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# Leland & Pyle Meet Foreign Aid? Adverse Selection and the Procyclicality of Financial Aid Flows

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**Abstract:** Official development assistance (grants and subsidized loans from foreign aid agencies) is the main source of external finance in developing countries. These financial aid flows are positively correlated with the recipients' business cycles, which is puzzling because it reinforces already strong and costly macroeconomic fluctuations in the recipient countries. We propose an explanation related to a familiar corporate finance theory of inside equity commitments. We assume that donor agencies and recipient governments value projects differently, and that donors know less than recipients do about projects. We show that donors can make an aid recipient identify high-return projects by conditioning aid on the recipient's committing some of its own funds to the selected projects. This commitment makes recommending bad projects costly. Contributing "counterpart funds" is more difficult during economic downturns, however – which leads to aid procyclicality. This simple model of investment financing and aid provision produces aid contracts consistent with those used by aid agencies, rationalizes observed aid flow patterns, and yields a rich set of testable empirical predictions.

# 1 Introduction

A key source of external finance in developing countries is official development assistance (ODA) from bilateral and multilateral aid agencies. Much of this foreign aid comes in the form of outright grants, and the rest is made up of long-term concessional loans. A striking characteristic of these foreign aid flows is their positive correlation with the business cycles of the recipient countries [Pallage & Robe (2001); Bulír & Hamann (2003)]. As a result, far from helping these recipients smooth out the impact of aggregate economic shocks, foreign aid reinforces their business cycle – making good years even better, but further exacerbating economic downturns. This procyclicality is awkward, given that developing countries are subject to strong and very costly macroeconomic fluctuations [e.g., Ramey & Ramey (1995); Pallage & Robe (2003)] and typically have little access to international financial markets when their economies are in the doldrums [e.g., Atkeson (1991); Brennan & Cao (1997)].

The extant literature provides little insight into why foreign aid is procyclical, and the data are inconsistent with some obvious potential explanations. For example, one might suppose that rich countries are more willing or able to provide foreign aid in times of plenty. Then, if North and South business cycles are positively correlated [Agénor, McDermott, & Prasad (2000); Kouparitsas (2001)], financial aid flows should be positively correlated with the business cycles of donors and, in turn, with those of recipients. In practice, however, commitments and disbursements of aid to poor countries are typically not procyclical from the perspective of the donors [Pallage & Robe (2001)]. Thus, budgetary pressures at the donor-country level are unlikely to be the main cause of the procyclicality of foreign aid flows. Likewise, because ODA is effectively rationed in good and bad years alike, it is doubtful that cyclical fluctuations in the recipient country's investment opportunity set are the source of aid procyclicality. Put differently, to the extent that a recipient country always has more candidate projects than donor agencies can afford to fund, the donors' budget constraints should be binding in any given year. Hence, variations in the availability of worthy projects are unlikely to be driving intertemporal aid flow patterns.

In this paper, we propose a simple screening model of investment financing and ODA provision under adverse selection that provides a possible solution to the puzzle. We show that observed aid contracts and aid flow patterns can be rationalized by building on a well known corporate finance intuition behind inside equity commitments – even though aid donors are assumed to be altruistic and aid grants are never repaid. Specifically, we consider a one-period model of a donor agency and a recipient government, and show that aid procyclicality can arise naturally from the donor's desire

to maximize the returns accruing to the recipient economy on the projects it funds. The model rests on four assumptions. (i) The aid recipient has more projects it would like to see financed than the aid agency can fund. (ii) The aid agency acts altruistically, in that it tries to select projects with the highest financial returns to the recipient *country*. (iii) The recipient *government* values projects differently. It ranks projects based not only on their financial returns but also on a second, complementary dimension – e.g., the extent to which they benefit a given constituency. (iv) The donor agency knows less about project characteristics than does the recipient government.

We show that the donor agency can elicit truthful revelation of this private information by requiring that the recipient government provide counterpart funds to help finance the projects. Intuitively, if the donor wants to fund only the most productive projects (regardless of other considerations that also matter to the recipient government), then requiring that the recipient government invest some of its own funds in the projects makes it relatively more costly for this government to choose less productive projects that it might otherwise prefer (for example, because these projects disproportionately benefit one of its core constituencies). However, if the recipient can ill afford these "counterpart funds" requirements during economic downturns, then the upshot is aid flow procyclicality.[1] The model produces aid contracts similar to those that aid agencies use for project finance, helps explain observed aid flow patterns, and yields many testable empirical predictions. It also has important implications for consumption smoothing in developing countries.

The remainder of the paper is organized as follows. Section 2 summarizes our contribution to the literature. Section 3 describes the model. Section 4 derives the first-best aid policy and shows how counterpart fund requirements can align preferences under asymmetric information. Section 5 discusses the consequences of these contracts in terms of aid procyclicality, fleshes out empirical predictions, and contrasts our results with the available empirical evidence. Section 6 concludes and outlines some policy implications.

