on the level of taxation and the amount of resources made available to each foreign investor. We focus on the difference between the single investor case and the case of two competing investors, since our interest is to identify the differential effect between these two cases in the absence of commitment. We summarize our benchmark finding:

**Proposition 1** *With commitment, total factor inputs, total output, tax rates, total tax revenue and after tax profits are the same in the single and the competing investor case.*

**Proof.** *See appendix.* ■

Intuitively, under commitment, the decision problem of each individual investor is structurally equivalent to that of a single investor, given a certain level of local resources provided to the investor and given the level of taxation. Moreover, the host government will divide the local resource equally between investors and choose the same tax rate as with a single investor to maximize its revenue. Given the constant returns to scale technology, the aggregate inputs of all investors equal the total inputs of the single investor. Accordingly, total output is equal in both cases as well as total tax revenues and total after-tax profits. The bottom line is that under commitment it makes no difference whether the host government deals with a single or multiple investors.<sup>8</sup>

## 2.3 No commitment: A single investor

We consider first the case in which there is only a single foreign investor. The sequence of events is as follows. At stage 1, the foreign investor decides on how much capital to invest in the host country. At stage 2, the host country government chooses the tax rate  $t_s$  which is levied on the output and decides how to allocate the local resource  $m$ . At stage 3, the investor decides on the input of the additional factor  $z_s$ . Solving backwards,

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<sup>7</sup>This may be due to the fact that the local non-benevolent government is facing a high probability of losing power and aims to maximize its revenue over a short time horizon (Robinson et al. 2006).

<sup>8</sup>This would obviously be different if the foreign investors were credit or resource constrained, or risk averse under uncertainty. We abstract from such complications.



at stage three, the investor chooses his inputs to

$$\max_{z_s} \pi_s = (1 - t_s) f(k_s, m_s, z_s) - w z_s,$$

with first order condition

$$(1 - t_s) \frac{\partial f(k_s, m_s, z_s)}{\partial z_s} = w, \quad (1)$$

which implicitly defines  $z_s^* = z_s^*(t_s)$ , with  $\frac{\partial z_s^*}{\partial t_s} < 0$ .

At stage 2, the host country government decides on  $t_s$  and  $m_s$ . We assume that it maximizes revenue. This can either be motivated by a non-benevolent government, but it is also fully compatible with welfare maximization since output is sold in the world market and the foreign investor's profits accrue to non-local residents. Since the host country has no alternative use for the local resource, it sets  $m_s = m$ . The government's problem with respect to the optimal ex post taxation is to

$$\max_{t_s} R_s = t_s f(k_s, m, z_s^*(t_s)),$$

with first order condition

$$f(k, m, z_s^*(t_s)) + t_s \frac{\partial f(k_s, m, z_s)}{\partial z_s} \frac{\partial z_s^*}{\partial t_s} = 0, \quad (2)$$

which implicitly defines  $t_s^* = t_s^*(k_s^*)$ . While, in general,  $\frac{\partial t^*}{\partial k^*}$  may be negative, we assume that  $\frac{\partial t^*}{\partial k^*} > 0$  throughout. This is economically intuitive and holds for standard production functions such as the Cobb-Douglas case.<sup>9</sup>

At stage 1, the single investor chooses  $k_s$  to maximize

$$\max_{k_s} \pi_s = (1 - t(k_s)) f(k_s, m, z_s) - r k_s,$$

with first order condition

$$-\frac{\partial t}{\partial k_s} f(k_s, m_s, z_s) + (1 - t_s) \frac{\partial f(k_s, m_s, z_s)}{\partial k_s} = r \quad (3)$$

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<sup>9</sup>Algebraically we have  $\frac{\partial t^*}{\partial k_s} = - \frac{\frac{\partial f}{\partial k_s} + t \left[ \frac{\partial^2 f(k_s, m, z_s)}{\partial z_s \partial k_s} + \frac{\partial f(k, m, z_s)}{\partial z_s} \frac{\partial \left( \frac{\partial z_s^*}{\partial t_s} \right)}{\partial k_s} \right]}{\frac{\partial^2 R_s}{\partial t_s^2}}$ , which suggests that  $\frac{\partial f(k, m, z_s)}{\partial z_s} \frac{\partial \left( \frac{\partial z_s^*}{\partial t_s} \right)}{\partial k_s}$  must be sufficiently negative for an overall negative response. For standard production functions such as Cobb-Douglas this term is positive, such that we always have  $\frac{\partial t^*}{\partial k_s} > 0$ .

