What Is Gained By Selectively Withholding Foreign Aid?

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PRELIMINARY

ABSTRACT: We consider the case for withholding foreign aid from countries with a history of aid being ineffective in achieving its goals. The argument may be summarized by four statements. First, foreign aid is often ineffective in achieving its aims because it is misappropriated by the recipient governments. Second, this misappropriation reflects the nature of the "political regime" (broadly defined) by which collective decisions are made. Third, in these cases, aid will not become effective in the absence of a "regime change". Fourth, absent that regime change, denying aid ("selectivity") may be not simply the only way to ensure that it is not wasted, but also the only way to help bring about the necessary change in the political regime. Put another way, the paper investigates the political economy of "blunt instruments" and argues that they while they generally cannot be justified by economic arguments, they may be justified by political arguments given the nature of aid appropriation in recipient countries. We present a formal model of the role of denying foreign aid in inducing policy reform and summarize empirical research that supports the approach of selectivity.

1. Introduction -- What is the Effect of Aid?

Foreign assistance programs, meaning grants or concessional loans, have been massive in the postwar period, estimated to be close to $70 billion (in 1995 prices) to developing countries in 1991. For the typical recipient country, aid was approximately 8% of GDP in the 1980's. Aid programs are striking in another way in addition to their magnitude. The aim of foreign assistance has been alleviating poverty and stimulate growth in the recipient countries. A widely-held view is that foreign aid programs have strikingly ineffective in achieving these aims. For example, Boone (1996) has argued that empirically aid does not appear to significantly increase investment or benefit the poor, as measured by improvements in human development indicators. Instead, Boone finds that aid goes to increase government size, government consumption rising by approximately three-quarters of aid receipts in his sample of 96 recipient countries in the 1970's and 1980's.

Numerous others have found similarly unimpressive overall results as well. Looking at growth rates, Burnside and Dollar (1997) find little relationship between the amount of aid that developing countries receive and their growth rates in general. They do however find that this result depends on the policies that countries are pursuing independent of aid -- they find that aid has a positive impact if a country is pursuing good fiscal, monetary, and trade policies, but no effect in the presence of poor policies. In their study, aid does not appear to affect policy choice. Svensson (1998b) similarly finds that aid does little to improve growth rates on average in a large sample of recipients, though finds that it is more effective in democracies.

Many studies also find disappointing results for alleviation of poverty. In addition to Boone, for example, Burnside and Dollar (1998) consider the effect of aid on infant mortality, both as an important social indicator in itself and as an indirect indicator of social welfare more generally in the population as a whole. Paralleling their earlier results on growth, they find that there is no significant relation between aid and the decline in infant mortality in a broad cross-section of aid recipients.[1] (The same is true when they instrument for aid in an infant mortality regression to address endogeneity problems.) As did Boone, they find that aid largely goes to increase government consumption, but that higher government consumption has no significant

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[1] This is consistent with the finding of Pritchett and Summers (1995) that growth leads to reductions in infant mortality, as aid does not in general stimulate growth.

effect in general on infant mortality.[2] As with their growth results, they find that aid is more effective in reducing infant mortality in countries with sound fiscal, monetary, and trade policies, as well as lower government corruption and stronger property rights. (We return to these results below.) Using an expanded data set, Collier and Dollar (1998) similarly argue that aid has been quite ineffective in reducing poverty.

These results raise two basic questions: why has aid been so ineffective in achieving its aims? How can aid programs be restructured to better achieve their goals? The answers to these questions are obviously related. In this paper, we explore a (perhaps extreme) answer to the second question, based on a strong view about the answer to the first question in the case of some recipients. Put simply the argument in this paper may be summarized by four statements. First, foreign aid is often ineffective in achieving its aims because it is misappropriated by the recipient governments. Second, this misappropriation reflects the nature of the "political regime" (broadly defined) by which collective decisions are made. Third, in these cases, aid will not become effective in the absence of a "regime change". Fourth, absent that regime change, denying aid ("selectivity") may be not simply the only way to ensure that it is not wasted, but also the only way to help bring about the necessary change in the political regime. Our focus is especially on the last two, that is, the argument for selectively denying aid when misappropriation reflects the political regime.