## 2    Related work

Our paper straddles several literatures in finance and economics. First, it belongs to the literature that explains intertemporal patterns in capital flows to, and investment financing in, developing

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[1] Our usage of the word "counterpart funds" and of the less common substitute term "matching grants" reflects these terms' meaning in aid agencies. It differs from that in the large fiscal federalism literature on how "matching grants" (as opposed to block grants) from federal authorities can help local governments internalize various externalities in their public investment decisions. Oates (1999) and Snoddon & Wen (2001) review that literature.

countries. Extant studies focus on private capital flows, be they equity investments [e.g., Brennan & Cao (1997); Henry (2000)]; the result of corporate capital structure choices [e.g., Booth, Aivazian, Demirguc-Kunt, & Maksimovic (2001)]; or sovereign debt [e.g., Kehoe & Perri (2002)]. In poor countries, however, ODA is the main source of international financing. Even in other developing countries, a significant portion of all net capital inflows comes from international aid agencies.[2] Our first contribution is to explain the key feature of these financial aid flows – their procyclicality.[3]

Although aid agencies' preferences and constraints differ from those of commercial investors, our analysis incorporates elements of the finance literature on financing and project selection under adverse selection. In contrast to papers that demonstrate how own-equity commitments can be used as costly [e.g., Leland & Pyle (1977)] or costless [e.g., Heinkel (1982)] signals to solve asymmetric information problems, matching grants or counterpart funds act here as a costly screening device.[4] Our paper is therefore also related to the large literature on collateral requirements and credit rationing.[5] Closest to our model are Bester (1987) and Besanko & Thakor (1987) who show that, when borrowers are cash-constrained, collateral may not work and credit rationing may be necessary. Although a related intuition yields the procyclicality of foreign aid flows in our environment (aid is withheld when the recipient cannot afford contributing the required counterpart funds), there are important differences. First, counterpart funds paid up-front dominate contingent mechanisms (such as the pledging of collateral) because aid recipients are sovereign countries. Second, and more importantly, we show that aid or credit rationing may occur even when the donor has an objective function very different from that of a commercial lender. That is, we show that counterpart-fund requirements, combined with a threat of aid rationing, can be optimal simply

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[2]In the last fifteen years, ODA has constituted from 10% to 60% of net capital flows to all developing nations; for the poorest ones, the ratio has averaged 50% to 90% [World Bank (2002)].

[3]In almost all developing countries, foreign aid inflows are either strongly or weakly positively correlated with both the recipient country's GDP [e.g., Pallage & Robe (2001); Bulír & Hamann (2003)] and its government's fiscal position [Bulír & Lane (2002)]. Only food aid is countercyclical [Gupta, Clements, & Tiongson (2003)].

[4]Seemingly related also are many finance papers that use signaling frameworks to show that corporate financial policies in general, and capital structure choices in particular, can be used to tackle informational asymmetries [e.g., Brennan & Kraus (1987); Constantinides & Grundy (1989); Nachman & Noe (1994); Darrough & Stoughton (1996); Heider (2002); Koufopoulos (2003)]. However, because foreign aid flows take the form of either grants or grant-like loans, some central issues in such studies (equilibrium security pricing and choosing among possible external financing tools) are not relevant here.

[5]See Coco (2000) for an extensive review. Key work on the link between asymmetric information in private credit markets and the business cycle includes Stiglitz & Weiss (1987), Bernanke & Gertler (1989), and Kiyotaki & Moore (1997). For recent empirical evidence on the impact of macroeconomic fluctuations on financial constraints and capital structure choices by U.S. firms, see Korajczyk & Levy (2003).

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because fund providers and recipients have different preferences.

A key element of our analysis, then, is to recognize the divergence between the interests of aid agencies and recipient governments. Like several recent theoretical studies of foreign aid, we therefore view the donor and the recipient in the context of an agency relationship. Those papers focus on the role that aid policies can play in promoting military expenditure reduction [Murshed & Sen (1995)], poverty alleviation [Svensson (2000); Cordella & Dell'Ariccia (2002, 2003); Azam & Laffont (2003)], or good policies in general [Svensson (2003)]. Logically, they consider situations in which the preferences of either the recipients or both the donors and the recipients lead to moral hazard with respect to the implementation of these policies. Those analyses, however, do not seek to explain aggregate aid flow patterns.[6] In a study of debt forgiveness, Cordella, Dell'Ariccia, & Kletzer (2002) show that aid flows can be procyclical even if the sole purpose of foreign aid grants is to support poverty reduction in highly indebted countries. However, because these authors model aid flows between two endowment economies, they can only analyze issues related to consumption smoothing – not investment. Hence, their findings cannot explain the procyclical behavior of the large fraction of aid flows that help finance investment in developing countries – namely, the grants and the heavily subsidized loans that make up official development assistance.

To get at the link between foreign aid and the recipient's business cycle, we focus not on poverty reduction but instead on the other, long-stated goal of foreign aid: the promotion of development. It seems reasonable to posit that recipient governments will want to see productive projects succeed once they have been funded, so we assume away moral hazard questions related to whether the recipient will work diligently on the project after aid monies start flowing. We also abstract from agency issues related to possible default by a sovereign borrower because they have been studied in depth elsewhere and, more importantly, because default is not an issue given that the bulk of ODA takes the form of either outright grants or concessional loans with maturities measured in decades. Instead, we posit that the fuel of the conflict between the donor agency and the recipient government is the recipient's superior knowledge about the intrinsic qualities of the candidate projects. In what follows, we show that this informational asymmetry and a divergence between the preferences of aid donors and recipient governments together produce procyclical patterns in foreign aid flows.

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[6]The same is true for Asiedu & Villamil (2002) and Azam (2002). Those authors analyze how, when sanctions against a "wayward" government are not credible, foreign aid grants can be used to induce the targeted recipient to repay commercial loan or to respect domestic minorities.

# 3 Model

Consider a one-period model of a donor agency and a recipient government. The latter has a set $I$ of like-sized projects that it would like to undertake but does not have enough domestic resources to fund. It faces limited access to international financial markets, so that foreign aid is its only significant source of external capital.[7] The donor agency's budget constraint, however, means that it can provide official development assistance for only some of these projects.

