Expropriations and Foreign Direct Investment in a Positive Economic Theory of Foreign Aid

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Abstract

This paper articulates a positive economic theory of foreign aid and presents a novel analysis of the nexus between institutions, foreign direct investment (FDI), and aid. In the model aid is motivated by non-altruistic economic considerations, namely the desire of the donor to protect FDI from expropriation. We first identify the conditions under which aid will be granted and characterize how the quantity of aid varies with the host country's development stage. We then endogenize the host country's institutions and identify the conditions under which institutional reform (adoption of a commitment technology) will be carried out, as well as the conditions that give rise to an expropriation trap—a situation where neither will the host country reform its institutions voluntarily nor will the donor provide incentives for the institutional reform.

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1 Introduction

When a multinational corporation (MNC) sets up a subsidiary abroad, the MNC faces the risk that its investments may be expropriated by the host country. The home country of the MNC may be able to provide some protection for the MNC by signing an investment treaty with the host country. For example, one of the "core" principles of U.S. bilateral investment treaties (BITs) is to establish clear limits on the expropriation of investments and provide for payment of prompt, adequate and effective compensation when expropriation takes place. Thus in principle, BITs can reduce expropriation risk and thereby enhance foreign direct investment (FDI) flows. However, there are at least two reasons why BITs may not be an effective mechanism for facilitating FDI to developing countries. First, the effectiveness of BITs hinges on the premise that governments can be held accountable if they violate a contractual agreement with a private foreign firm. This is problematic because there is no supranational entity that enforces contracts across borders. In addition, the sovereignty status of countries limits the extent to which governments can be punished. The second reason is that complete protection of FDI from expropriation will require that the home country sign treaties with many host countries. Clearly, this option is unrealistic. Indeed, the data suggest that BITs are generally rare. As of 2002, the average number of BITs per country was 45 for developed countries and 12 for developing countries. We use the U.S., the world's leading provider of FDI to

illustrate our point. As of 2006, there were 24,456 U.S. affiliates in 202 countries, suggesting that the U.S. needs to have treaties with over 200 countries. However, during that period, the U.S. had signed treaties with only 48 countries and 6 of the treaties had not been ratified.[1]

In the light of the discussion above, foreign aid can be considered as an alternative to BITs. We regard it most appropriate to suit the study of the role played by aid in promoting FDI within certain institutional settings. It is precisely the goal of this paper to investigate the nexus between institutions, expropriation and aid. We conceive the most fundamental aspect of institutions as the embedment of a commitment technology into a country's governance system to prevent itself from expropriating foreign investment. The paper considers a model where a foreign donor can potentially provide aid to a host country. An MNC engages in FDI in the host country. If the host country expropriates FDI, it loses access to FDI *and* aid in all future periods. Thus aid serves as a quasi government guarantee for investment protection: it has the potential to facilitate FDI flows by reducing the incentive of the recipient (host) country to expropriate. Our analysis is carried out at two levels.

At the first level we take as given the nonexistence of the commitment technology. We show that aid will have a role to play if and only if the host country is sufficiently impatient and sufficiently poor. The impatience makes the threat of

[1]See http://www.bea.gov/ and http://www.unctad.org/ for more information about BITs.

expropriation binding in the absence of aid. The poverty makes the marginal benefit of aid sufficiently large to the host country. At the second level, we assume that the commitment technology is available and investigate the incentives for the host country to adopt it, thereby reforming its institutions. Paradoxically, the foreign donor's providing aid as a means of mitigating the distortions caused by the threat of expropriation might actually discourage the host country from undertaking the reform: the host country would have chosen to reform its institutions if the foreign donor were not anticipated to provide any aid at all. Nevertheless, to avoid providing aid all the time, the foreign donor might find it desirable to provide a one-time stimulus to the host country in order to induce the reform and eliminate the threat of expropriation once and for all. If neither will the host country adopt the no-expropriation commitment technology voluntarily nor will the foreign donor provide incentives for institutional reforms, then the world economy is said to be in an *expropriation trap*, in which the binding threat of expropriation persists. Our analysis identifies the conditions under which an expropriation trap will occur.

Our work builds on the seminal paper by Eaton and Gersovitz (1984) who showed that the threat of expropriation has an adverse effect on FDI.[2] We broaden their analysis by investigating whether foreign aid can ameliorate this under-investment problem, and more importantly, by bringing in institutions as another dimension

[2]See Che and Facchini (2009) and Ghosh and Robertson (2012) for further discussions on expropriation, FDI, and trade.

of the analysis. Our paper is also related to Asiedu and Villamil (2002). They construct a model of bilateral aid where a poor country borrows from international private markets and also receives aid from a rich country. If the country defaults on a loan, it loses access to loans and aid in future periods. They find that the threat of default constrains sovereign lending and that aid raises the opportunity cost of default and therefore enhances lending. Our model differs from theirs in two respects. First, we focus on *direct* foreign investment whereas they focus on sovereign lending, i.e., *indirect* foreign investment. The main reason for focusing on FDI is that many countries, for example countries in Sub-Saharan Africa, have been unsuccessful in attracting FDI although FDI is crucial for poverty alleviation.[3] It is therefore important to analyze whether aid can facilitate FDI to these countries given their existing institutions. Second, the analysis concerning endogenous institutions is absent in both Asiedu and Villamil (2002) and Eaton and Gersovitz (1984). As there has been increased discussion among donor countries about using aid as a tool to induce recipient countries to improve their institutions, such an analysis is important since it sheds light on the underlying incentive problems.[4]

The paper makes two major contributions to the literature. First, the aid liter-

[3]FDI offers many potential advantages to host countries: it is a source of capital, creates employment, boosts wages, enhances the productivity of domestic firms and workers, facilitates technology transfer and promotes growth. The importance of FDI in poverty alleviation is noted in The New Partnership for Africa's Development (NEPAD) documents as well as the United Nations Millennium Declaration document.

[4]Bräutigam and Knack (2004) explore the institutional impact of aid.

ature has generally focused on two motives for providing aid: the altruistic motive (e.g., poverty reduction in recipient countries) or geopolitical motive (e.g., promoting the donor country's ideology or political interest).[5] Our paper articulates a positive economic theory of aid. In particular, it analyzes aid from a different perspective, in that aid is motivated by non-altruistic economic considerations—i.e., the desire of the donor country to protect its investment in the host country from expropriation.[6] We view our approach as complementary to existing approaches in the literature. Our second contribution lies in the novel study of the nexus between institutions, expropriation, and aid. In particular, we identify conditions under which aid will be provided as well as conditions under which the host country will carry out institutional reform.

The rest of the paper is organized as follows. Section 2 lays out our basic model of expropriation and aid, assuming that there exists no commitment technology to prevent the host country from expropriating. The conditions for aid provision are presented, along with an aid Kuznets curve. Section 3 endogenizes the adoption or non-adoption of the commitment technology and identifies the conditions for the existence of expropriation traps. The last section concludes. Detailed proofs are

[5]For discussions on various motives for foreign aid, see Dudley and Montmarquette (1976), Lumsdaine (1993), Alesina and Dollar (2000), Boone (1996), Schraeder et al. (1998), Maizels and Nissanke (1984), among others. See Mavrotas (2010) and Riddell (2007) for recent discussions on a broad range of issues related to foreign aid.

[6]Asiedu et al. (2009) construct a model of FDI, expropriation risk, and foreign aid. In their model foreign aid is motivated by altruism.

relegated to the Appendix.

2 Expropriation and Aid

2.1 The Environment

Suppose that the world economy consists of a (small) host country, a foreign donor, and a private foreign firm (MNC).[7] At the beginning of every period the host country and the foreign donor are endowed with K^H and K^F units of capital goods, respectively. (Think of these agents as endowed with K^H and K^F units of labor, which is supplied inelastically and transformed into capital goods on a one-for-one basis.) For simplicity, capital depreciates completely after production. Let r be the given gross world interest rate. The foreign firm engages in FDI by setting up a subsidiary in the host country and invests k^M. Let $f\left(k^M\right) = \left(k^M\right)^\theta$ be the production technology operated by the foreign firm in the host country, where $\theta \in (0,1)$ is the returns to scale. It is important not to confuse θ with the share of capital in a Cobb-Douglas production function.[8]

At the same time the foreign donor provides A units of capital as aid to the host country. The amount of aid is nonnegative but can possibly be zero. The remaining capital, $\left(K^F - k^M - A\right)$, is invested in the world capital market and earns the period return, r. Note that providing aid is costly to the foreign donor since A

[7] The analysis is broader than bilateral sovereign aid. The donor could be a foreign country or a multilateral agency that is set up to promote international trade and investment.