This argument has been raised before, though perhaps using different terms. For example, as discussed in Drazen and Fischer (1998), Michael Bruno, during his years at the World Bank, argued consistently for greater selectivity in Bank lending. In part, this argument was based on the sort of evidence outlined above: that many countries had been in Bank (and also IMF) programs for many years, with little sign of progress; that the amounts of Bank lending to individual countries seemed insensitive to economic performance; and, more controversially, Bruno's belief that countries do not attempt to reform seriously unless they are in crisis -- and that is when international financial institutions (IFI's) like the Bank and the Fund, should lend to them. The argument is controversial, for it has been taken to imply cutting off lending to encourage the

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[2] Filmer and Pritchett (1997) find little effect of the quantity of health expenditures on infant or child mortality in many developing countries.

occurrence of crises (or at least waiting for them to happen) before addressing legitimate development needs. The overriding importance of the issues involved and the seemingly extreme nature of the prescription calls for a more careful analysis. That is the purpose of this paper.

To better understand the paper's perspective, consider for a moment a less radical view. A standard (and quite logical) response to the two basic questions raised above is as follows. For a range of reasons for why aid might fail, it can be made more effective by use of *conditionality*, meaning making aid conditional on countries pursuing a specific set of economic policies, or at least promising to pursue such policies. To the extent that aid failure appears to be correlated with bad policies in the recipient countries, making aid conditional on policy choice might appear to address the core of the problem. In section 2 we briefly address conditionality and argue that it is a very imperfect solution that very often hasn't worked. We suggest that its promise is limited is because it doesn't (and really cannot) address a key reason why aid fails. In section 3, we argue that aid failure often has a political origin, in that the nature of decisionmaking in the recipient country means that aid will be wasted. For aid to achieve its goals requires good policies in the recipient countries, but policies won't be changed until the nature of the "decisionmaking regime" changes. With no change in the political regime (broadly defined), economic conditionality is very likely to fail. "Political conditionality," meaning making aid conditional on underlying political structural changes, is ill-advised for a number of reasons.

The reasons for aid failure (and the implications for conditionality) leads to the main argument of the paper, namely a role for *selectivity*, taken to mean denying aid based on the nature of the regime (or on repeated past failures which signal an underlying political problem), rather than on failure to fulfill specific policy conditions. Put another way, the paper investigates the political economy of "blunt instruments" and argues that they while they generally cannot be justified by economic arguments, they may be justified by political arguments given the nature of aid appropriation in recipient countries. Whereas section 3 considers the main arguments conceptually, in section 4 we present a formal model of the role of denying foreign aid in inducing policy reform. In section 5, we summarize empirical research, largely from the World Bank, that we argue supports the approach of selectivity. Section 6 concludes.

2. Why Not Conditionality?[3]

In this section we briefly review the theory and practice of conditionality, based on the discussion in Drazen and Fischer (1998) and material in chapter 12 of Drazen (forthcoming).[4] The importance of conditionality may be seen by considering the case where a donor[5] gives (or lends at concessional terms) simply on the basis of need, measured let's say on the basis of average consumption or some other social indicator. The evidence presented above gives no reason to believe that aid based simply on good intentions will achieve its aims. Nor would simple logic lead us to expect that it would. If poor economic outcomes lead to receiving more aid, then countries would often have the incentive not to reform, especially if part of the aid goes to things other than increasing the social welfare indicator according to which aid is given.

To the extent that the poor performance of aid programs reflects unsound policies in the recipient countries, it is often argued that *conditionality* should be applied as a way to prevent misallocation of aid, so that it achieves its policy or project purposes. Making continued lending conditional on the recipient pursuing a specific set of economic policies has in fact long been a feature of IFI lending. In practice, conditionality sometimes takes the form of *prior actions*, actions that are taken before the loan is disbursed, with the loan then given. More generally, the actions relevant to the success of the loan have to be implemented after the loan has been agreed upon. The primary method of enforcement is cutting off further loans to governments that misappropriate the initial aid. In practice, this generally takes the form of *tranching* of loans, making the loan payments in installments, so that payments can be kept conditional on actions for

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[3] Some would argue that the distinction between selectivity and tough conditionality is semantic. To try to draw this distinction in a meaningful way, we view enforcing conditionality means withdrawing aid in response to the failure to pursue a *specific* set of economic policies *previously contracted upon*, while enforcing selectivity means not giving aid based on the donor's perception of the nature of the regime in the recipient country. To the extent that this perception is based on past policy failures, the concepts will appear to be similar.

[4] Sachs (1989) presents an excellent discussion of the conceptual and theoretical issues, Guitián (1995) presents a general history and discussion of IMF conditionality.