## 3.1 Projects

All projects require the same investment outlay, $X$. The projects are not divisible: they yield no utility to either the donor agency or the recipient government unless the full amount $X$ is invested. Each project is summarized by two statistics: its financial return, $\theta > 0$; and the extent to which it specifically benefits one of the recipient government's core constituencies, $\alpha > 0$. If one of the candidate projects is a road, for example, then its financial return $\theta$ might come from tolls or the increase in tax receipts due to economic growth attributable to the road.

There is no reason why more productive projects should have a greater (or a lower) $\alpha$, so we make no specific assumption about the extent to which the two characteristics are correlated. Without loss of generality, we number the projects in decreasing order of productivity: $\theta_i > \theta_{i+1} \ \forall i \in I$.

## 3.2 Donor

The agency's aid budget for the recipient, $B$, is exogenous. This assumption reflects the fact that, in both bilateral and multilateral aid agencies, budgets for individual countries are determined through a political process that amalgamates many aims besides promoting development or reducing poverty [Alesina & Dollar (2000)]. Formally, the donor's beginning-of-period budget constraint is given by:

$$B \geq \sum_{i \in F} b_i \tag{1}$$

where $F$ is the set of funded projects, and $b_i$ is the amount disbursed on the $i^{th}$ project ($b_i \leq X \ \forall i \in F$). The aid agency can fund at most a subset $F$ of the set of available projects, so $F \subset I$.

Most ODA flows take the form of grants; the rest are concessional loans with long maturities and

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[7]We abstract from the possibility that releasing aid may affect the flow of private capital to the recipient country, be it positively [e.g., Harms & Lutz (2003)] or negatively [e.g., Basu & Morita (2002)].

heavily subsidized interest rates.[8] We approximate this fact by assuming that foreign aid is never repaid and, hence, that the donor agency is not preoccupied with issues related to end-of-period default. Instead, we posit that the agency is altruistic in that it chooses the set of funded projects, $F$, to maximize the *recipient country*'s return on the projects it finances:

$$U_D \equiv \sum_{i \in F} (\theta_i - X) \quad s.t. \quad U_D \geq 0 \ \ and \ \ (1) \tag{2}$$

where $\theta_i$ is the return on the $i^{th}$ project. This objective function differs from those of commercial lenders (who worry about default) and equity investors (who care about their own return on investment, i.e., about $\theta_i - b_i$), but nevertheless ensures that the agency does not fund unprofitable projects (for which $X > \theta_i$) even if $b_i < \theta_i$.[9]

## 3.3  Recipient

In contrast to the donor agency, whose utility depends solely on the return on the projects it funds, the recipient government is concerned not only with maximizing its resources at the end of the period (and, hence, with the return $\theta$) but also with helping its core constituency (i.e., with $\alpha$). Formally, we assume that these characteristics enter the recipient government's utility multiplicatively:

$$U_R \equiv \sum_{i \in F} (\theta_i - M_i)^\sigma \alpha_i^{1-\sigma} \tag{3}$$

where $M_i$ is the recipient government's contribution to the $i^{th}$ project. The parameter $0 < \sigma \leq 1$ summarizes the divergence between the preferences of the donor agency and the recipient government. At one extreme, there is no agency conflict when $\sigma = 1$. At the other extreme, when $\sigma$ is close to 0, the recipient government is little concerned *per se* with its country's returns on various projects.

The recipient government has limited funds available for discretionary spending, $G$, that fluctuate with the recipient country's gross domestic product, $Y$: $G \equiv g(Y)$, where $g'(.) > 0$. Even in good years, though, the government cannot fund any of the projects by itself: $X > G$. Put differently, $I$ is the set of projects that the government, even in good years, is unable to fund on its own.

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[8]For example, using data from Chang, Fernandez-Arias, & Serven (1999), one can readily compute that the median grant element in ODA loans to non-oil-producing African countries exceeded 90% between 1975 and 1995.

[9]In practice, aid agencies may have institutional incentives to always disburse their entire country allocations even if it is clear that a project is best abandoned [e.g., Svensson (2003)]. We abstract away from this possibility.

## 3.4 Information structure

In practice, even though donor agencies do carry out detailed cost-benefit analyses, aid recipients nevertheless have an informational advantage on donors. First, notwithstanding donor due diligence, the recipient government likely retains better information on the worthiness of a given project or on the opportunities that the project presents for corrupt procurement deals. We model this situation by assuming that, at the beginning of the period (i.e., prior to aid disbursement and investment in the project), the recipient government knows the exact values of all $(\theta, \alpha)$ pairs, but the donor agency only knows the unconditional probability distributions of each of those two variables, $P(\theta_i)$ and $P(\alpha_i)$ ($i \in I$). Second, it seems reasonable to assume that only the recipient government truly knows the extent to which it can free funds for discretionary spending. Accordingly, we assume that only the recipient government observes $G$.

For example, suppose that there are only two projects ($\#I = 2$). Following our notation in Section 3.1, the high-return project is project 1, with characteristics $\theta_1$ and $\alpha_1$, and the low-productivity project is project 2, with characteristics $\theta_2$ and $\alpha_2$. Whereas $\theta_1 > \theta_2$ according to our notational convention, it could be that $\alpha_1 > \alpha_2$ or $\alpha_1 < \alpha_2$. Precisely, if $\alpha$ can take the values $\alpha_L$ or $\alpha_H > \alpha_L$, then either $\alpha_1 = \alpha_H$ (and $\alpha_2 = \alpha_L$) or $\alpha_1 = \alpha_L$ (and $\alpha_2 = \alpha_H$). The recipient government knows which project is project 1, but the donor agency does not. The recipient government also knows the value taken by $\alpha_1$ ($\alpha_L$ or $\alpha_H$), but the donor agency again does not.