[8] A full description of the production technology would include capital and other factor inputs. Here we have suppressed the problem of hiring the other inputs in order to simplify notation.

could have been invested in the world capital market. The host country employs a production technology, $h(\cdot)$, which is strictly increasing, strictly concave, and satisfies the usual Inada conditions. Foreign aid augments the host country's domestic capital. Therefore the total amount of capital available for use in production by the host country is $\left(K^H + A\right)$.

Time is discrete. In each period, the host country has an option to expropriate after FDI and production complete. If expropriation occurs, the host country seizes the entire FDI output and also retains the current-period aid.[9] However, the host country is punished by being deprived of access to FDI and aid for all future periods.[10] If the host country chooses not to expropriate, it taxes the foreign firm's output at rate $\tau \in [0, 1)$: the host country gets $\tau f(k^M)$ and the remaining $(1 - \tau)f(k^M)$ goes to the foreign firm. The tax rate, τ, is set by the host country and is known to the foreign firm before it makes investment decisions.[11]

Following Asiedu and Villamil (2002), we assume that all income is consumed in the period it is generated, and for simplicity, that both the host country and the foreign donor are risk neutral.[12] Since the environment we consider is stationary, the same equilibrium outcome applies every period. The timing *within* each period

[9] Note that in reality expropriation can be partial. For example, the government can request a higher ownership share in the foreign subsidiary or increase the tax rate on the foreign firm ex post. For simplicity, we consider only complete expropriation, following Eaton and Gersovitz (1984).

[10] This trigger strategy punishment is standard in the literature. See Kletzer (1994) and Eaton and Fernandez (1995) for discussions of various penalties.

[11] An alternative interpretation of the tax rate is the equity share demanded by the host country.

[12] We focus on risk neutrality in order to study the effect of "pure expropriation" on investment. Asiedu and Villamil (2002) and Eaton and Gersovitz (1984) make a similar assumption.

can be summarized as follows. First, the foreign donor determines the amount of aid. Second, the host country chooses the optimal tax rate that would apply in the case of no expropriation. Finally, the foreign firm chooses the amount of FDI. We analyze below these three decision problems backwards.

2.2 The Foreign Firm's Problem

The foreign firm's FDI decision depends on its anticipation of the host country's expropriation action. If the firm deems it credible that the host country will refrain from expropriating, it will choose the level of FDI by solving the following profit maximization problem, taking the tax rate τ as given:

$$\max_{k^M} (1-\tau) f\left(k^M\right) - rk.$$

The optimal FDI, k^{M*}, satisfies the first-order condition:

$$(1-\tau) f'\left(k^{M*}\right) = r. \tag{1}$$

Denote by $k^{M*}(\tau)$ the optimal amount of FDI as a function of τ. It follows from equation (1) that

$$\frac{\partial k^{M*}}{\partial \tau} = \frac{f'\left(k^{M*}\right)}{(1-\tau) f''\left(k^{M*}\right)} < 0.$$

That is, lowering the tax rate by the host country will attract more FDI. However, when the tax rate gets too low, it may trigger the host country to expropriate as the amount of tax revenues would be less than the benefits of expropriating.

Anticipating this, no FDI will take place, i.e., $k^{M*} = 0$. Later on we will show that although expropriation never occurs in equilibrium, the threat of expropriation might exert a negative influence on FDI decisions by distorting the host country's choices of τ.

2.3 The Host Country's Problem

Let β be the host country's discount factor. Asiedu and Villamil (2000) model β as the product of two factors, i.e., $\beta = \delta\rho$, where $\rho = 1/r$ is the common pure discount factor determined by the world market. And as in Yaari (1965), δ is an idiosyncratic survival probability that reflects the "patience" of decision makers in a particular country, and can be interpreted as a measure of country-specific risk following Barro and Sala-i-Martin (1995). Asiedu and Villamil (2000) estimate β to range from as low as 0.23 to the highest value 0.95 for the annual frequency for 40 countries.

The host country takes the firm's optimal investment function, $k^M = k^{M*}(\tau)$, and the level of foreign aid, A, as given and decides on an optimal tax rate if it chooses not to expropriate. Otherwise it confiscates all the FDI output. Observe that the host country strictly prefers positive FDI to no FDI due to the positive share of FDI output it can receive. It also understands that if the foreign firm anticipates expropriation, there will be no FDI and there will be nothing to expropriate. Therefore, the host country can successfully attract FDI only if it can assure the foreign firm that it will refrain from expropriating. For the moment we assume,

using the standard language in the rule-versus-discretion literature, that there does not exist commitment technology to tie the host country's hands, so that the host country may deviate ex post from the pre-announced policy if it is better off doing so.[13] Thus, a constraint, which we shall refer to as the *no-expropriation constraint* (NEC hereafter), has to be satisfied, whereby the discounted payoff from not expropriating (denoted by H^N) is greater than or equal to the discounted payoff from expropriating (denoted by H^E). We consider these two payoffs below.

Not expropriating. The host country receives aid, A, and the tax revenue from FDI output, $\tau f\left(k^M\right)$. Its current-period income is therefore $\tau f\left(k^M\right)+h\left(K^H+A\right)$. The host country's discounted payoff associated with this situation is then

$$H^N = \tau f\left(k^M\right) + h\left(K^H + A\right) + \beta \max\left\langle H^N, H^E\right\rangle,$$

where the max operator in this recursive equation indicates that the host country faces again the problem of choosing whether to expropriate or not in the next period.

Expropriating. The host country confiscates the total FDI output, $f\left(k^M\right)$, retains the aid, A, but loses both FDI and aid for all future periods. Its current-period income is $f\left(k^M\right) + h\left(K^H + A\right)$, and its income in every future period is simply $h\left(K^H\right)$. Hence the discounted payoff from expropriating, denoted by H^E, is

$$H^E = f\left(k^M\right) + h\left(K^H + A\right) + \frac{\beta}{1-\beta} h\left(K^H\right). \tag{2}$$

[13] The availability of the commitment technology and the choice to adopt it will be considered in Section 3.

The NEC states that

$$H^N \geq H^E. \tag{3}$$

Only if this constraint is satisfied will not-expropriating be credible. The host country's problem is to choose τ in order to maximize H^N subject to the NEC (3), taking the foreign firm's optimal investment function, $k^{M*}(\tau)$, as given. Observe that if (3) holds, then

$$H^N = \frac{1}{1-\beta}\left[\tau f\left(k^M\right) + h\left(K^H + A\right)\right]. \tag{4}$$

Maximization of H^N ignoring the NEC gives the unconstrained optimal tax rate, $\tau^* = 1-\theta$ (the second-order condition holds since $d^2H^N/d\gamma^2 < 0$). This says that the returns-to-scale parameter θ in the FDI technology determines the optimal tax rate whenever the threat of expropriation is not an issue. It remains to check whether $\tau^* = 1-\theta$ satisfies the NEC.

Denote by $\hat{\tau}$ the level of τ such that the NEC holds with equality $H^N = H^E$, i.e.,

$$\left[(1-\beta)-\hat{\tau}\right] f\left(k^{M*}(\hat{\tau})\right) = \beta\left[h\left(K^H + A\right) - h\left(K^H\right)\right], \tag{5}$$

we have $\hat{\tau} = 1-\beta$ when $A = 0$, and

$$\frac{d\hat{\tau}}{dA} = \frac{-\beta h'\left(K^H + A\right)}{f\left(k^{M*}\right) - \left[(1-\beta)-\hat{\tau}\right] f'\left(k^{M*}\right)\left(dk^*/d\hat{\tau}\right)} < 0 \tag{6}$$

whenever $\hat{\tau} \leq 1-\beta$. Hence $\hat{\tau}$ is a decreasing function of A and $\max_{A\geq 0}\hat{\tau} = 1-\beta$.

It is not difficult to show that

$$\frac{\partial\left(H^N - H^E\right)}{\partial\tau} = \frac{1-\theta\beta-\tau}{(1-\beta)(1-\theta)(1-\tau)}\left[k^{M*}(\tau)\right]^{\theta}.$$

This implies that $\left(H^N - H^E\right)$ is increasing in τ for $\tau < 1-\theta\beta$.[14] Note that $\tau^* = 1-\theta < 1-\theta\beta$ and $\hat{\tau} \leq 1-\beta < 1-\theta\beta$, implying that we are on the increasing part of $\left(H^N - H^E\right)$ when $\tau = \tau^*$ or $\hat{\tau}$. Thus checking whether τ^* satisfies the NEC amounts to checking whether τ^* is no less than $\hat{\tau}$.