The investor equates the direct marginal effect on net profits and the indirect marginal effect from the resulting adjustment of the tax rate with the opportunity cost of capital.

## 2.4 No commitment: Competing investors

Consider now the case where the host country admits two investors  $i = 1, 2$  into the country. The sequence of events is as in the single investor case. At stage 3, both investors decide on  $z_i$  with first order conditions analogous to (1). At stage 2 the government now needs to decide how to allocate the resources between the two firms and how to set the tax rate  $t_c$ .<sup>10</sup> The government's problem is

$$\max_{t_c, m_1} R_c = t_c f(k_1, m_1, z_1) + t_c f(k_2, m - m_1, z_2),$$

where we have directly substituted the local resource constraint  $m_1 + m_2 = m$ , and the subscript  $c$  indicates the competing investors case. The solution to this problem is characterized by

$$\sum_{i=1,2} \left[ f(k_i, m_i, z_i^*) + t_c \frac{\partial f(k_i, m_i, z_i^*)}{\partial z_i} \frac{\partial z_i^*}{\partial t_c} \right] = 0, \quad (4)$$

and

$$\frac{\partial f(k_1, m_1^*, z_1)}{\partial m_1} = \frac{\partial f(k_2, m_2^*, z_2)}{\partial m_2}, \quad (5)$$

where condition (5) illustrates how the host government allocates local resources between the two competing investors such that the marginal returns are equalized. Since the host government participates in both firms' output with a share  $t_c$ , it is in its interest to maximize total output by allocating the resources efficiently between the firms.

In stage 1 both firms simultaneously decide on their investment  $k_i$ , solving

$$\max_{k_i} \pi_i = (1 - t_c(k_i)) f(k_i, m_i(k_i), z_i) - r k_i,$$

with first order condition

$$-\frac{\partial t_c}{\partial k_i} f(k_i, m_i, z_i) + (1 - t_c) \left[ \frac{\partial f(k_i, m_i^*, z_i)}{\partial k_i} + \frac{\partial f(k_i, m_i^*, z_i)}{\partial m_i} \frac{\partial m_i^*}{\partial k_i} \right] = r. \quad (6)$$

For both investors, adding an additional unit of capital again changes the level of taxation.

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<sup>10</sup>Given that we focus on the symmetric equilibrium below, the assumption of a uniform tax treatment appears reasonable, and it facilitates the analysis substantially.

Moreover, there are now two effects of an additional unit of capital on after tax profits as can be seen by the terms in squared brackets on the left hand side of (6). First, the direct effect is analogous to the single investor case. Second, there is now an additional strategic effect, which results from the response of the host government to adjust available local resources. The first order conditions (6) implicitly define the investor's best responses *vis-a-vis* each other,  $k_1^*(k_2)$  and  $k_2^*(k_1)$ . To guarantee a unique equilibrium, we additionally assume that these best responses are monotone in the capital invested by the other firm, i.e.,  $\frac{\partial k_i^*}{\partial k_j} > 0$  or  $\frac{\partial k_i^*}{\partial k_j} < 0$ . This restriction is not particularly strong and is always fulfilled for Cobb-Douglas production functions, for example, in which case we have  $\frac{\partial k_i^*}{\partial k_j} < 0$ .<sup>11</sup>

## 2.5 Comparison

We can now proceed to the main purpose of our analysis and study the differential effects of the introduction of competing investors relative to the situation in which there is only a single investor. First, we consider the overall level of investment.