[5] Aid is both *bilateral*, from one country to another, and *multilateral*, from an IFI like the World Bank or International Monetary Fund to a recipient country. Much of what we argue applies to both types of donors.

longer, with later tranches not being disbursed if the necessary conditions have not been met.

Two key questions arise. First, why must a country be *constrained* to undertake the recommended policies if they are beneficial to the recipient country? Second, how effective are the penalties to enforce compliance? The failure of conditionality turns on the answer to these questions. A basic answer is that socially optimal policies may not be adopted because the decisionmakers in the recipient country have goals other than social welfare maximization in choosing how to use aid.[6] The focus of this paper, as discussed in the next section, is on a leading example of this problem, namely where appropriative conflict (or, more generally, rent-seeking) leads to misallocation of aid. If policymakers have goals other than social welfare maximization, conditionality will probably have limited effectiveness -- policymakers who do not want to undertake the recommended policies will try to find ways to get around conditionality.

In fact, aid programs may fail for a variety of reasons other than misappropriation of aid: the difficulty of the problems which motivated aid in the first place, bad luck, low government competence, and poor design on the part of the donor because of its desire to disburse aid.[7] Each reason for failure has its own implications about limitations on conditionality. Sachs (1989), for example, argues that the problem of enforcing conditionality is made worse by debt overhang. The requirement to pay extremely large debt service, he argues, greatly reduces the incentives of

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[6] Sachs (1989) and Diwan and Rodrik (1992) argue that policies of recipient governments are time inconsistent, their accepting *ex ante* the need for policy change as a condition for receiving aid, but having a strong incentive to avoid the change in policy once aid has been received. Sachs, for example, considers the choice between current consumption and investment. The latter has a high return, so that a country realizes the value of taking a loan to increase investment; however, the government's discount rate is even higher than the return on investment, so that once aid is received, it will be spent on current consumption. Conditionality binds a country to a course of investment and consumption postponement.

[7] Many observers argue that a key problem is incentives *within* both bilateral and multilateral donor organizations are to "push aid out the door," making sure that it gets disbursed. Svensson (1998a), for example, argues that in donor organizations there is a strong bias towards giving loans to the originally designated recipient, regardless of government performance in that country and regardless of conditions in other potential recipient countries. Svensson, Mosley, Harrigan, and Toye (1995), and others have argued that there is significant evidence of such behavior for both bilateral and multilateral donors.

countries to comply with adjustment conditions, as the extra income produced goes to foreign banks rather than improving the condition of the country's residents. Mosley, Harrigan, and Toye (1995) argue, the desire of IFI's to disburse loans (see footnote 6) also greatly weakens enforcement. When recipient countries know the incentive of donors to push loans, threats to not disburse aid that has been committed (that is, conditionality) are not credible.

The multiplicity of potential causes for failure means that the cause of any particular failure is not necessarily identifiable, not only *ex ante*, but even *ex post*. The ability of an appropriative government to conceal actions that violate conditionality makes this inference problem even harder.[8] Drazen and Fischer (1998), in their general review of conditionality and selectivity, stress the problems arising from multiple causes of failure combined with imperfect observability. They argue that conditionality is bound to be imperfect because a government's actions are imperfectly observable. A related difficulty in enforcing conditionality follows from the complexity of negotiations that go into the giving of aid. Complexity and consequent lack of uniformity of reform programs complicates statistical inference about the causes of failure.

The strong conclusion of many empirical studies of conditionality is that it works poorly. A key theme in the literature on the failure of conditionality is that the enforcement mechanism, namely, the threat of aid cut-off, is inherently weak and limited. Sachs (1989) argues that conditionality has had very limited success, as do Mosley, *et al.* (1995). Collier (1997) concludes simply that conditionality has failed, with the recipient governments's decisions of whether or not to reform being independent of the structure of assistance programs. Numerous other case studies could be cited suggesting the ineffectiveness of conditionality.

Dollar and Svensson (1998) present econometric analysis of the effect of conditionality on the success of World Bank structural adjustment lending, based on quantitative measures of conditionality and aid success. They use internal World Bank data from the Operations Evaluation Department (OED) evaluating the success or failure of individual adjustment loans.

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[8] One can go a step further in the case where programs fail because of the desire of governments to make transfers to special interests. The use of conditionality to attempt to stop such transfers may lead to the transfers simply being disguised and made in inefficient ways, so that conditionality might actually *lower* the welfare of the representative citizen.