Under what situations will the threat of expropriation not be an issue? It turns out that whenever the host country is sufficiently patient in that $\beta \geq \theta$, constraint (3) will be satisfied at the unconstrained optimal tax rate τ^*, no matter how much aid the foreign donor provides. This is because $\tau^* \equiv 1-\theta \geq 1-\beta = \max_{A\geq 0}\hat{\tau}$ in this case. Hence for the threat of expropriation to be an issue, it must be true that the host country is sufficiently impatient, i.e., $\beta < \theta$. For example, consider an environment without aid. With $\beta < \theta$ we have $\tau^* \equiv 1-\theta < 1-\beta = \hat{\tau}\big|_{A=0}$ and the NEC violated by the unconstrained optimal tax rate. We summarize the results reached so far in the following lemma.

Lemma 1 ***(Optimal Tax Rate)***. *Let $\hat{\tau}$ be defined by equation* (5) *and $\tau^* \equiv 1-\theta$.*

i. The host country's optimal choice of τ equals $\max\langle\tau^*, \hat{\tau}\rangle$.

ii. $d\tau^*/dA = 0$ and $d\hat{\tau}/dA < 0$.

[14] $\left(H^N - H^E\right)$ attains a positive maximum value when $\tau = 1-\theta\beta$.

iii. When $\beta \geq \theta$, the unconstrained optimal tax rate τ^* is chosen and the amount of FDI is $k^{M*}(\tau^*)$, regardless of the value of A.

iv. When $\beta < \theta$ and $A = 0$, the constrained optimal tax rate $\hat{\tau}$ is chosen and the amount of FDI is $k^{M*}(\hat{\tau}) < k^{M*}(\tau^*)$.

Figure 1 illustrates the host country's optimal tax decision. The horizontal axis measures the host country's tax rate. First note that the total discounted income from not-expropriating, H^N, increases initially and then declines after reaching the maximum at $\tau^* \equiv 1-\theta$. This "Laffer curve" reflects the fact that the positive effect of a higher tax rate first dominates and is then dominated by the negative effect of a smaller tax base. In contrast, the total discounted income from expropriation, H^E, is a monotonically decreasing function of τ since a higher tax rate reduces the amount of FDI as well as the amount of FDI output that can be expropriated. In panel (a) of Figure 1, the intersection of H^N and H^E curves lies to the left of the maximum point of H^N. In this case $\tau^* \equiv 1-\theta$ is optimal for the host country and renders non-expropriation credible at the same time. Panel (b) of Figure 1 presents the case where τ^* violates the NEC. In this case the binding NEC forces the host country to choose $\hat{\tau}$, which is higher than τ^*. This leads to a lower amount of FDI than in the unconstrained case. The familiar under-investment result, as in Eaton and Gersovitz (1984), obtains in this case due to the threat of expropriation.

Lemma 1 highlights the importance of preferences and technology in determining

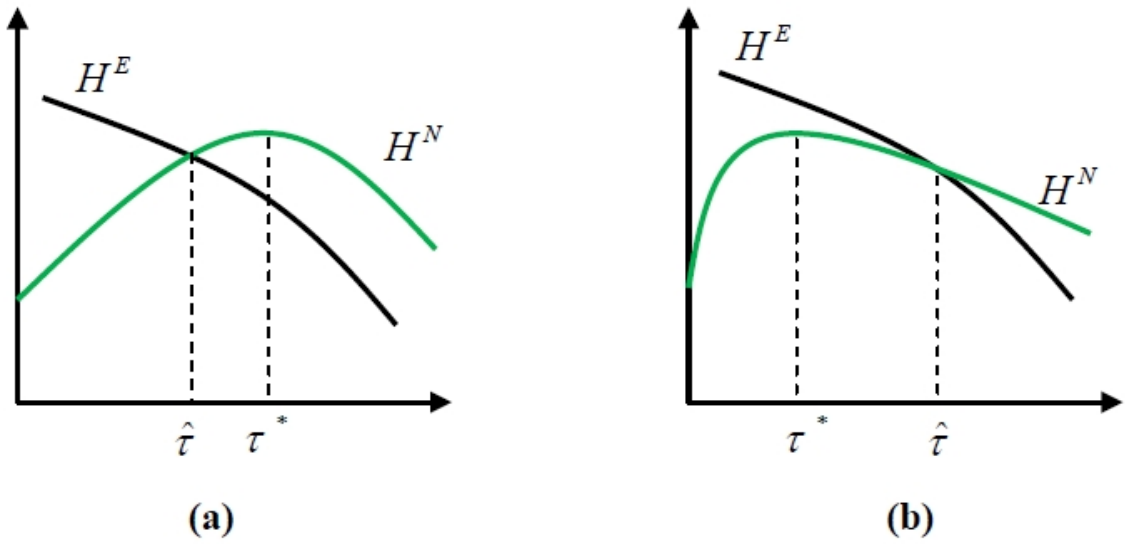

Figure 1: The host country's optimal decision. (a) $\tau = \tau^* = 1-\theta$; (b) $\tau = \hat{\tau} > 1-\theta$

expropriation and FDI. The returns-to-scale parameter in the FDI technology, θ, determines the unconstrained optimal tax rate. The more responsive FDI output is with respect to capital inputs, the stronger the (negative) tax base effect of raising the tax rate, and the earlier the maximum of the Laffer curve will be reached. Hence higher values of θ lead to lower values of the unconstrained optimal tax rate, τ^*. If this rate is too small, then it will be optimal for the host country to expropriate ex post, as it would only get a small share of FDI output otherwise. How small is "small" depends on the host country's time preferences. The more impatient the host country is, the more heavily it discounts the future benefits from tax revenues, and the more likely it is going to expropriate now. Absent aid, whether the unconstrained

optimal tax rate is large enough to make no-expropriation credible boils down to a simple comparison of the preference parameter β and the technology parameter θ. When the host country is sufficiently impatient ($\beta < \theta$), even the grimmest punishment of precluding the host country from access to FDI and aid in all future periods cannot sustain the unconstrained outcome.

Lemma 1 also highlights the importance of aid policy when the host country is so impatient that the threat of expropriation becomes a problem. To fix idea, think of $\hat{\tau}$ as delineating two regions for θ. When $\theta \in (0, 1-\hat{\tau}]$, FDI is not constrained by the threat of expropriation and equals $k^{M*}(\tau^*)$. When $\theta \in (1-\hat{\tau}, 1)$, the NEC binds and we have constrained FDI: $k^{M*}(\hat{\tau})$. An important implication of Lemma 1 is that increases in aid expand the unconstrained region and narrow the constrained region ($d\hat{\tau}/dA < 0$). When there is no aid, the unconstrained region for θ is $(0, \beta]$. When A becomes strictly positive, some θ's that are larger than β will be allowed in the unconstrained region. In fact, the unconstrained region can be expanded to $(0, 1]$ if A is sufficiently large. This means that the host country will not choose to expropriate even if it receives a zero share of FDI output: expropriation is too costly due to the loss of the large amount of aid in the future. But bear in mind that providing aid is costly for the foreign donor. How much aid it will choose to provide is what we analyze next.

2.4 The Foreign Donor's Problem

Let F^N be the foreign donor's total discounted income associated with the situation of no expropriation. Then

$$F^N = \frac{1}{1-\beta}\left[(1-\tau)\, f\left(k^M\right) + r\left(K^F - k^M - A\right)\right]. \tag{7}$$

The foreign donor's current-period income consists of the after-tax FDI output, $(1-\tau)\, f\left(k^M\right)$, and the return on its investment in the world capital market.

Let F^E be the foreign donor's total discounted income associated with the situation of expropriation. Under this situation, all FDI output is confiscated by the host country. Hence the foreign donor's total income in the current period is simply $r\left(K^F - k^M - A\right)$. In all future periods, no aid or FDI will be provided. The entire stock of foreign capital, K^F, is invested in the world capital market and earns a return r. Thus,

$$F^E = r\left(K^F - k^M - A\right) + \frac{\beta}{1-\beta} r K^F. \tag{8}$$

Since the host country will choose such tax rates that no expropriation would ever occur, the foreign donor seeks to maximize F^N by choosing the optimal amount of aid, taking as given the FDI firm's optimal investment function, $k^M = k^{M*}(\tau)$, and the host country's choice of the tax rate which respects the NEC. Note that the host country's choice of the tax rate may depend on the amount of aid provided.