Because the recipient government knows the donor agency's objective function (2) and the characteristics of each candidate project, it knows the agency's exact ranking of these projects. In contrast, the donor agency only knows the recipient government's preferences over the two project *characteristics*, $\theta$ and $\alpha$, and the statistical properties of all stochastic variables. The informational asymmetry it faces is therefore two-dimensional, involving both $\theta$ and $\alpha$. A key consequence is that the agency does not know the government's actual ranking of the projects – it merely knows the probability distribution of possible rankings. For example, if there are only two candidate projects, the agency only knows $\widehat{P} \equiv P(\theta_1^\sigma \alpha_1^{1-\sigma} < \theta_2^\sigma \alpha_2^{1-\sigma})$, i.e., the probability that the recipient government prefers project 2 even though it has a lower return ($\theta_2$) than does project 1 ($\theta_1$).

## 3.5 Timing

Events proceed as follows:

- The donor agency announces the number of projects it can fund, $\#F$, and the required amount of counterpart funds, $M_i$ ($i \in I$).

- The recipient government discloses its preferred projects, i.e., announces $(\theta_i, \alpha_i)$ $(i \in F)$.

- After the recipient government observes its available resources $G$, it transfers its counterpart funds (if any) to an escrow account controlled by the donor. The donor does not observe $G$.

- Donor and counterpart funds are released by the donor for all projects that have received counterpart funds; projects that have not received counterpart funds are not undertaken.

- The donor agency consumes all its unused funds, which contributes 0 to its utility $U_D$.

- Returns and payoffs are realized.


# 4    Aid contracts

For simplicity, we carry out the analysis in the two-project case and do not consider mixed strategies.[10] Suppose that the recipient government has two similarly-sized projects that it wants to undertake ($\#I = 2$) but does not have enough resources to fund either; and that the donor agency can only fund one project ($\#F = 1$). In a first-best environment, the donor agency would have full information about each project's characteristics and could readily mandate investment in the more productive of the projects. Thus, project 1 would be undertaken because $\theta_1 > \theta_2$. When only the recipient government observes the projects' characteristics, the same choice will obtain as long as the values of $\theta$ and $\alpha$ are positively correlated (i.e., as long as $\alpha_1 > \alpha_2$). However, the recipient government can face a trade-off between productive efficiency and favoritism if $\theta_1 > \theta_2$ but $\alpha_1 < \alpha_2$ (i.e., if $\alpha_1 = \alpha_L$ and $\alpha_2 = \alpha_H > \alpha_L$). Indeed, it strictly prefers project 2 to project 1 whenever $\theta_1^\sigma \alpha_1^{1-\sigma} < \theta_2^\sigma \alpha_2^{1-\sigma}$. Therefore, if the donor agency does not observe the two projects' characteristics, it must devise a way to elicit the recipient government to truthfully report the project's return $\theta$.

Collateral would not generate truth-telling in the modelled environment, because the sovereign nature of the aid recipient precludes the donor from forcing it to make payments in the event of lower-than-promised project performance. Faced in practice with similar constraints, bilateral and multilateral aid agencies (such as the World Bank) typically ask recipient governments to deposit, in an escrow account controlled by the donor agency, some matching grants that are then used to help finance the recipients' candidate projects. The up-front payment of these counterpart funds

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[10]Results qualitatively similar to those obtained in this section are readily derived when there are more than two candidate projects. The main complications are to show that the size of the matching grant requirement varies with the number of projects that can potentially be funded (i.e., with the donor agency's budget $B$) and that, conditional on the donor's budget, the same-size grant is used for all projects.

is meant to help align the preferences of donor and recipient. Proposition 1 shows that requiring the recipient government to contribute an appropriate matching grant $M$ to the project indeed can help alleviate the agency conflict. Formally, let $K = (1 - \sigma)/\sigma$; then, we have:

**Proposition 1:** *Suppose that the aid agency does not observe the project characteristics, $\theta$ and $\alpha$. Then, it can elicit truthful reporting of this private information by mandating that the recipient government contribute an amount $M^*$ toward the total investment, $X$. This matching grant, $M^*$, is such that:* $\text{Max}[0, \frac{\theta_2 \alpha_H^K - \theta_1 \alpha_L^K}{\alpha_H^K - \alpha_L^K}] \leq M^* \leq \theta_2$.

Proof: See the Appendix.


Intuitively, in our model the donor agency wants to fund only the most productive project, regardless of other considerations that also matter to the recipient government. By requiring that the latter invest some of its own funds in the projects, the donor makes it relatively more costly for this government to choose the less productive project that it might otherwise prefer.

Faced with a demand to contribute $M^*$ to the project, however, the recipient government might be unable or unwilling to do so. Given this possibility, should the aid agency threaten to disburse nothing (i.e., to ration aid) unless the recipient government makes the requested matching grant? Proposition 2 shows that the answer depends both on the likelihood $P^* \equiv P(G > M^*)$ that the recipient government will be able to afford the matching grant $M^*$ and on the probability $\widehat{P} \equiv P(\theta_1^\sigma \alpha_1^{1-\sigma} < \theta_2^\sigma \alpha_2^{1-\sigma})$ that the preferences of donor and recipient would not be aligned in the absence of a matching grant requirement.