(The OED is independent of the Bank's senior management, reporting directly to the board of directors.) The OED evaluates loan performance in terms of whether its broad reform objectives have been met and classifies them as successes or failures. While there is clearly a subjective element in these evaluations, Dollar and Svensson argue that there is no reason to believe the assessments are biased in one direction or another. Over the period 1980-95, the OED found that about one-third of adjustment loans failed to achieve their objectives. Dollar and Svensson investigate the effects of two sets of variables on success or failure for 179 loans over this period for which they were able to assemble data -- political variables and variables measuring World Bank loan "inputs." (We return to the empirical role of political variables in section 5 below.) World Bank inputs include: the amount of preparation that went into the loan, measured in various ways, and the amount of conditionality, both types and numbers of conditions. With this data from a large set of individual loans, Dollar and Svensson conclude that Bank input variables have *no* explanatory power in explaining loan success once political variables are included. Their evidence is striking in showing that success or failure of structural adjustment loans appears to be independent of conditionality and measurable Bank inputs in loan preparation.

3. The Politics of Aid Misappropriation and Selective Aid Denial

In the previous section we listed a number of reasons why conditionality was ineffective. Each argument flowed from underlying arguments on why aid itself is ineffective in achieving its aims and implied particular remedies. Our focus in the paper is on one specific argument for the ineffectiveness of aid and of conditionality, an argument that suggests selectivity as a remedy. Specifically, we argue that foreign aid is often ineffective in achieving its aims because it is misappropriated by the recipient governments, where this misappropriation follows from the political structure. The case for selectivity is based on these observations. In this section, we present the basic arguments conceptually, providing a formal treatment in the next section.

In the recent literature, Boone (1996) has perhaps most forcefully argued that misappropriation of aid reflects government intentions. He stresses the importance of the type of political regime for the effectiveness of aid programs, classifying regimes in terms of which citizens are in the government's utility function. Politicians, he argues, use distortionary taxation

and foreign aid to finance transfers to their political supporters: an "elitist" government, for example, maximizes the welfare of its high-income supporters, while finally a "laissez-faire" government maximizes the welfare of the population as a whole by using aid to reduce distortionary taxes, leading to higher investment and higher income. The "elitist" model is consistent with his finding that aid has no significant empirical effect on either investment or quality of life for the poor. An increase in transfers to the favored group implies a higher tax rate on capital, a lower capital stock, and lower output. The favored group that received the transfer will however have higher utility than in the case of no transfers.

Boone further argues that cross-country patterns in macroeconomic performance (including saving and investment) are driven by underlying differences in political regimes. A rise in foreign aid permits a laissez-faire government to reduce tax distortions and increase income. In contrast, poor countries in his model are those with governments that have chosen redistributive policies, so that distortionary taxes need not fall. If these regimes have already chosen the tax rate to equate the benefits (higher infrastructure) and costs of distortionary taxes, aid goes to increase transfers, but does not affect distortionary taxes and output. An egalitarian government reduces poverty, while with an elitist government, foreign aid will have no effect on welfare of the poor. If foreign aid induces an increase in transfers exceeding the amount of aid, it will actually reduce output and make the poor worse off.

A distinguishing feature of Boone's analysis is that he takes the government's "type" to be exogenous -- some governments are appropriative, others are oriented towards development or increasing social welfare. An alternative argument is that the degree of appropriative behavior is endogenous, not only to the political and legal institutions that serve to prevent appropriation in countries where aid is effective, but also to the quantity of resources to be appropriated. This latter point is quite important to the argument in the paper. It suggests that the diversion of aid to unproductive uses is *not* an immutable characteristic of a country, but one that will depend on its economic situation, and hence can be affected, albeit indirectly, by donor behavior. Specifically, suppose that interest groups find appropriative behavior optimal if and only if there is a lot to be appropriated. Call this state an appropriative regime. In the absence of a change in regime, not only will aid be ineffective in increasing general social welfare, but may actually make things

worse. If a fall in wealth is necessary for and leads to a change in the regime, then temporarily denying aid may be play a role in eventually making it effective. We explore this argument formally in the next section.