If the host country is sufficiently patient ($\beta \geq \theta$), the foreign donor's decision

on A turns out to be trivial. Since aid does not affect the host country's optimal tax rate τ^* and hence has no impact on FDI, it brings no benefit to the foreign donor but is costly to provide. This implies an optimal amount of aid that equals zero. Thus for aid to have a role to play it must be the case that the host country is sufficiently impatient. So, consider the case where $\beta < \theta$. From the preceding analysis we know that without aid the host country will set the tax rate to $\hat{\tau} = 1-\beta$. According to Lemma 1, increases in A will lower $\hat{\tau}$, and will lower the prevailing τ until $\hat{\tau}$ reaches $\tau^* \equiv 1 - \theta$. Beyond that point the prevailing tax rate will stay at τ^*, as further increases in aid will have no effect on the tax rate and FDI. Thus in analyzing the optimal amount of aid one has to take into account the possibility of *regime switching* (from the constrained optimum $\hat{\tau}$ to the unconstrained optimum τ^*) as induced by increases in A. To find out the foreign donor's optimal choice of aid, our strategy is to first derive A^*—the amount of aid that maximizes F^N, assuming $\tau = \hat{\tau}$ and therefore ignoring the possibility that $\hat{\tau}$ falls below τ^* before A reaches A^*. We then check whether A^* is consistent with no regime-switching, i.e., satisfies $\hat{\tau}(A^*) \geq \tau^*$. If so, A^* is indeed the optimal aid. Otherwise the optimal aid is given by $\bar{A}$, which satisfies $\hat{\tau}\left(\bar{A}\right) = \tau^*$. Taking into account the possibility of regime switching, the optimal amount of aid is thus given by $\min\left\langle A^*, \bar{A}\right\rangle$.

Next we derive conditions for $\bar{A}$ and A^* to be positive. It is easy to see $\bar{A} > 0$ since $\hat{\tau}(A)|_{A=0} = 1 - \beta$, $\hat{\tau}\left(\bar{A}\right) = 1 - \theta$, and $\hat{\tau}$ decreases with A when $\beta < \theta$. Note

that A^* satisfies the first-order condition

$$\frac{dF^N}{dA} = \frac{-f\left(k^{M*}\right)\left(d\hat{\tau}/dA\right) - r}{1-\beta} = 0, \tag{9}$$

where $d\hat{\tau}/dA$ is given by equation (6).[15] Then A^* is strictly positive if and only if

$$\left.\frac{dF^N}{dA}\right|_{A=0} > 0,$$

which holds if and only if the host country's domestic capital stock, K^H, is sufficiently small:

$$K^H < h'^{-1}\left(\frac{r}{\beta}\right).$$

The following proposition summarizes the conditions under which aid will be provided.

Proposition 1 ***(Aid Provision).*** *There will be positive amounts of aid provided by the foreign donor if and only if all the following conditions are satisfied:*

i. The host country is sufficiently impatient: $\beta < \theta$,

ii. There is no commitment technology to prevent the host country from expropriating, and

iii. The host country is sufficiently poor: $K^H < \bar{K}^H \equiv h'^{-1}\left(r/\beta\right)$.

Proposition 1 constitutes the first part of our positive economic theory of aid. It predicts that aid will be extended by the foreign donor if and only if the host country

[15] Note that the effect of A on k^* via $\hat{\tau}$ vanishes thanks to the envelope theorem.

is sufficiently impatient, sufficiently poor, and lacks commitment to not expropriate. In our environment, aid can potentially mitigate the negative impact of expropriation risks on FDI. Only if the threat of expropriation is binding absent aid ($\beta < \theta$) does aid have a role to play. But if the host country can commit to not expropriate, there is no need for the foreign donor to provide aid because the host country would voluntarily choose the unconstrained optimal tax rate. It is important to note that the impatience of the host country and the lack of commitment technology are not sufficient to rationalize aid provision. The extra condition needed is that the host country is sufficiently poor. Since aid augments the host country's domestic capital stock, the marginal benefit of aid will be high if the marginal product of capital in the host country's domestic production process is high, i.e., when the host country capital stock is low.

Suppose all the three conditions spelt out in Proposition 1 hold. It remains to determine the optimal quantity of aid. Either A^* or $\bar{A}$ will be chosen, depending on whether moving from $A = 0$ to $A = A^*$ induces regime switching. If $A^* \leq \bar{A}$, i.e., $\hat{\tau}(A^*) \geq \tau^* \equiv 1 - \theta$, then there is no regime switching and the optimal choice of τ remains to be the constrained optimum, $\hat{\tau}$. In this case the optimal amount of aid equals A^*. If to the contrary $A^* > \bar{A}$, i.e., $\hat{\tau}(A^*) < \tau^*$, then there is regime switching (when A passes $\bar{A}$) and the optimal choice of τ becomes the unconstrained optimum, τ^*. In this case the optimal amount aid is given by $\bar{A}$. The foreign donor

never provides more aid than is needed to move to the regime of unconstrained FDI, because once this regime is reached aid ceases to bring any additional benefit. It can also be shown that when a positive amount of aid is provided, it leads to Pareto improvement for both countries.

Proposition 2 *Let A^* be defined by equation (9) and $\bar{A}$ satisfies $\hat{\tau}\left(\bar{A}\right) = \tau^*$. The optimal amount of aid equals $\min\left\langle A^*, \bar{A}\right\rangle$. Whenever the optimal aid is positive, both the host country and the foreign donor are better off relative to no aid.*

Proof. See the Appendix. ■

We illustrate in Figure 2 the foreign donor's decision on aid, as stated in Proposition 2. The horizontal axis measures the quantity of aid. As long as $\hat{\tau}$ is the host country's choice, aid effectively reduces the prevailing tax rate. Ignoring the possibility of regime switching, the foreign donor's discounted income, F^N, is a strictly concave function of A and there exists an interior maximum at $A = A^*$. However, a kink is encountered at $A = \bar{A}$ since the prevailing τ reaches the unconstrained optimum τ^* at this point, beyond which aid has no additional benefit and only entails costs for the foreign donor. Hence F^N is linearly downward sloping for $A \geq \bar{A}$, with the slope given by $-r/(1-\beta)$. There are thus two possibilities. In Panel (a), we have $A^* < \bar{A}$ and the optimal aid equals A^*. The opposite is true in Panel (b), where the optimal aid equals $\bar{A}$. In the latter case, aid sufficiently remedies all the negative impact of the threat of expropriation on FDI.

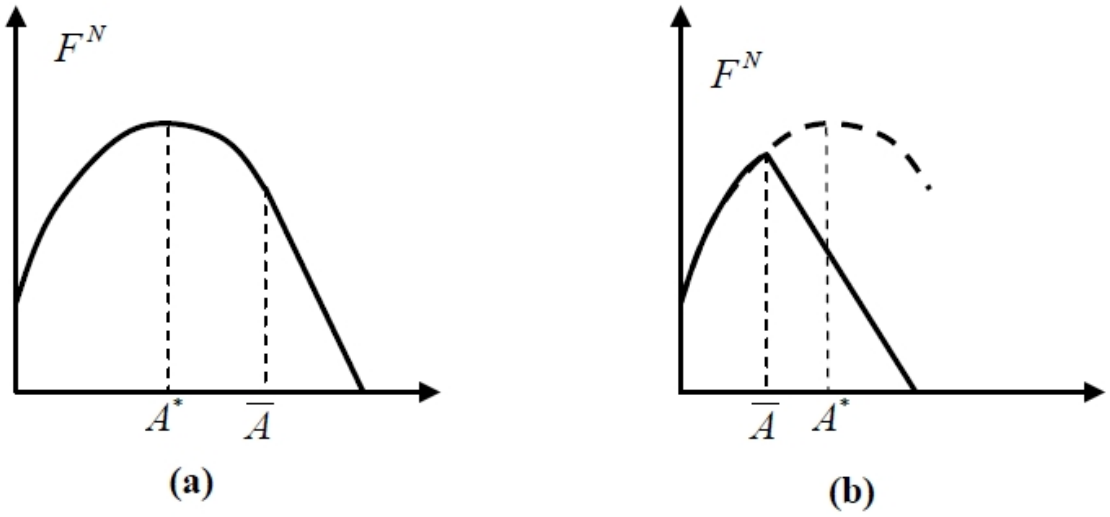

Figure 2: The foreign donor's optimal aid. (a) $A = A^*$; (b) $A = \overline{A}$

The usefulness of our positive theory of aid can be illustrated by answering questions such as: How does the amount of aid change as the recipient country becomes more developed, e.g. commands more capital? The following proposition advances an *aid Kuznets curve*, according to which the optimal aid can be an inverted U-shape function of the host country's domestic capital stock.

Proposition 3 *Suppose that the three conditions specified in Proposition 1 are all satisfied. Let* $\bar{K}^H \equiv h'^{-1}(r/\beta)$.

i. If $\bar{A} \geq A^*$ *at* $K^H = 0$, *then the optimal aid is positive and monotonically decreasing in* K^H *until it reaches* $\bar{K}^H$.

ii. If $\bar{A} < A^*$ *at* $K^H = 0$, *then there exists an aid Kuznets curve. Let* $K_1^H \equiv$

$h^{-1}\left[h\left(h'^{-1}\left(\frac{1-\beta}{1-\theta}\frac{r}{\beta}\right)\right)-\frac{\theta-\beta}{\beta}\left(\frac{r}{\theta^2}\right)^{\frac{\theta}{\theta-1}}\right]$. *The optimal aid equals* $\bar{A}$ *and increases with* K^H *for* $K^H \in (0, K_1^H]$*; it equals* A^* *and decreases with* K^H *for* $K^H \in \left(K_1^H, \bar{K}^H\right)$.