**Proposition 2:** *Let $P^* \equiv P(G > M^*)$ and $\widehat{P} \equiv P(\theta_1^\sigma \alpha_1^{1-\sigma} < \theta_2^\sigma \alpha_2^{1-\sigma})$. It is optimal for the donor agency to require a matching grant $M^*$, and the agency is credible when it threatens to withhold aid if the recipient government does not provide this matching grant, whenever:*

$$P^*[\theta_1 - X] > \widehat{P}[\theta_2 - X] + (1 - \widehat{P})[\theta_1 - X] \tag{4}$$

Proof: See the Appendix.


Condition (4) implies that the donor agency makes aid disbursement conditional on the recipient government's contributing $M^*$ in counterpart funds as long as (i) the probability $\widehat{P}$ that the recipient government would pick the bad project absent this requirement is large enough, (ii) the probability $P^*$ that the recipient government will be able to afford $M^*$ is large enough, and (iii) the quality

gap between the two projects $(\theta_1 - \theta_2)$ is large enough. For example, when $P^*$ and $\widehat{P}$ are both small, it is not optimal to mandate matching grants if even the worst project is profitable.[11]

How large should $M^*$ be? From Proposition 1, we know that $M^* \geq \frac{\theta_2\alpha_H^K - \theta_1\alpha_L^K}{\alpha_H^K - \alpha_L^K}$. From Proposition 2, we see that the donor agency's expected utility is *ceteris paribus* increasing in $P^* \equiv P(G > M^*)$ and, therefore, decreasing in $M^*$. It follows that $M^*$ equals the lower bound of the range identified in Proposition 1:

**Corollary 1:** *If it is optimal for the donor to mandate a matching grant, then its size is:*

$$M^* = \frac{\theta_2\alpha_H^K - \theta_1\alpha_L^K}{\alpha_H^K - \alpha_L^K} \tag{5}$$

When $\alpha_1 \neq \alpha_2$ but $\theta_1 = \theta_2$, the donor should be indifferent between projects and there should be no need for a matching grant. Consistent with this intuition, equation (5) shows that there is no feasible matching grant in that case.[12] Similarly, $M^* = 0$ when $\alpha_1 = \alpha_2$ but $\theta_1 \neq \theta_2$: if all the candidate projects have the same $\alpha$, then the agency knows that the recipient will always pick the most productive one and there is no need for matching grants. Finally, if $\theta_1^\sigma \alpha_L^{1-\sigma} > \theta_2^\sigma \alpha_H^{1-\sigma}$, then $\widehat{P} = 0$ and there is no need for a matching grant.[13]

# 5 Empirical implications

In the last three decades, very few aid recipients have experienced counter-cyclical financial aid flows. In the overwhelming majority of developing countries, foreign aid receipts have been at least mildly, and often strongly, positively correlated with the contemporaneous levels of both GDP [Pallage & Robe (2001); Bulír & Hamann (2003)] and government revenues [Bulír & Lane (2002)] in the recipient country.

Our model predicts such patterns. Intuitively, the donor agency makes the aid recipient identify the high-return project by conditioning aid on the recipient's committing an amount $M^*$ of its own funds to the selected project. This commitment of counterpart funds makes recommending a bad project costly. However, because the recipient government's resources $(G)$ are an increasing function of GDP $(Y)$, meeting that counterpart-fund requirement is more difficult for the recipient

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[11]With $P^* + \widehat{P} < 1$, (4) becomes: $[\theta_1 - X] < \widehat{P}[\theta_2 - X]/[P^* + \widehat{P} - 1]$, which can be true only if $\theta_2 < X$.

[12]$M^* = \theta_1$, which is impossible given that $\theta_1 > X$ by assumption and $M^* \leq G < X$.

[13]$M^* < 0$ in equation (5), which is impossible.

government when it is experiencing an economic downturn – which leads to the procyclicality of foreign aid disbursements. Formally:

**Proposition 3:** *From the recipient's perspective, foreign aid is either procyclical or acyclical.*

Proof: See the Appendix.

Proposition 3 shows that our model explains the main phenomenon documented in the empirical papers on foreign aid flows cited above. These same papers establish two other important stylized facts, which the model also matches:

(i) *The strongest correlation between the cyclical components of aid flows and recipient output is contemporaneous* (as opposed to a correlation affected by leads or lags).

Our results imply that aid rationing should take place as soon as the recipient government becomes cash-constrained, which suggests that there should be no significant lag between an economic downturn (and attendant fiscal difficulties) in the recipient country and decreases in foreign aid flows to that country.

(ii) *Aid inflows are much more volatile than the recipient country's GDP.*

Our model is consistent with this pattern: aid takes either the value 0 or the value $X - M^*$, so even a small change in the level of $Y$ and $G$ can lead to large percentage aid flow changes. More generally, even with a greater number of projects ($\#I > 2$ and $\#F > 1$), a small change in the recipient government's resources can bring about discrete changes in its ability to provide the *requisite* counterpart funds and, hence, cause large changes in aid flows.