**Proposition 2** *In a symmetric equilibrium, for each individual investor we have  $k_i^* > k_s^*/2$ , and total investment is higher than in the single investor case, i.e.  $\sum_{i=1,2} k_i^* > k_s^*$ .*

**Proof.** *For both investors the best response to a capital choice of zero by the other firm is to behave like a single investor, i.e.,  $k_1^*(0) = k_2^*(0) = k_s^* > k_s^*/2$ . Moreover, consider a potential symmetric equilibrium, in which both firms choose a  $k_i^* = k_s^*/2$ . Consider firm 1. Given that firm 2 chooses a  $k_2^* = k_s^*/2$  it must also be optimal for firm 1 to choose  $k_1^* = k_s^*/2$ . With these investments, the host government chooses exactly the same tax rate for both firms as in the single investor's case, and the investors would each choose  $z_i^* = z_s^*/2$  by the constant returns to scale property of production. However, this also implies that (3) must hold, which implies that the equations (6) cannot hold. By (6), the best response to  $k_2^* = k_s^*/2$  is a higher investment level  $k_1^* = k_1^*(k_s^*/2) > k_s^*/2$ , since  $0 < \frac{\partial t_c^*}{\partial k_1} f\left(\frac{k_s^*}{2}, \frac{m}{2}, \frac{z_s^*}{2}\right) < \frac{\partial t_s^*}{\partial k_s} f(k_s^*, m, z_s^*)$ , and  $\frac{\partial m_1^*}{\partial k_1} > 0$ . The latter can be derived from the comparative statics of the first order conditions of the government's problem in stage 2, (4) and (5), see Appendix. Thus, choosing  $k_1^* = k_s^*/2$  cannot be optimal, such that  $k_1^* = k_2^* = k_s^*/2$  cannot be an equilibrium. The same argument can be made analogously for firm 2. Thus for either firm we have  $k_i^*(k_s^*/2) > k_s^*/2$ . Together with  $k_1^*(0) > k_s^*/2$  this implies that the best response functions intersect at  $k_1^* = k_2^* > k_s^*/2$ , given that the best responses are either monotonously increasing or decreasing, and thus,  $\sum_{i=1,2} k_i^* > k_s^*$ .*

■

<sup>11</sup>A sufficient condition for this is that either  $\frac{\partial^3 f}{\partial m^2 \partial k} > 0$  or  $\frac{\partial^3 f}{\partial m^2 \partial k} < 0$  throughout.

The economic intuition of the result is straightforward. Since the host government cannot commit itself to a certain level of local resources to be provided to the investor, both investors try to affect the allocation of the local resources in their favor. Since the host country participates via ex post taxation in the overall production, additional investment, which increases overall output, is a suitable instrument to affect the distribution in the respective investor's direction. Of course, in the symmetric equilibrium, the strategic effects of additional investment cancel out and both investors receive only half of the available local resources.

We turn now to the effect of competition on tax revenues.

**Proposition 3** *Tax revenues are higher with competing investors.*

**Proof.** *Given that both firms together choose a higher level of investment, the host government could choose the same tax rate as in the single investor case. In this case, the firms would choose levels of  $z_i$ , such that  $\sum_{i=1,2} z_i^* > z_s^*$ , resulting in higher total output, given constant returns and increased levels of  $k$  and  $z$ , and a constant level of  $m$ . Accordingly, tax revenues must increase. If the host government chooses to change the tax rate relative to the single investor case, tax revenues must further increase, such that tax revenues are unambiguously higher in the competing investor case. ■*

This result shows that the host government unambiguously profits from increased competition. With competing investors, its inability to commit is turned into a strategic advantage. Given that it cannot credibly pledge a certain level of resources, the competing investors are trying to shift the distribution of locally available resources in their favor by investing relatively more. Of course, in equilibrium, these efforts offset each other, but generate higher output, which increases the host government's tax revenues.

Finally, we consider profits.

**Proposition 4** *Total profits in the single investor case are higher than aggregate profits in the multiple investor case, i.e.  $\pi_s^* > \sum_{i=1,2} \pi_i^*$ .*

**Proof.** *The single investor could choose an alternative, higher level of investment  $\tilde{k}_s = \sum_{i=1,2} k_i^*$ . This would result in the same level of taxes as in the competing investors case and the same overall level of additional factor inputs. Accordingly, output and after tax profits would equal  $\sum_{i=1,2} \pi_i^*$ . The fact that this level of investment is not chosen in the single investor case reveals that profits are lower in the competing investors case. ■*

The result shows how competition for local resources not only induces higher investment, but that increased investment hurts the firms relative to the single investor case.