Proof. See the Appendix. ■

The solid curve in Figure 3 depicts the aid Kuznets curve for a given configuration of parameter values that gives rise to $0 < \bar{A} < A^*$ at $K^H = 0$. The optimal aid is given by $\bar{A}$ when $K^H = 0$. As K^H increases, $\bar{A}$ increases while A^* decreases. They coincide at K_1^H. After K^H passes K_1^H, the optimal aid is given by A^* and keeps going down until it reaches zero at $K^H = \bar{K}^H$. Note that the inverted U-shape is obtained conditional on the optimal aid being positive. After K^H reaches $\bar{K}^H$ the optimal aid stays at zero, as Proposition 1 indicates. In general, Proposition 3 implies that whether economic development via capital accumulation will lead to more aid received by a poor country depends on how much capital that country already has. If the aid Kuznets curve prevails, then the amount of aid increases with capital accumulation if the country is extremely poor but decreases with capital accumulation if the country becomes less poor. Cross-sectionwise, if we partition the set of poor countries (with $K^H \leq \bar{K}^H$) into two groups—the poorest and the less poor—according to the threshold, K_1^H, then within the poorest group richer countries receive *more* aid, but within the less poor group richer countries receive *less* aid.

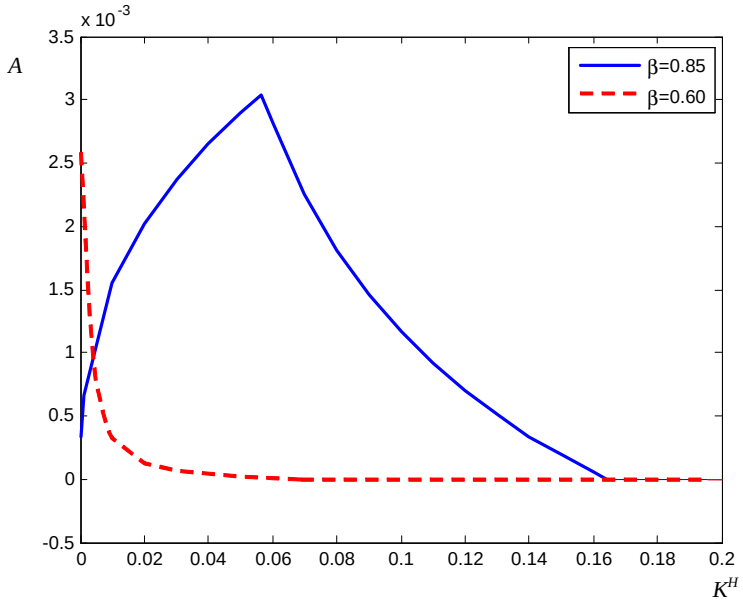

Figure 3: The optimal aid as a function of K^H

For illustrative purpose, we provide some numerical examples here. Let a period correspond to a year. We follow Asiedu and Villamil (2000) to set $r = 1.05$. This implies a common pure discount factor $\rho = 1/r = 0.95$. Using data from the *International Country Risk Guide*, they estimate the idiosyncratic risk factor δ for 40 different countries and obtain estimates of country-specific β that ranges from a high of 0.95 to a low of 0.23. In our examples, $f\left(k^M\right) = \left(k^M\right)^\theta$ and $h\left(K^H\right) = \left(K^H\right)^\eta$ and we set $\theta = 0.9$ and $\eta = 0.6$, so that the host country's production technology exhibits diminishing returns to a greater extent. We look at two values of β: a higher value of 0.85 and a lower value of 0.6. Figure 3 plots the optimal aid curves associated with the two values of β. For $\beta = 0.60$, the optimal aid is monotonically decreasing in K^H. But for $\beta = 0.85$, the optimal aid curve exhibits the Kuznets

pattern. It increases with K^H until K^H reaches K_1^H and declines afterwards. It then stays at zero after K^H reaches $\bar{K}^H$. The maximum amount of aid extended, which occurs at $K^H = K_1^H$, amounts to 5.40% of the host country's existing capital.

3 Expropriation Traps

The preceding analysis characterized the behavior of aid, tax policy, and FDI assuming that there is no commitment by the host country to not expropriate. An interesting question naturally arises once we realize that commitment (or no commitment) is endogenous: Will the host country carry out institutional reform to tie its hands away from opportunistic behavior? What we mean here by insitutional reform is the establishment of a legal system for property right protection and an enforcement system, under which the host country severely punishes expropriation behavior. In other words, the system makes ex post expropriation prohibitively costly for any agent or agency that might otherwise benefit from confiscating foreign asset, making it credible to commit to an ex ante efficient arrangement of not expropriating under whatever circumstances. We will refer to such a system as the no-expropriation commitment technology (NECT).[16] The question goes further. If the host country does not adopt the NECT, is it to the advantage of the foreign donor to provide the host country incentives to engender institutional reforms to

[16]Krasa and Villamil (2000) analyze the distinction between the ex ante contract and ex post monitoring in the costly state verification framework.

adopt the NECT? If neither the host country will adopt the NECT voluntarily nor the foreign donor will provide incentives for institutional reforms, then the world economy is said to be in an *expropriation trap*. These are the issues we analyze in this section. For simplicity we assume that the physical cost of reforming institutions to adopt the NECT is zero.

Consider the case $\beta < \theta$. Our first observation is that the host country is willing to adopt the NECT *whenever aid is absent*. Referring to Panel (b) of Figure 1, committing to $\tau^* = 1 - \theta$ makes the host country better off than choosing $\hat{\tau} > \tau^*$. Our second observation is that the foreign donor's providing aid might actually discourage the host country from undertaking the institutional reform. Let $L(A)$ denote the difference between the host country's total discounted income without commitment to no expropriation when the amount of aid equals A and its total discounted income with such a commitment, that is,

$$\begin{aligned} L(A) &\equiv H^N(\hat{\tau}(A), A) - H^N(\tau^*, 0) \qquad (10) \\ &= \frac{1}{1-\beta}\left[\hat{\tau}(A) f\left(k^M(\hat{\tau}(A))\right) - \tau^* f\left(k^{M*}\right) + h\left(K^H + A\right) - h\left(K^H\right)\right]. \end{aligned}$$

Let $G(A)$ denote the difference between the foreign donor's total discounted income with and without commitment of the host country given A:

$$\begin{aligned} G(A) &= F^N(\tau^*, 0) - F^N(\hat{\tau}(A), A) \qquad (11) \\ &= \frac{(1-\tau^*) f\left(k^{M*}\right) - rk^*}{1-\beta} - \frac{(1-\hat{\tau}(A)) f\left(k^M(\hat{\tau}(A))\right) - rA - rk^M(\hat{\tau}(A))}{1-\beta} \end{aligned}$$

Thus, $L(A)$ is the loss the host country would incur from the institutional reform. By carrying out the reform, it forgoes foreign aid A and will change the tax rate from $\hat{\tau}(A)$ to the unconstrained value τ^*, which in turn will affect the foreign firm's investment decision. At the same time, such a reform will save the foreign donor from continual provision of aid. Thus $G(A)$ is the gain accruing to the foreign donor from the host country's institutional reform.

According to Proposition 3, A equals $\bar{A}$ for $K^H \in (0, K_1^H]$ and A^* for $K^H \in \left(K_1^H, \bar{K}^H\right)$ in (10) and (11). The host country's adoption of the NECT induces a gain of $G\left(\bar{A}\right)$ for the foreign donor and a loss of $L\left(\bar{A}\right)$ for the host country itself when $K^H \in (0, K_1^H]$, a gain of $G(A^*)$ and a loss of $L(A^*)$ when $K^H \in \left(K_1^H, \bar{K}^H\right)$. Note that G is always nonnegative since commitment by the host country to no expropriation is unambiguously preferable to the foreign donor. If the host country's loss is positive, then it will not adopt the NECT voluntarily. Conditional on a positive loss for the host country, the foreign donor contemplates on whether or not to provide a one-time transfer to induce the host country to adopt the NECT. The amount of this transfer must be at least equal to $L(A)$. Hence for the foreign donor to find the transfer worthwhile it must be true that $G(A) \geq L(A)$, otherwise the gain will be more than eroded by the transfer and the net gain will be negative. It is clear from this reasoning that if $G(A) < L(A)$ then an expropriation trap occurs: there is no incentive, from either party's perspectives, to make the host country

adopt the NECT. If to the contrary $G(A) \geq L(A)$, then the foreign donor is willing to pay the amount that is just sufficient to stimulate such an adoption, i.e., $L(A)$, and retain the net gain $G(A) - L(A)$. In other words, the foreign donor is willing to incur the one-time cost, equal in amount to $L(A)$, in order to eschew the recurrent costs of aid provision, the discounted value of which equals $G(A)$.