Arguing for denying aid to poor countries under certain circumstances is controversial, so we end this section by attempting to clarify a number of points. First, it should be stressed that the argument for selectivity is primarily political, rather than simply economic. That is, in the absence of political considerations, it is extremely difficult to think of a convincing economic argument for denying aid. Arguments for the benefits of crisis or "shock treatment" make little sense if not put in an explicit political framework. Second, it is important not only to make the political dimension of the problem explicit, but also to make clear that the remedy of selectivity applies to *extreme* political situations. The argument for denying aid is that the appropriative nature of the political regime means that less extreme measures (especially further conditionality) are deemed unlikely to work in making aid effective, and that temporarily denying aid may achieve aims that other attempted remedies have not achieved. The view that selectivity is simply "waiting for the crisis to come" must be seen is this light, that is, that selectivity and what it implies is often a measure of last resort given the nature of the political regime.

Third, the argument presented in the next section assumes that the appropriative nature of the regime is known. If the donor is unsure of whether there is a political problem or not, the case for selectively denying aid is far weaker. When there is real doubt as to whether the failure of aid represents appropriative behavior instead of other factors discussed above, continued conditional lending may be justified.[9] On the other hand, evidence of continued aid over many years with little sign of progress in a country may suggest appropriative behavior, as would more direct evidence.

Finally, the arguments given appear to suggest an alternative to selectivity when donors are reasonably sure that the failure of aid reflects the nature of the political regime. Instead of simply denying aid, why not impose "political conditionality," meaning making continued receipt

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[9] Alternatively, it may be that the payoff to a successful reform program, in the form of a return to sustainable growth, is so high as to justify even loans that have a small chance of a major success while facing a large chance of moderate failure.

of aid more explicitly conditional on changes in the political regime? We want to draw a sharp distinction between selectivity and political conditionality, that is, between not giving aid because of the nature of the political regime in the recipient country and making aid *explicitly* conditional on changing that regime, or some aspect of it. Whereas the former may be justified, the latter is an extremely bad idea. Donors should be extremely careful about intervening in a country's domestic politics, or giving the impression they are doing so in an overt way. Although denying aid until decisionmaking in a country is more democratic and less appropriative may have the same intent as making aid specifically conditional on such changes, these two approaches would be viewed quite differently. The former is considerably more acceptable politically, especially for an IFI.

4. Modeling Selectivity

In what follows, we develop a model supporting selective aid, formalizing the arguments discussed in the previous section: the donor provides no aid at all to a country for some time, thereby producing an end to socially adverse behavior by the government. The analytic problem here is to explain why it is necessary to go through a period in which no aid is given, rather than having the country behave responsibly as soon as the aid strategy of the donor is established. The approach to explaining selectivity may be seen as a specific application of the general question of why reforms are delayed.[10] Empirically, why is deterioration (sometimes significant) in a country's economic situation often necessary to induce reform? Hence, it is necessary to explain both why welfare-improving policies are *not* immediately (or quickly) adopted, and why they eventually *are* adopted.

To model the dynamic process which underlies the argument for selectivity, we adopt a "common property" model, in which interest groups attempt to appropriate a country's resources, this process of appropriation leading to a deterioration in the economy.[11] Specifically we assume

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[10] This literature is summarized by Drazen (1996) and by Tommasi and Velasco (1997).

[11] Example of such an approach include Benhabib and Radner (1992), Lane and Tornell (1996), Tornell (1997), or Velasco (1998).

that there are two interest group's that have the ability to appropriate the economy's resources. These may be different arms of the government (an interpretation perhaps most consistent with the formalization below) or powerful outside interests. When there is a single appropriator (for example, when one part of the government faces no competition for the economy's resources either from other government bodies or from outside interests), then debt will be constant over time and the economy doesn't deteriorate, though only a fraction γ of national income (including aid) goes to consumers. However, when more than one group in the economy has the ability to appropriate resources, even if only a small fraction of national income, total demand on resources will be greater than national income, and the country's indebtedness will grow over time. Hence, as long as more than one group has the ability to compete for resources, no matter how small a fraction they can compete for, economic deterioration will result from appropriative behavior.