Our Propositions 2-4 rely crucially on the inability of the government to commit ex ante on the available level of local resources. If the production function did not require  $m$  as a factor of production, the hold-up problem would only consist of the host government setting excessively high taxes after investors have irrevocably invested. In this case, there would be no strategic interaction between investors. Thus, the inability to commit "to give" has specific implications that are not present in the traditional hold-up situation where the government only cannot commit "not to take".

### 3 Domestic state-owned firms

Nearly all resource-rich countries have set-up state-owned firms to operate in extracting and processing natural resources over the more recent decades (Victor et al. 2012). This is a distinct change to earlier periods in which MNC from Western source countries were often dominating resource-extracting industries, as exemplified by the famous "seven sisters" who largely dominated production and controlled most of the reserves in the international oil business until the 1970s (Yergin 1991, Venn 1986). Today the international oil industry is largely shaped by the "New Seven Sisters", those oil companies that have been established over recent decades in oil producing countries.<sup>12</sup> The new domestic competitors in resource-based industries are typically publicly owned, and were originally less efficient than their traditional international competitors from Western source countries.<sup>13</sup>

In the current section we explore the logic of the increasing spread of such domestic firms in resource-based industries in the framework of host governments that are unable to commit not only with respect to ex-post taxation, but also with respect to the ex-post provision of local resources. We argue that the establishment of a domestic alternative can serve a similar purpose as competing international investors for the host government. Intuitively, just as competing investors provide the domestic government with a credible threat to redirect local resources to other investors, with weak property rights protection, the existence of a domestic firm provides the host country government with an alternative use for its domestic resources. Given the inability to commit ex ante on the level of resources provided, this generates again a strategic incentive for the international investor to increase investment.

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<sup>12</sup>These include Saudi Aramco of Saudi Arabia, Gazprom of Russia, CNPC of China, NIOC of Iran, PDVSA of Venezuela, Petrobras of Brazil, and Petronas of Malaysia (Financial Times, March 11, 2007).

<sup>13</sup>In particular, non-conventional reserves and off-shore oil and gas fields are often technically demanding and require expertise from international firms. In fact, one reason behind the recent policy shift in Mexico to bring in foreign investors is driven by its need to bring in technical skills (Financial Times, August 14, 2013).

In practice we observe two different models of state-owned domestic firm. In some countries, the government sets such companies up as independent entities that are not subject to direct government control. Examples are Norway's Statoil or Brazil's Petrobras. However, in a context of weak governance and low levels of property rights protection such independence is unlikely to hold, and state companies may be used as a direct instrument of the government, such as Venezuela's PDVSA under the government of Hugo Chavez (Monzano and Monaldi 2010, Bremmer and Johnston 2009). Rather, in these countries, the domestic state-owned firm is a direct subordinate of the host government, so important business decisions are directly attributable to the government. As we are interested in the commitment problem under weak property rights protection, we focus on the latter case.

We assume that there is only a single international investor, indicated by subscript  $e$ , and that the government can set up a domestic firm, indicated by the subscript  $d$ . This domestic firm produces according to a production function  $q_d = af(k_d, m_d, z_d)$  with  $0 \leq a \leq 1$ . The factor  $a$  indicates the relative backwardness of local firms. For simplicity, factor prices for  $k$  and  $z$  are the same for the domestic firm and the international investor.<sup>14</sup>

The sequence of events is now as follows. At stage 1, the foreign investor and the domestic firm decide on their respective investment  $k_d$  and  $k_e$ . If the government chooses  $k_d = 0$ , this is equivalent to not starting a domestic firm, if it chooses  $k_d > 0$  a domestic firm is set up. At stage 2, the government allocates the available resources  $m$  to the foreign investor and its own domestic firm, sets the complementary input factor for its own firm and determines the tax levied on the foreign investor's output. Finally, at stage 3, the foreign investor chooses the input levels of the complementary input  $z_e$ .