We consider two cases below.

Case 1: The optimal aid is $\bar{A}$.

This corresponds to the situation where there exists an aid Kuznets curve and $K^H \in \left(0, K_1^H\right)$. To facilitate discussion, we illustrate the analysis in Figure 4. Panel (a) shows the host country's total discounted income as a function of τ (similar to Panel (b) in Figure 1), while Panel (b) shows the foreign donor's total discounted income as a function of A (similar to Panel (b) in Figure 2). Point P_1 in Panel (a) and point Q_1 in Panel (b) correspond to a starting situation where no aid is provided and the host country chooses a constrained optimal tax rate $\hat{\tau}$. Starting from this situation, the foreign donor optimally provides aid in the amount $\bar{A}$ to induce the host country to choose the unconstrained optimal tax policy τ^*. The increase of aid from $A = 0$ to $\bar{A}$ shifts both H^N and H^E up, with H^N shifting more. Thus the host country reaches point P_2 in Panel (a) of Figure 4 and the foreign donor reaches point Q_2 in Panel (b). Now, if the host country adopts the NECT, then it will end up with point P_3, which is strictly below point P_2. This is because the host

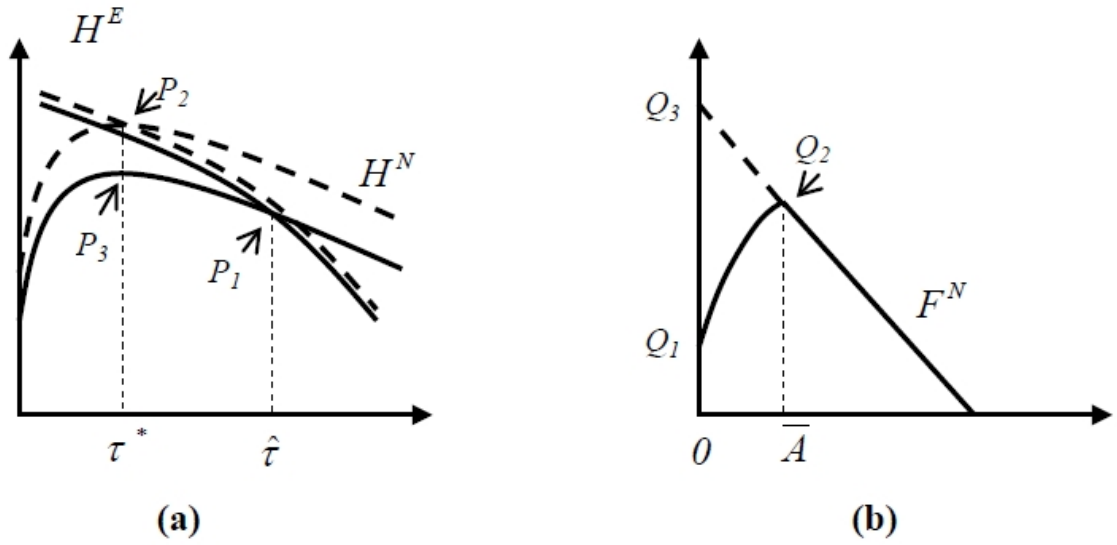

Figure 4: Effects of institutional reform. (a) The host country is worse off ($P_2 \rightarrow P_3$); (b) The foreign donor is better off ($Q_2 \rightarrow Q_3$)

country will choose τ^* even without aid, and the foreign donor needs not provide any aid. Thus the host country prefers not to adopt the available NECT so that it can enjoy the benefit of aid. In contrast, the host country's commitment is seen to be desirable by the foreign donor. As shown in Panel (b) of Figure 4, once the host country commits to τ^*, the foreign donor's total discounted income, F^N, becomes a downward sloping line for *all* values of aid since aid brings no benefits but only costs. The foreign donor obviously gets better off from being able to move from point Q_2 to point Q_3.

It becomes clear at this point that the foreign donor is also faced with a commitment problem. In particular, it can benefit from committing itself not to provide

any aid, because by making such a commitment it can induce the host country to voluntarily adopt the NECT to refrain from expropriating. Thus commitment has value, which is reminiscent of the insight of Schelling (1960).[17] However, there is *a priori* no reason to assume that the foreign donor has stronger commitment to not provide aid than the host country has to not expropriate. The foreign donor's commitment will not be credible unless it also establishes a legal system and an enforcement mechanism that *punishes aid provision*. This could be problematic if (1) the foreign donor is a multilateral agency and it is difficult to build consensus among the different parties involved, or (2) it is difficult for the foreign donor to strictly separate aid motivated by investment protection from aid motivated by altruistic or geopolitical motives.

Suppose that the foreign donor cannot commit not to provide aid and that the host country will adopt the NECT to refrain from expropriating *if and only if it is sufficiently compensated* for the loss from the adoption. Then the next question to ask is whether the foreign donor is willing to provide such compensation, thereby triggering the host country to reform its institutions and adopt the NECT. Figure 5 plots the two functions $G(A)$ and $L(A)$ in this case ($A = \bar{A}$), where these functions

[17] Svensson (2000) discusses the commitment problem by the donor in inducing the recipient countries to exert efforts to alleviate poverty.

simplify to

$$G(A) = \frac{rA}{1-\beta}, \tag{12}$$

$$L(A) = \frac{1}{1-\beta}\left[h\left(K^H + A\right) - h\left(K^H\right)\right]. \tag{13}$$

Obviously $G(A)$ is an upward sloping straight line and $L(A)$ is increasing and concave, with $G(0) = L(0) = 0$. Define $\tilde{A}_f > 0$ such that $L\left(\tilde{A}_f\right) = G\left(\tilde{A}_f\right)$. If $\bar{A} < \tilde{A}_f$, then the foreign donor will not pay to trigger the host country's adoption of the NECT. The following lemma establishes that when there exists an aid Kuznets curve and we are on the increasing part of this curve, we have $\bar{A} < \tilde{A}_f$ and $L\left(\bar{A}\right) > G\left(\bar{A}\right)$, i.e., the host country's loss always dominates the foreign donor's gain associated with the host country's adoption of the NECT.

Lemma 2 *Suppose that the three conditions specified in Proposition 1 are satisfied, that $K_1^H > 0$ exists, and that $K^H \in \left(0, K_1^H\right)$. Then the host country will not adopt the NECT voluntarily. Furthermore, the foreign donor has no incentive to induce such an adoption by providing a one-time stimulus to the host country.*

Proof. See the Appendix. ■

Case 2: The optimal aid is A^*.

This situation arises when the optimal aid is monotonically decreasing in K^H or when there exists an aid Kuznets curve and we are on its decreasing part. In this

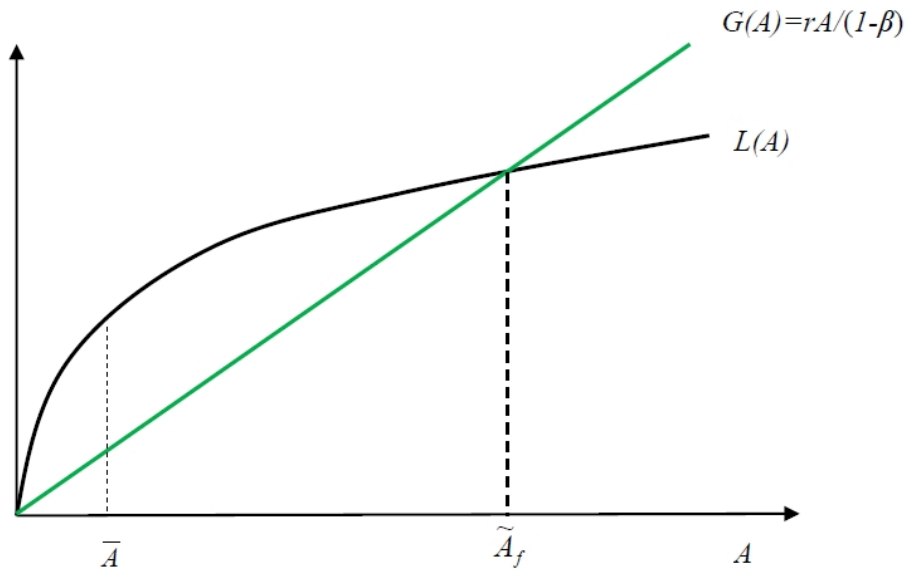

Figure 5: Gain function $G(A)$ and loss function $L(A)$ in equilibrium with $\bar{A}$

case, one can show that if the host country's domestic capital stock is sufficiently large, or if the optimal amount of aid is sufficiently small, then the foreign donor may be willing to provide a one-time stimulus to induce the host country to adopt the NECT, or even the host country may be willing to do so voluntarily. The result is summarized by the following lemma.