The existence of a possible (though small) competitor to the government for the economy's resources (or the existence of multiple appropriators within the government) provides a far better explanation for "overconsumption" than does an appeal to irrationality or myopic behavior on the part of the government. Governments who want to appropriate national income for their own purposes should engage in "appropriation smoothing" if they see no threat to their ability to do so. On the other hand, if a government believes that it will lose the ability to appropriate resources if it doesn't act selfishly, it will rationally try to "milk" the economy of its resources as long as they are there. In our model, this results from the existence of another agent who always has the ability to grab resources. Alternatively, one could assume that the government has the sole claim to resources today, but believes it might lose that exclusive ability in the future. The basic results would be the same: aid failure reflects the attempt to appropriate common property; "crisis" may stop such appropriation as there are fewer resources to go around, while (largely unconditional) aid may exacerbate it; there is a dynamic process whereby rent-seeking impoverishes a country and "sows the seeds of its own destruction" as long as interest groups have some concern about social welfare and as long as donors don't design aid programs which end up encouraging rent-seeking.

We now turn to the details of the model.

4.1 *Objective Functions*

We consider possible appropriative behavior in a single country. Key to the dynamics is competition for rents, when in fact there are resources to be appropriated.[12] Appropriation of resources by the government and by other special interest groups reduces general consumption. Call the two groups that can appropriate resources simply group 1 and group 2. Each group cares about general consumption C_t and the resources it can appropriate at t, denoted X_t^i.[13] Hence, a group's objective may be written:

$$\Omega^i = \sum_{s=t}^{\infty} \beta^{s-t}\left(\gamma \ln C_s + (1-\gamma)\ln X_s^i\right),$$ **(1)**

where $0 < \gamma \leq 1$. For simplicity, we assume that the discount factor β is equal to the inverse of the interest factor $1/R < 1$. We use a log-linear form to obtain a closed form solution.

There are two reasons why appropriation of resources may not take place in equilibrium. First, the legal and political environment may be such that appropriation may be infeasible no matter what is the level of economy-wide wealth W_t. This outcome would reflect not simply a legal system protecting property rights, but also a political system which strongly limits appropriative behavior. We call this non-appropriative regime the "property rights regime"

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[12] Svensson (1999) presents a common-property model of aid failure with many of the same features, but with some key differences. Special interests devote expenditures to rent-seeking in order to receive transfers, where otherwise government revenue would be used to provide public goods projects that benefit all groups. There is both a non-cooperative equilibrium, in which rent-seeking activity implies that all government revenues go to transfers, with no spending on public goods, and a cooperative equilibrium. A deviation from cooperation by one group triggers a punishment in the form of reversion to noncooperative behavior by all other groups. As in the model presented here, Svensson is interested in the possible dependence of equilibrium on the state of the economy, but unlike the deterministic model with deterioration here, he assumes that the state of the economy is stochastic with no trend. This difference means there is no role for deterioration, central to the argument here, but allows consideration of the optimality of precommitment to tough conditionality in a stochastic environment.

[13] An alternative specification would have the government maximizing an objective such as (7) and the other interest group caring only about appropriation, where they have the ability to appropriate some fraction (say α, where $0 \leq \alpha < 1$) of the economy's resources. The basic results would be identical. Similarly, assuming the interest groups put different weights on consumption C in their objective functions will not change the basic nature of the results.

representing the case where $X_t^i = 0$ for any values of γ and W_t due to the political-legal system. Second, even when there are no formal restraints on appropriation and $\gamma < 1$, so that interest groups are potentially appropriative, they may choose not to appropriate in equilibrium. (As we shall see, this will depend on the level of resources W_t to be appropriated.) To distinguish this case from the "property rights regime," we call it the "cooperative" solution, that is, where an appropriative government operating in an environment where appropriation is feasible (an "appropriative" regime) nonetheless acts cooperatively. Aid programs designed to induce good behavior can be thought of in two ways: inducing "appropriative" interest groups *not* to appropriate resources even though it is feasible; and inducing a deeper institutional change, whereby we move from an appropriative regime to a property rights regimes. We consider both possibilities, initially focussing on the former.

With two interest groups with the power to appropriate resources, the economy's budget constraint is:

$$A_{t+1} = RA_t - C_t - X_t^1 - X_t^2 + Y + Z_t , \tag{2}$$

where A_t is net assets, Y is output, and Z_t is the amount of aid (or the concessional component of loans) received from the donor at t. (For simplicity, we assume no capital accumulation.) It will be useful sometime to work with a measure of economy-wide wealth, namely:

$$W_t = A_t + \frac{Y + Z_t}{r} , \tag{3}$$

where the interest rate $r = R - 1$ and where Z_t will depend on the aid structure.