Solving backwards, at stage 3, the investor chooses  $z_e$  for a given level of  $t_e, k_e$  and  $m_e$  analogous to (1). At stage 2, the government determines the tax rate, how to split the local resources and chooses complementary inputs for the domestic firm  $z_d$ .

$$\max_{t_e, m_e, z_d} R_h = t_e f(k_e, m_e, z_e(m_e, t_e)) + af(k_d, m - m_e, z_d) - rk_d - wz_d,$$

where the taxes paid by the domestic firm are irrelevant to total revenues, since the government is the residual claimant on the domestic firm's profits. The first order conditions with respect to  $t_e, z_d$ , and  $m_f$  are

$$f(k_e, m_e, z_e^*) + \frac{\partial f(k_e, m_e, z_e)}{\partial z_e} \frac{\partial z_e}{\partial t_e} = 0, \quad (7)$$

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<sup>14</sup>We could also discuss the case where the domestic firm faces higher capital costs or has to pay more for the additional input  $z$ . However, this does not add much to the analysis, given that we can already model the domestic firm's handicap by the efficiency parameter  $a$ .

$$a \frac{\partial f(k_d, m_d, z_d)}{\partial z_d} = w. \quad (8)$$

$$t_e \left[ \frac{\partial f(k_e, m_e, z_e)}{\partial m_e} + \frac{\partial f(k_e, m_e, z_e)}{\partial z_e} \frac{\partial z_e^*}{\partial m_e} \right] = a \frac{\partial f(k_d, m_d, z_d)}{\partial m_d}, \text{ if } k_d > 0, \quad (9)$$

and  $m_e = m$ , if  $k_d = 0$ . At stage 1, the foreign investor's problem is

$$\max_{k_e} (1 - t(k_e)) f(k_e, m_e(k_e), z_e) - r k_e,$$

with first order condition

$$-\frac{\partial t_e}{\partial k_e} f(k_s, m_s, z_s) + (1 - t_e) \left[ \frac{\partial f(k_e, m_e, z_e)}{\partial k_e} + \frac{\partial f(k_e, m_e, z_e)}{\partial m_e} \frac{\partial m_e}{\partial k_e} \right] = r. \quad (10)$$

From the solution of this game, we can consider the optimality of three different arrangements as a function of the relative backwardness of the domestic producer. The first option for the host country is to rely only on a foreign investor for the exploitation of its resources. The second alternative is a hybrid regime, in which a domestic firm and an international investor both participate in the exploitation. Finally, the country may choose to only use its domestic firm for this purpose.

**Proposition 5** *Without commitment the host country will not choose to establish a domestic firm, if its technological and business expertise is below a minimum threshold,  $0 \leq a < \check{a}$ . It will choose to establish a domestic firm operating together with foreign firms, at intermediate levels of technological and business expertise  $\check{a} \leq a < \hat{a}$ . Production will be fully in the hands of domestic producers, if the domestic level of technological and business expertise  $\hat{a} \leq a \leq 1$  is sufficiently high.*

**Proof.** Observe first, that for  $a = 0$  it will never be optimal to set up a domestic firm. Moreover, for  $a = 1$ , it is optimal for the host country to only operate a domestic firm, since this allows the country to keep all the profits to be made from the resource and it neither has to share these rents nor will production be distorted. Next, observe that the government's revenues are increasing in  $a$  under the hybrid system. Thus it remains to be shown that for intermediate values of  $a$ , i.e., between the critical values  $\check{a}$  and  $\hat{a}$ , it is optimal for the host country to establish a domestic firm while at the same time relying on international investors. Denote by  $\tilde{a}$  the technology level at which the government revenues are the same with either using only a foreign investor or only a domestic state-owned firm. At this level of technology, using a hybrid system will generate

higher revenues, since the foreign investor is triggered to increase its investment in order to obtain a higher share of domestic resources. ■

If domestic firms are far behind international investors in their technological business capabilities, they are not a viable option to exploit natural resources. However, at intermediate technology levels, domestic firms can serve host governments as an instrument to threaten foreign investors to shift the access to domestic resources away from the international investors. This can generate higher investment levels and higher tax revenues for the host governments at intermediate technology levels. Finally, as domestic firms become even more efficient, it is optimal to entirely shift the exploitation of natural resources to domestic firms. This overcomes the hold-up problem and keeps resource rents in the country. From a dynamic perspective, where the level of domestic competence  $a$  is increasing over time, our approach helps to explain the observed decline of the traditional MNC in resource-based industries and the rise of domestically owned firms, where, over some intermediate period, these operate concurrently in resource-rich countries.