Lemma 3 *Suppose that the three conditions specified in Proposition 1 are satisfied and the optimal aid equals* A^*. *Define* $\tilde{A}_h$ *such that* $L\left(\tilde{A}_h\right) = 0$ *and* $\tilde{A}_f$ *such that* $L\left(\tilde{A}_f\right) = G\left(\tilde{A}_f\right)$.

i. If $A^* \leq \tilde{A}_h$, *then the host country will adopt the NECT voluntarily.*

ii. If $\tilde{A}_h < A^* \leq \tilde{A}_f$, *then the host country will not adopt the NECT voluntarily*

but the foreign donor is willing to provide the one-time stimulus to the host country to induce such an adoption.

iii. If $A^* > \tilde{A}_f$, then neither will the host country adopt the NECT voluntarily nor will the foreign donor provide the one-time stimulus to induce adoption.

Proof. See the Appendix. ■

In Figure 6 we plot $L(A)$ and $G(A)$ as functions of A. In the proof we show that $L(0) < 0$ and $L'(A) > 0$, thus the curve $L(A)$ is increasing and intersects the horizontal axis at $A = \tilde{A}_h$. We also show that $G(A)$ is always positive and is a convex function with a minimum obtained at $A = A^*$. As before $\tilde{A}_f$ satisfies $L\left(\tilde{A}_f\right) = G\left(\tilde{A}_f\right)$. Since $\tilde{A}_h < \tilde{A}_f$, there exist three possibilities as enumerated in Lemma 3. Figure 6 shows the second case where $\tilde{A}_h < A^* \leq \tilde{A}_f$. According to Lemma 3, the adoption of the NECT is only possible when the amount of optimal aid, absent commitment, is small enough. A small amount of optimal aid indicates that the opportunity cost of adopting the NECT is small for the host country. Meanwhile, the opportunity cost of inducing the host country to adopt the NECT is also small for the foreign donor.

Recall that A^* is a decreasing function of K^H (see Figure 3). Let K_h^H and K_f^H be the host country's domestic capital stock associated with $\tilde{A}_h$ and $\tilde{A}_f$, respectively. One can then rewrite Lemma 3 in terms of the cutoff values for K^H instead of A. Furthermore, Lemmas 2 and 3 can be combined to yield the following proposition.

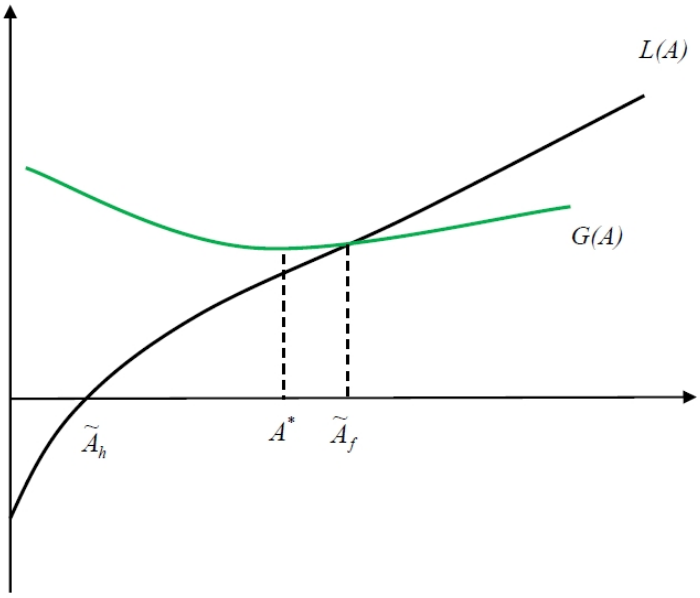

Figure 6: Gain function $G(A)$ and loss function $L(A)$ in equilibrium with A^*

Proposition 4 ***(Expropriation Traps).*** *Suppose the host country is sufficiently impatient:* $\beta < \theta$.

i. If $0 < K^H < K_f^H$, *then the host country will not adopt the NECT voluntarily. Furthermore, the foreign donor has no incentive to induce such an adoption by providing a one-time stimulus to the host country. The world economy is in an expropriation trap.*

ii. If $K_f^H \leq K^H < K_h^H$, *then the host country will not adopt the NECT voluntarily but the foreign donor is willing to provide the stimulus.*

iii. If $K_h^H \leq K^H < \bar{K}^H$, *then the host country will adopt the NECT voluntarily.*

Proposition 4 takes our positive economic theory of aid to a more fundamental level. In Proposition 1, the lack of commitment technology for the host country to refrain from expropriating (along with the sufficient impatience and poverty of the host country) is taken as exogenously given when rationalizing aid provision. Assuming the lack of the NECT is equivalent to assuming that the host country always refuses to adopt such a commitment technology even if it is made available, i.e., it commits not to commit not to expropriate. Proposition 4 endogenizes this lack of commitment for host countries that are sufficiently impatient. It divides the set of poor countries (those with $K^H < \bar{K}^H$) into three categories: the extreme poor ($K^H < K_f^H$), the medium poor ($K_f^H \leq K^H < K_h^H$), and the less poor ($K_h^H \leq K^H < \bar{K}^H$).

Proposition 4 predicts that commitment is not a problem for the less poor countries after all: if the NECT becomes available, these countries will adopt it voluntarily. Nor is commitment a problem for the medium poor countries. Although these countries will not adopt the NECT voluntarily, with the compensations willingly provided by the foreign donor they will have sufficient incentives to adopt the NECT. When is the lack of commitment on the part of the host country unavoidable then? The answer is when the host country is extremely poor. In this case neither will the host country adopt the NECT voluntarily nor will the foreign donor provide the host country with the stimulus to induce adoption of the NECT. The world

economy is in an expropriation trap under this situation. In the expropriation trap the binding threat of expropriation persists and there is continual provision of aid to mitigate distortions caused by the threat of expropriation.[18]

The idea of expropriation traps is intimately related to the well-known concept of poverty traps.[19] As the Monterrey Consensus (United Nations, 2002) put it, "private international capital flows, particularly foreign direct investment (FDI), are vital complements for national and international development efforts. FDI contributes toward financing sustained economic growth over the long term. It is especially important for its potential to transfer knowledge and technology, create jobs, boost overall productivity, enhance competitiveness and entrepreneurship, and ultimately eradicate poverty through economic growth and development." Hence if a country is caught in an expropriation trap, it is less likely to be lifted out of a poverty trap.

Following the numerical example in Figure 3, we compute the expropriation traps for a high value and a lower value of β. When $\beta = 0.85$, $K_f^H = 0.0732$ and $K_h^H = 0.1300$. This implies that the trap range (extreme poor) is 1.3 times as large as the intermediate range (medium poor). When $\beta = 0.60$, $K_f^H = 0.0019$

[18]The assumption that capital depreciates fully each period is not critical for this insight. A natural question to ask is whether allowing for the dynamics of capital will make the host country postpone consumption and accumulate enough capital so that it is completely self-financed, i.e., does not need foreign investment. We conjecture that this is not case. In different settings, it has been shown that impatient agents will never accumulate enough capital to be self-financed and will keep borrowing from patient agents (e.g., Carlstrom and Fuerst, 1997 and Iacoviello, 2005). Although we do not explicitly model capital accumulation, we note that expropriation frictions are relevant in our theory precisely because the host country is impatient, thus the results from the previous literature will likely carry through.

[19]See Azariadis and Stachurski (2005) for a survey of the literature on poverty traps.

and $K_h^H = 0.0042$, implying a trap range that is 86% as large as the intermediate range. These numbers are useful to answer questions such as how much extra capital (say, by helicopter drop) would be needed to move a host country from the extreme poor to the medium poor who do not face an expropriation trap and will have institutional reform. Note that K^H, beyond which the host country will carry out the institutional reform voluntarily, can be regarded as a threshold value of capital richness. Our calculation indicates that for a median country in the "extreme poor" category (with $K^H = K_f^H/2$), the amount of extra capital needed is 28% for $\beta = 0.85$ and 23% for $\beta = 0.60$ of the threshold value of capital richness.