Suppose, for extreme simplicity that the donor's aid (or loan) disbursal may be summarized as follows. In a world with no donor selectivity, all countries receive $Z_t = Z$. In a world with donor selectivity, countries in which appropriation takes place in period t receive $Z_{t+1} = 0$, while countries which act cooperatively (that is, where interest groups do not appropriate aid and other resources) in t receive $Z_{t+1} = Z$, where $Z > Z$. The magnitudes Z and Z are determined by the donor' objectives and overall resource constraint. When Z_t is constant over time, the economy's budget constraint can then be written in an alternative form, namely:

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$$W_{t+1} = RW_t - C_t - X_t^1 - X_t^2 . \tag{4}$$

This will hold for all points except when Z_t changes discretely (for example, with a cut-off or resumption of aid) implying that W_t will change discretely as well, as calculated by (3) rather than (4).

4.2 *Behavior under Cooperation and Appropriation*

In a cooperative equilibrium, there is no appropriation by interest groups. If aid is constant, say at level $Z_t = Z$ per period, consumption smoothing implies that consumption should be set at the highest possible constant level, which is given by (2) for constant wealth W_t (and hence constant net assets, that is, $A_t = A_{t+1}$). One thus has:

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\begin{aligned}
X_t^i &= 0 \qquad i = 1,2 \\
C(A_t,Z) &= Y + Z + rA_t = rW_t
\end{aligned}
\tag{5}
$$

The resultant infinite horizon utility of the government from t onward in a cooperative equilibrium (hence, of an "appropriative" government acting cooperatively) is, from (1) and (5) and hence the constancy of net assets:

$$
\begin{aligned}
\Omega^C(A_t,Z) &= \sum_s^\infty \beta^s \gamma \ln(Y + Z + rA_{t+s}) \\
&= \frac{\gamma}{1-\beta} \ln(Y + Z + rA_t)
\end{aligned}
\tag{6}
$$

Equations (5) and (6) will also represent equilibrium behavior and realized utility in the property rights regime.

In contrast, suppose both interests follow the selfish strategy of appropriating resources to maximize their present discounted welfare, consistent with (1). With log-linear preferences, it can be shown that if the strategy of interest groups is assumed to depend on time only via the evolution of the state of the economy, optimal consumption C_t and transfers X_t^i are linear in W_t. The non-cooperative strategy (or Nash-Markov strategy, dependent only on a state variable) is:

$$X_t^i = (1 - \gamma)\phi r W_t \quad i = 1,2$$
$$C_t = \gamma \phi r W_t$$

(7)

where ϕ is defined by:

$$\phi = \frac{R}{R + (1 - \gamma)r} < 1 .$$

(8)

(The mathematical derivation of these and other results is found in the appendix.) One may easily show that if there were only one appropriative group, $\phi = 1$ and appropriation plus general consumption exactly exhaust current income rW_t. On the other hand, when interest groups faces compete in appropriation, optimal appropriation by both interests will imply that total demand for resources will exceed net income of the economy, that is:

$$X_t^1 + X_t^2 + C_t = (2 - \gamma)\phi r W_t > r W_t .$$

Substituting this into (4), one obtains:

$$W_{t+1} = \phi W_t ,$$

(9)

so that under appropriation by both groups, the wealth of the economy will be falling over time. As long as appropriation continues wealth will fall (but at a decreasing rate) until it asymptotes to zero. As W_t falls, so will C_t and the X_t^i, via (7).

The resultant utility of an appropriative interest group is denoted by $\Omega^N(B_t, 0)$, where the notation is a reminder that appropriation by either group induces a cut-off of aid. Substituting (7), (8), and (9) into (1), one obtains, after some calculation:

$$\Omega^N(W_t, 0) = \sum_{s=0}^{\infty} \beta^s (\gamma \ln C_{t+s} + (1 - \gamma) ln X_{t+s}^i)$$
$$= \frac{\ln(Y + rA_t) + K}{1 - \beta}$$

(10)

where the constant $K = \gamma \ln \gamma + (1 - \gamma)\ln(1 - \gamma) + 2\ln\phi + \beta/(1 - \beta)$. The quantity $\Omega^N(W_t)$ will

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be used to determine the value of "defecting" from cooperative behavior. The deterioration of the economy, as well as the cut-off of aid, that appropriation triggers will generally imply that $\Omega^N(W_t)$ $< \Omega^C(W_t)$. This inequality does not however imply that an interest group with appropriative preferences will refrain from appropriation and act "cooperatively" in the appropriative regime. Cooperation is only preferred to appropriation if all potential appropriators cooperate. If a group knew that its non-appropriative behavior would be met by appropriation on the part of other interests, cooperation would not be in its interest. Something more must be needed to sustain cooperation. We now turn to this issue.