## 4 Discussion and conclusion

Our main argument is that the competition for access to natural resources in an uncertain legal environment gives rise to a "second" hold-up problem. Not only do international investors suffer the standard risk of being taxed beyond initial agreement or being expropriated, but the rise of alternative sources of investment helps host countries to induce higher investment in the absence of commitment. Our approach, we would argue, is particularly relevant for the recent surge in natural resources-related foreign investments by investors from emerging countries. After all, multinational firms from traditional "Western" countries have been competing with each other for access to natural resources in developing countries for many decades (Venn 1986, Yergin 1991). However, the problem as analyzed above may be less relevant for such investors. These investors may turn to help to the legal system in their home countries and pursue formal or informal action against other investors who are benefiting from the re-allocation of local resources by the host government (Joffé et al. 2009). Such measures are likely to be particularly effective where multinationals have business interests and tangible property in the source countries of competing multinationals, facilitating collusion.

In the case of competing investors from emerging countries, such action is much less effective, since these new source countries themselves have weaker protection of foreign investment and often no unbiased access to the legal system. Moreover, investors from



these countries typically have less developed business interests and fewer assets in the traditional source countries. Thus, the scope for suitable actions by an investor from a traditional source country who is negatively affected by a decision of a host country to reallocate access to natural resources or other essential local inputs to a rival from an emerging country is much more limited compared to actions against a traditional competitor.

Our framework captures the latter situation and is accordingly well suited to explain why the recent expansion of FDI in resource-based and resource-extracting industries in countries with weak governance is perceived to threaten the profitability of investments by investors from traditional source countries. It is also in line with the observation that the arrival of this new class of investors has been very welcome to the rulers of these countries. In the light of these arguments, the position of multinationals from traditional source countries in the competition for natural resources in developing countries may benefit substantially from stronger governance in the emerging source countries and from higher levels of business activities of the emerging investors in the traditional source countries.

## 5 Appendix

### (i) Proof of Proposition 1

Consider first the case of a single investor. For any tax rate  $t_s$  and resources  $m_s$ , the investor maximizes

$$\max_{k_s, z_s} \pi_s = (1 - t_s) f(k_s, m_s, z_s) - rk_s - wz_s, \quad (\text{A1})$$

with first order conditions

$$(1 - t_s) \frac{\partial f(k_s, m_s, z_s)}{\partial k_s} = r, \quad (\text{A2})$$

$$(1 - t_s) \frac{\partial f(k_s, m_s, z_s)}{\partial z_s} = w, \quad (\text{A3})$$

which implicitly define the optimal factor inputs as functions of  $t_s$  and  $m_s$ . Taking this into account, the host government's problem is

$$\max_{t_s, m_s} R = t_s f(k_s(t_s), m_s, z_s(t_s)), \quad (\text{A4})$$

s.t.  $m_s \leq m$ , and optimality given by

$$\frac{\partial R}{\partial t_s} = f(k_s(t_s), m_s, z_s(t_s)) + \frac{\partial f(k_s, m_s, z_s)}{\partial k_s} \frac{\partial k_s}{\partial t_s} + \frac{\partial f(k_s, m_s, z_s)}{\partial z_s} \frac{\partial z_s}{\partial t_s} = 0, \quad (\text{A5})$$

and  $m_s = m$ . The optimal policy under commitment and a single investor is to make all resources available to the investor and to choose the tax rate maximizing tax revenue, i.e. the top of the Laffer curve.