In addition to rationalizing these key stylized facts on international financial aid flows, the model yields a series of additional empirical predictions. For example, we can use Corollary 1 to identify several economic determinants of the amount of required counterpart funds, $M^*$. One expects $M^*$ to be directly related to the magnitude of the agency conflict between the donor agency and the recipient government – the stronger the conflict, the greater $M^*$. This conflict is a function both of the extent of the informational asymmetries between the players (i.e., the distributions of $\theta$ and $\alpha$) and of the divergence between their respective preferences (i.e., the value of $\sigma$). Indeed, we have:

**Prediction 1:** $M^*$ *is increasing in* $(1 - \sigma)$, *the parameter that measures the intensity of the recipient governments' focus on project characteristics other than the project's financial return to the recipient country.*

<u>Proof:</u> See the Appendix.


**Prediction 2:** *The size of the matching grant, $M^*$, is inversely related to the spread between the quality of different candidate projects ($\theta_1 - \theta_2$) and directly related to uncertainty about $\alpha$.*

<u>Proof:</u> See the Appendix.


Prediction 1 confirms that it is harder to align incentives when the preferences of donor and recipient are far apart. Prediction 2 formalizes two intuitions. One, the larger $\theta_1$ is relative to $\theta_2$, the more inclined the recipient government is to pick project 1 (i.e., the project preferred by the donor agency) in any event. Likewise, the lower $\theta_2$ is relative to $\theta_1$, the more costly it is for the recipient government to choose project 2 and the easier it is for the donor agency to induce the choice of project 1. Two, when there is a large difference between $\alpha_H$ and $\alpha_L$, the recipient government naturally finds it costly to pick project 1 over project 2, and the size of the necessary matching grant increases accordingly.

Another natural question is what factors affect the intensity of the correlation between foreign aid flows and recipient GDP. First is the magnitude of the agency conflict. However, whereas its implications for the size of the matching grant $M^*$ are clear, its impact on aid procyclicality is not straightforward. To see why, recall that aid procyclicality results from the possibility that the recipient government lacks the resources to contribute $M^*$ – which happens when the country's GDP (and, hence, $G$) is too low. The likelihood of such a shortfall is itself increasing in $M^*$. Therefore, as ($\theta_1 - \theta_2$) increases, the size of $M^*$ falls – which (i) increases the likelihood $P^*$ that the recipient government can provide counterpart funds and, given that a matching grant was already required, weakens the link between aid and the government's fiscal position but also (ii) makes it more likely that the donor imposes a matching grant requirement in the first place, which introduces the possibility of procyclicality. Still, it is possible to show the following:


**Prediction 3:** *As long as $P^*$ and $\widehat{P}$ are sufficiently large, aid procyclicality is increasing in $(1-\sigma)$, i.e., in the intensity of the recipient governments' focus on project characteristics other than its financial return. This relation is reinforced if the worst project is unprofitable, i.e., if $\theta_2 < X$.*

<u>Proof:</u> See the Appendix.


Second, the model also suggests a link between procyclicality and recipient-country wealth. On the one hand, if the aid recipient has no financial resources to speak of, then $P^* \simeq 0$ and it is

immediate from Proposition 2 that no matching grant will be required. That implication of the model is in line with the behavior of of donor agencies in countries recovering from civil wars, from which no counterpart funds are typically required. On the other hand, matching grant requirements lead to aid procyclicality in our model only to the extent that the recipient government can become cash-constrained. Consequently, as long as the typical aid project size $X$ is not itself related to the recipient country's wealth, aid procyclicality should be inversely related to that wealth. That is:

**Prediction 4:** *Aid flows are more procyclical in poorer countries.*

Proof: See the Appendix.

# 6   Conclusion

In this paper, we build a simple model of investment financing and aid provision under asymmetric information to rationalize key stylized facts about international aid flows. We show that, if the donor agency knows less than the recipient government does about the intrinsic quality of projects, then the agency can overcome this informational disadvantage by requiring the aid recipient to make a matching grant, i.e., to invest some of its own funds in the projects it recommends. Such a requirement is less affordable during economic downturns, which leads to a positive correlation between foreign aid flows and the recipient's business cycle.

In our model, the agency conflict stems adverse selection combined with cash constraints and a *possible* divergence between the interests of donor agencies and recipient governments. That is, our results obtain even though we assume that there is no moral hazard (either on the donor's side or on the recipient's side) and that the aid agency is altruistic (in that it prefers projects that yield the highest returns to the recipient country).

Our analysis leads to a rich set of testable empirical predictions. In particular, the model predicts that aid procyclicality should be related to the extent of informational asymmetries in a country (e.g., the likelihood that some projects might be truly undesirable from the donor's perspective) and to the opacity of the recipient government's operations (e.g., the importance of corruption).

Most far-reaching are the model's implications for poor countries. In developing countries, customary ways to smooth out the impact of output fluctuations on domestic consumption are likely to be very onerous. At the same time, foreign aid is a major source of income to those countries. In such an environment, aid flows have the potential to play a key smoothing role. Our

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results imply that foreign aid cannot play that role if donors face adverse selection issues. Indeed, our model predicts that aid will be most procyclical in poor countries – despite the fact that aid procyclicality is most costly to these countries from a risk sharing perspective. This prediction is broadly consistent with empirical evidence that aid is most procyclical in sub-Saharan Africa. Our model also forecasts that aid procyclicality will be contemporaneous, i.e., that recipient countries will experience reduced aid flows as soon as they experience financial difficulties – which is exactly when commercial sources of financing should be hardest for those countries to come by.