4 Conclusions

Both FDI and foreign aid are important for development efforts. In this paper we have shown that the two are intimately related. A positive economic theory of aid that takes into account non-altruistic economic motives for aid provision has been presented. We identify the conditions under which aid will be granted and characterize how the quantity of aid will vary with the host country's development stage. We also identify the conditions under which institutional reform will be carried out in the FDI host country, as well as the conditions that give rise to an expropriation trap. The theory sheds light on a broad range of issues concerning expropriation, FDI, and institutions, and is complementary to existing approaches

(emphasizing mainly altruistic and geopolitical motives) to foreign aid.

Compliance with Ethical Standards

Conflict of Interest: The authors declare that they have no conflict of interest.

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Appendix

Proof of Proposition 2.

As long as the foreign donor chooses a positive amount of optimal aid, it must be better off than providing no aid at all. To show that the host country is also better off with aid, differentiate H^N with respect to A:

$$\frac{dH^N}{dA} = \frac{1}{1-\beta}\left[h'\left(K^H + A\right) + \left(k^{M*}\right)^{\theta}\frac{\tau - (1-\theta)}{(1-\tau)(1-\theta)}\frac{-d\tau}{dA}\right].$$

This indicates that the effect of aid on the host country's total discounted income comes from two sources. The first is the direct effect, captured by $h'\left(K^H + A\right) > 0$: foreign aid augments the host country's domestic capital stock and increases its production. The second is the indirect effect coming from the enhancement of FDI due to a reduction in τ. Note that only when the host country's optimal choice of τ equals $\hat{\tau}$ is this second effect present, which is positive since $\hat{\tau} > 1-\theta$ and $d\hat{\tau}/dA < 0$. If the optimal choice of τ is $\tau^* \equiv 1-\theta$, which is independent of aid ($d\tau^*/dA = 0$), then the second effect will be zero. Nevertheless, the direct effect is still strictly positive. Therefore it is always true that $dH^N/dA > 0$.

Proof of Proposition 3.

Totally differentiating the NEC (5) with $\hat{\tau}\left(\bar{A}\right) = 1-\theta$ with respect to K^H gives

$$\frac{d\bar{A}}{dK^H} = \frac{h'\left(K^H\right) - h'\left(K^H + \bar{A}\right)}{h'\left(K^H + \bar{A}\right)} > 0.$$

Totally differentiating (9) yields

$$\frac{dA^*}{dK^H} = \frac{h''\left(K^H + A^*\right)}{\frac{r\theta}{1-\theta}\frac{-d\hat{\tau}/dA^*}{[1-\hat{\tau}(A^*)]^2} - h''\left(K^H + A^*\right)} < 0.$$

If $\bar{A} \geq A^*$ at $K^H = 0$, then it is obvious that the optimal aid equals A^*, which is positive and monotonically decreasing in K^H until it reaches $\bar{K}^H$. We now consider the case where $\bar{A} < A^*$ at $K^H = 0$. In this case $K_1^H > 0$ exists and is unique. When $K^H = K_1^H$, we obtain the maximum amount of aid, denoted by $A_{\max}$. Note that $\hat{\tau}\left(\bar{A} = A^* \equiv A_{\max}\right) = 1 - \theta$. At $A_{\max}$, the first order condition (9) can be simplified as

$$h'\left(K_1^H + A_{\max}\right) = \frac{1-\beta}{1-\theta}\frac{r}{\beta} \tag{A1}$$

Since $\beta < \theta$, we have $h'\left(K_1^H + A_{\max}\right) > r/\beta = h'\left(\bar{K}^H\right)$, or $K_1^H + A_{\max} < \bar{K}^H - A_{\max} < \bar{K}^H$. Evaluating the NEC at $A = A_{\max}$, $K^H = K_1^H$ and $k^{M*}(\tau = 1-\theta) = \left(r/\theta^2\right)^{1/(\theta-1)}$ yields

$$(\theta - \beta)\left(\frac{r}{\theta^2}\right)^{\frac{\theta}{\theta-1}} = \beta\left[h\left(K_1^H + A_{\max}\right) - h\left(K_1^H\right)\right]. \tag{A2}$$

Equations $(A1)$ and $(A2)$ can be used to pin down K_1^H :

$$K_1^H = h^{-1}\left[h\left(h'^{-1}\left(\frac{1-\beta}{1-\theta}\frac{r}{\beta}\right)\right) - \frac{\theta-\beta}{\beta}\left(\frac{r}{\theta^2}\right)^{\frac{\theta}{\theta-1}}\right].$$

To complete the proof we need to show that $\bar{A}_{\min} < A_{\max}$. Note that $\bar{A}_{\min}$ is determined by the NEC evaluated at $K^H = 0$ and $\hat{\tau}\left(\bar{A}\right) = 1 - \theta$, which can be simplified as

$$(\theta - \beta)\left(\frac{r}{\theta^2}\right)^{\frac{\theta}{\theta-1}} = \beta h\left(\bar{A}_{\min}\right) \tag{A3}$$

Combining $(A2)$ and $(A3)$ yields $h\left(K_1^H\right) + h\left(\bar{A}_{\min}\right) = h\left(K_1^H + A_{\max}\right)$. The concavity of h, however, implies that $h\left(K_1^H\right) + h\left(\bar{A}_{\min}\right) > h\left(K_1^H + \bar{A}_{\min}\right)$. Thus $A_{\max} > \bar{A}_{\min}$. This also implies that $K_1^H > 0$.

Proof of Lemma 2.

Since $L\left(\bar{A}\right) > 0$ for any positive $\bar{A}$, the host country will not adopt the commitment technology voluntarily. Consider Figure 5. We know that (1) $G\left(A=0\right) = L\left(A=0\right) = 0$; (2) $G'\left(A\right) = r/\left(1-\beta\right) > 0$; (3) $L'\left(A=0\right) = \left[h'\left(K^H\right) - r\right]/\left(1-\beta\right) > 0$ and $L''\left(A\right) = h''\left(K^H + A\right)/\left(1-\beta\right) < 0$. So we must have $L'\left(A=\tilde{A}_f\right) < G'\left(A=\tilde{A}_f\right)$. Recall that $dF^N/dA|_{A=\bar{A}} > 0$ for $K^H \in \left(0, K_1^H\right)$. This implies that

$$h'\left(K^H + \bar{A}\right) > r\frac{1-\beta}{1-\theta}\frac{1}{\beta} > r$$

That is, $L'\left(A=\bar{A}\right) > G'\left(A=\bar{A}\right) = G'\left(A=\tilde{A}_f\right) > L'\left(A=\tilde{A}_f\right)$. Therefore $\bar{A} < \tilde{A}_f$.

Proof of Lemma 3.

$L\left(A\right)$ is increasing and intersects the horizontal axis at $A = \tilde{A}_h$ because (1) $L\left(A=0\right) = \left[\hat{\tau}\left(A=0\right) f\left(k^M\left(\hat{\tau}\left(A=0\right)\right)\right) - \tau^* f\left(k^{M*}\right)\right]/\left(1-\beta\right) < 0$ since τ^* maximizes the host country's tax revenue; and (2) $L'\left(A\right) = h'\left(K^H + A\right)\left(1-\hat{\tau}\right)/(1-\hat{\tau}-\beta\theta) > 0$. If $A^* \leq \tilde{A}_h$, that is, $L\left(A^*\right) \leq L\left(\tilde{A}_h\right) = 0$, then the host country will adopt the commitment technology voluntarily. Otherwise if $A^* > \tilde{A}_h$, or $L\left(A^*\right) > L\left(\tilde{A}_h\right) = 0$. Note that $G'\left(A\right) = -dF^N\left(\hat{\tau}\left(A\right), A\right)/dA$. Then $G\left(A\right)$ is a convex function and obtains the minimum at $A = A^*$ (since in the foreign donor's problem $F^N\left(\hat{\tau}\left(A\right), A\right)$ is concave and obtains the maximum at $A = A^*$). Let $\pi\left(\tau\right) \equiv \left(1-\tau\right) f\left(k^M\left(\tau\right)\right) - rk\left(\tau\right)$, the profit of the foreign firm. Then $G\left(A\right)$ can be written as $G\left(A\right) = \left[\pi\left(\tau^*\right) - \pi\left(\hat{\tau}\right) + rA\right]/\left(1-\beta\right)$. Since $d\pi/d\tau = -f\left(k^M\right) < 0$ and $\tau^* < \hat{\tau}$, we have $G\left(A\right) > 0$ for all A. This result also implies that $\tilde{A}_h < \tilde{A}_f$

as $G(A)$ can never be negative. Therefore there exist three possibilities: $A^* \leq \tilde{A}_h$, $\tilde{A}_h < A^* \leq \tilde{A}_f$, or $A^* > \tilde{A}_f$. And the result follows.