Consider now the alternative with two symmetric investors. Each of these solves an analogous problem to (A1) with first order conditions that are analogous to (A2) and (A3). The government chooses

$$\max_{t_c, m_1} R = t_c f(k_1(t_c), m_1, z_1(t_c, m_1)) + t_c f(k_2(t_c), m - m_1, z_2(t_c, m - m_1)), \quad (\text{A6})$$

with first order conditions

$$\frac{\partial R}{\partial t_c} = \sum_{i=1,2} \left[ f(k_i, m_i, z_i) + \frac{\partial f(k_i, m_i, z_i)}{\partial k_i} \frac{\partial k_i}{\partial t} + \frac{\partial f(k_i, m_i, z_i)}{\partial z_i} \frac{\partial z_i}{\partial t} \right] = 0, \quad (\text{A7})$$

$$\begin{aligned} \frac{\partial R}{\partial m_1} &= t \left( \frac{\partial f(k_1, m_1, z_1)}{\partial m_1} + \frac{\partial f(k_1, m_1, z_1)}{\partial k_1} \frac{\partial k_1}{\partial m_1} + \frac{\partial f(k_1, m_1, z_1)}{\partial z_1} \frac{\partial z_1}{\partial m_1} \right) \\ &\quad - t \left( \frac{\partial f(k_2, m_2, z_2)}{\partial m_2} + \frac{\partial f(k_2, m_2, z_2)}{\partial k_2} \frac{\partial k_2}{\partial m_2} + \frac{\partial f(k_2, m_2, z_2)}{\partial z_2} \frac{\partial z_2}{\partial m_2} \right) \\ &= 0. \end{aligned} \quad (\text{A8})$$

In a symmetric equilibrium we have  $m_1 = m_2 = m/2$ . Moreover, using the constant returns to scale assumption the comparison of (A5) and (A7) illustrates that total factor input, total output, the tax rates and total tax revenues, and total after tax profits are the same with a single and multiple investors under commitment. ■

**(ii) Comparative statics of the allocation of local resources with respect to investment by firm 1 as used in the proof of Proposition 2**

The first order conditions of the government's problem with competing investors are

$$0 = \sum_{i=1,2} f(k_i, m_i, z_i^*) + t \sum_{i=1,2} \frac{\partial f(k_i, m_i, z_i^*)}{\partial z_i} \frac{\partial z_i^*}{\partial t} \equiv \Phi^t \quad (\text{A8})$$

$$0 = \frac{\partial f(k_1, m_1^*, z_1)}{\partial m_1} - \frac{\partial f(k_2, m_2^*, z_2)}{\partial m_2} \equiv \Phi^{m_1}. \quad (\text{A9})$$

We linearize this system

$$0 = \Phi_{m_1}^t dm_1 + \Phi_t^t dt + \Phi_{k_1}^t dk_1, \quad (\text{A10})$$

$$0 = \Phi_{m_1}^{m_1} dm_1 + \Phi_t^{m_1} dt + \Phi_{k_1}^{m_1} dk_1, \quad (\text{A11})$$

where the subscripts indicate partial derivatives. The comparative statics are

$$\frac{\partial m_1^*}{\partial k_1} = - \frac{\begin{vmatrix} \Phi_t^t & \Phi_{k_1}^t \\ \Phi_t^{m_1} & \Phi_{k_1}^{m_1} \end{vmatrix}}{\begin{vmatrix} \Phi_t^t & \Phi_{m_1}^t \\ \Phi_t^{m_1} & \Phi_{m_1}^{m_1} \end{vmatrix}} = - \frac{\begin{vmatrix} \Phi_t^t & \Phi_{k_1}^t \\ 0 & \Phi_{k_1}^{m_1} \end{vmatrix}}{\begin{vmatrix} \Phi_t^t & \Phi_{m_1}^t \\ 0 & \Phi_{m_1}^{m_1} \end{vmatrix}} = - \frac{\Phi_t^t \Phi_{k_1}^{m_1}}{\Phi_t^t \Phi_{m_1}^{m_1}} = - \frac{\Phi_{k_1}^{m_1}}{\Phi_{m_1}^{m_1}}. \quad (\text{A12})$$

This can be evaluated as

$$\frac{\partial m_1^*}{\partial k_1} = - \frac{\Phi_{k_1}^{m_1}}{\Phi_{m_1}^{m_1}} = - \frac{\frac{\partial^2 f(k_1, m_1^*, z_1)}{\partial m_1 \partial k_1}}{\frac{\partial^2 f(k_1, m_1^*, z_1)}{\partial m_1^2} + \frac{\partial^2 f(k_2, m_2^*, z_2)}{\partial m_2^2}} > 0. \quad (\text{A13})$$

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