Macroeconomic fluctuations in developing countries and emerging markets are very costly. Several recent papers have shown that potentially large benefits exist if ways to reduce the impact of this volatility on local consumption can be identified and implemented. Many other papers have documented that, and explained why, arms-length capital flows in fact reinforce this volatility. Our results suggest that foreign aid cannot be expected to mitigate cyclical fluctuations either. In turn, this conclusion suggests that a fruitful venue for further theoretical and empirical research is to assess whether opening up developing countries' banking sector to foreign entry might help to significantly lower aggregate volatility.

Our results imply two other logical venues for further research. First, our analysis considers a one-period model of the relationship between donor agency and recipient government. In essence, we assume that the recipient government has a high discount rate. This assumption enables us to construct a plausible yet simple model that rationalizes the use of matching grants (which are widely used in practice), and produces aid procyclicality (which has been extensively documented). A natural question is whether, if the recipient's discount factor were lower and the donor-recipient relationship were that of a repeated agency, matching grants could be replaced by trigger strategies. Intuitively, if the donor could credibly threaten aid cutoffs whenever the recipient is found to have lied about project characteristics, then it might be able to restore efficiency with much smaller matching grants. A calibration analysis of a dynamic model might therefore make it possible to quantify potential welfare consequences of governance improvements that effectively lower the recipient government's discount factor and bring about lower foreign aid flow procyclicality.

Second, some of the informational issues in private project-finance are related to the ones raised by our analysis of aid grants. Our results suggest that unprofitable projects may end up being selected unless the local government is forced to invest, early on, a significant amount of its own into the projects that it proposes to foreign investors. It would be interesting to assess empirically whether the eventual success of actual projects is related to the equity stake contributed by local authorities.

# 7 Appendix

**Proof of Proposition 1:**

The donor agency does not know which project the recipient prefers. It must therefore ensure that the matching grant requirement aligns the preferences of donor and recipient, regardless of the recipient's actual ranking of projects in the absence of such a requirement.

Suppose first that $\theta_1^\sigma \alpha_1^{1-\sigma} < \theta_2^\sigma \alpha_2^{1-\sigma}$, i.e., the recipient strictly prefers project 2 over project 1 even though $\theta_1 > \theta_2$. In this case, it must be that $\alpha_1 = \alpha_L$ and $\alpha_2 = \alpha_H$. Conditional on contributing a matching grant $M$, the recipient's utility from each project is either $(\theta_1 - M)^\sigma \alpha_L^{1-\sigma}$ or $(\theta_2 - M)^\sigma \alpha_H^{1-\sigma}$. We need:

$$(\theta_1 - M)^\sigma \alpha_L^{1-\sigma} > (\theta_2 - M)^\sigma \alpha_H^{1-\sigma}$$

$$\iff \theta_1 \alpha_L^K - M \alpha_L^K > \theta_2 \alpha_H^K - M \alpha_H^K \text{ (where } K = (1-\sigma)/\sigma)$$

$$\iff \theta_1 \alpha_L^K - \theta_2 \alpha_H^K > M(\alpha_L^K - \alpha_H^K)$$

Given that $\alpha_L < \alpha_H$ by assumption, the recipient will pick the more productive project if: $M \geq \frac{\theta_1 \alpha_L^K - \theta_2 \alpha_H^K}{\alpha_L^K - \alpha_H^K} = \frac{\theta_2 \alpha_H^K - \theta_1 \alpha_L^K}{\alpha_H^K - \alpha_L^K}$. Clearly, if $M \geq X$, there is no feasible matching grant.

Next, suppose that $\theta_1^\sigma \alpha_1^{1-\sigma} > \theta_2^\sigma \alpha_2^{1-\sigma}$, i.e., the preferences of recipient and donor are aligned in the absence of a matching grant. In this case, we only need to show that the recipient is still better off choosing project 1 over project 2 even though it is being asked to contribute $M^*$. We prove this result as follows. First note that $\alpha_1 > 0$; $\alpha_2 > 0$; and $0 \leq \sigma \leq 1$. Therefore:

$$\theta_1^\sigma \alpha_1^{1-\sigma} > \theta_2^\sigma \alpha_2^{1-\sigma} \iff (\tfrac{\theta_1}{\theta_2})^\sigma > (\tfrac{\alpha_2}{\alpha_1})^{1-\sigma}$$

But, by assumption, $\theta_1 > \theta_2 > 0$. Hence, $\forall 0 < M \leq \theta_2$:

$$(\tfrac{\theta_1 - M}{\theta_2 - M})^\sigma > (\tfrac{\theta_1}{\theta_2})^\sigma > (\tfrac{\alpha_2}{\alpha_1})^{1-\sigma}$$

To finish the proof, we therefore only need to show that $M^* \leq \theta_2$. Let $\underline{M}^*$ denote the lower-bound for $M^*$. Then, $\theta_2 < \theta_1$ implies:

$$\underline{M}^* = \frac{\alpha_H^K \theta_2 - \alpha_L^K \theta_1}{\alpha_H^K - \alpha_L^K} < \frac{\alpha_H^K \theta_2 - \alpha_L^K \theta_2}{\alpha_H^K - \alpha_L^K} = \theta_2$$

That is, the lower-bound for $M^*$ is never above the return of the worst project. In Proposition 2 and Corollary 1, we show that $M^* = \underline{M}^*$.

Finally, if $\theta_1^\sigma \alpha_L^{1-\sigma} > \theta_2^\sigma \alpha_H^{1-\sigma}$, then there is never any conflict between the preferences of the donor and the recipient, so $\widehat{P} = 0$ and $M^* = 0$. **Q.E.D.**

**Proof of Proposition 2:**

By construction, requiring that the recipient contribute $M^*$ ensures that project 1 is selected. The recipient can only contribute $M^*$ if $G > M^*$. The donor agency's expected utility if it requires a matching grant from the recipient, then, is $P(G > M^*)[\theta_1 - X]$. The right-hand side of (4) is immediate from the fact that, absent a matching grant requirement, one project is always funded – with the recipient choosing project 2 with probability $\widehat{P}$ and project 1 otherwise. **Q.E.D.**

**Proof of Proposition 3:**

First recall that, by assumption, $G = g(Y)$ and $g'(.) > 0$. That is, the recipient government's discretionary funds available for project funding are strictly increasing in the country's GDP.

Next observe that, when there is a possibility that donor and recipient government have conflicting project rankings, Proposition 2 requires that (i) when $P(G \equiv g(Y) > M^*)[\theta_1 - X] > \widehat{P}[\theta_2 - X] + (1 - \widehat{P})[\theta_1 - X]$, aid be rationed if the recipient cannot contribute a matching grant $M^*$ – which implies aid procyclicality; or (ii) aid be always provided if $P(G > M^*)[\theta_1 - X] < \widehat{P}[\theta_2 - X] + (1 - \widehat{P})[\theta_1 - X]$ – in which case aid flows will be acyclical.

Finally note that, if the donor knows for sure that $\theta_1^\sigma \alpha_1^{1-\sigma} > \theta_2^\sigma \alpha_2^{1-\sigma}$, then it knows that it and the recipient government make the same project choice $\forall M \geq 0$, so $M^* = 0$ and there is no need to threaten aid rationing: in that trivial case, then, aid flows are acyclical. **Q.E.D.**

**Proof of Prediction 1:**

Take the derivative of $M^*$ with respect to $\sigma$, which measures the divergence between the preferences of donor and recipient. It has the predicted sign: $\frac{\partial M^*}{\partial \sigma} < 0$. **Q.E.D.**

**Proof of Prediction 2:**

We need to show that the size of the matching grant $M^*$ is decreasing in $\theta_1 - \theta_2$ and increasing in $\alpha_H - \alpha_L$. To prove the first part, note that: $\frac{\partial M^*}{\partial \theta_1} = -\frac{\alpha_L^K}{\alpha_H^K - \alpha_L^K} < 0$ and $\frac{\partial M^*}{\partial \theta_2} = \frac{\alpha_H^K}{\alpha_H^K - \alpha_L^K} > 0$. Both inequalities follow from the assumption that $\alpha_i > 0 \ \forall \ i \in I$. To prove the second part, recall that $\theta_1 > \theta_2$, so: $\frac{\partial M^*}{\partial \alpha_H} = \frac{(\theta_1 - \theta_2)K\alpha_H^{K-1}\alpha_L^K}{(\alpha_H^K - \alpha_H^K)^2} > 0$ and $\frac{\partial M^*}{\partial \theta_2} = -\frac{(\theta_1 - \theta_2)K\alpha_H^K\alpha_L^{K-1}}{(\alpha_H^K - \alpha_H^K)^2} < 0$. **Q.E.D.**

**Proof of Prediction 3:**

We know from Prediction 1 that $(1 - \sigma) \uparrow \Rightarrow M^* \uparrow$, so $(1 - \sigma) \uparrow \Rightarrow P(G > M^*) \downarrow$. That is,

conditional on the donor agency's still requiring a matching grant, increasing $(1 - \sigma)$ increases the likelihood of aid rationing and aid procyclicality. Therefore, to prove the claim, it is sufficient to show that, if condition (4) holds, a small enough increase in $(1 - \sigma)$ does not cause the inequality to be reversed. First rewrite (4) as follows:

$$[\theta_1 - X][P^* + \widehat{P} - 1] > \widehat{P}.[\theta_2 - X]$$

Given that $\theta_1 > \theta_2$ and given the definition of $\widehat{P} \equiv P(\theta_1^\sigma \alpha_1^{1-\sigma} < \theta_2^\sigma \alpha_2^{1-\sigma})$, it is immediate that $\sigma \downarrow \Leftrightarrow (1 - \sigma) \uparrow \Rightarrow \widehat{P} \uparrow$, which reinforces the inequality. However, from the proof of Prediction 1, we know that $(1 - \sigma) \uparrow \Rightarrow M^* \uparrow \Rightarrow P(G > M^*) \downarrow$, which weakens the inequality. As long as $P^* + \widehat{P}$ is sufficiently large, however, these two conflicting effects leave the direction of (4) unchanged, matching grants keep being required, and the increase in their size leads to greater procyclicality.

The second part of the prediction follows from the observation that it is harder to violate (4) if $\theta_2 - X < 0$. **Q.E.D.**

**Proof of Prediction 4:**

The proof is similar in spirit to that of Prediction 3. Conditional on the donor agency's still requiring a matching grant, decreasing $G$ increases the likelihood of aid rationing and therefore aid procyclicality. To prove the claim, it is thus sufficient to show that, if condition (4) holds, a small enough decrease in $G$ does not cause that inequality to be reversed. First rewrite (4) as follows:

$$[\theta_1 - X][P^* + \widehat{P} - 1] > \widehat{P}.[\theta_2 - X]$$

$G \downarrow \Rightarrow P(G > M^*) = P^* \downarrow$, so decreasing $G$ weakens (4). As long as $P^* + \widehat{P}$ is sufficiently large, however, a sufficiently small decrease in $G$ leaves the direction of (4) unchanged, so matching grants keep being required, and greater procyclicality ensues.

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