4.3 *Sustaining "Good" Behavior in an Appropriative Regime*

On the basis of the results in section 4.2, we can now address the central question of the paper on the possible beneficial effects of the structure of foreign assistance when interest groups have a propensity to appropriate resources. We begin by examining behavior within an appropriative regime, that is, where there are no political or legal constraints that prevent appropriation. We will then consider the possibility of a regime change. Economic deterioration will play a key role in both cases.

In an appropriative regime, where interest groups have both the propensity and the ability to appropriate resources, we can pose the a number of key questions. Can the granting of loans in a selective way induce socially optimal behavior on the part of otherwise irresponsible governments, or at least hasten this behavior? Will selective lending programs be integral to appropriative governments adopting social-welfare maximizing behavior? If selective aid can induce socially optimal behavior on the part of appropriative governments, will it do so only after a period of economic deterioration? We now proceed to give affirmative answers to each of these questions.

Formally, the question may be put as follows. Can the cooperative, no appropriation equilibrium with behavior as in (6) be sustained in the absence of institutional restraints, so that powerful interest groups do not find it optimal to unilaterally "defect" from this equilibrium? "Defection" means that an interest group will find it optimal to act selfishly and appropriate resources to itself in a period when other interest groups are refraining from doing so.

Whether or not an interest group will find it optimal to defect will depend crucially on the

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"punishment" for defection, that is, on the behavior of other agents in response to unilateral selfish behavior on its part. We make the following, logical assumptions. Starting from a situation in which no appropriation is taking place, and hence aid is being received, appropriative behavior on the part of a powerful interest group ("defection from the cooperative equilibrium") triggers no change in behavior in the current period t by either other potentially appropriative groups or by the donor, but a reversion to appropriative behavior by all groups and a cut-off of aid starting in the next period. [14],[15] Hence, appropriative behavior by the government triggers a free-for-all and the appropriate response from the donor. The maximization problem faced by group 1 (for example) in choosing whether to deviate from the cooperative equilibrium may thus be represented by:

$$\Omega^D(A_t, Z) = \max_{C_t^D, X_t^{1D}} \gamma \ln C_t^D + (1 - \gamma) \ln X_t^{1D} + \beta \Omega^N(A_{t+1}^D, 0),$$

(11)

where C_t^D and X_t^{1D} are consumption and appropriation in the period of defection, and net assets in the period after a defection are $A_{t+1}^D = RA_t - C_t - X_t + Y + Z$. Note that aid Z will be received in the current period, but not in future periods and that $X_s^2 = 0$ for $s = t$, but positive for $s > t$.

Using (10), the solution to this problem can easily be calculated, namely:

$$X_t^{1D} = (1 - \gamma)(rW_t - \frac{Z}{R})$$

$$C_t^D = \gamma(rW_t - \frac{Z}{R})$$

(12)

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[14] This modeling of unilateral deviation from cooperative behavior follows standard game-theoretic assumptions that in the event of a unilateral defection from the cooperative equilibrium by one interest group at a point in time, all other groups "revert" back to appropriative behavior. That is, we consider an equilibrium in which each interest group acts in a cooperative way as long as all others do, but switches to acting selfishly if it sees some other group doing so, that is, an equilibrium where each interest group follows a "trigger strategy".

[15] We make the further assumption that following defection, there is no switch back to cooperative behavior, groups following the Nash-Markov strategy forever even though W_t is falling to zero over time as a result. This makes the calculation of equilibrium much easier without changing its qualitative nature.

The value of defecting may then be found by substituting (12) into (11). The incentive to defect from cooperation will then depend on the value of the resulting expression relative to (6). That is, the decision of whether to cooperate or defect from cooperation depends on the difference $\Omega^C(W_t) - \Omega^D(W_t)$, both evaluated at Z, the level of aid in the current period. When this difference is positive, cooperation can be sustained, in that each interest group will find it optimal to refrain from appropriation of resources if the other interest group is also refraining from appropriating resources. When this difference is negative, cooperation cannot be sustained. When the other group is acting cooperatively, appropriation is the optimal response, even though it is known that such behavior will trigger an appropriative "free-for-all", a cut-off of aid, and an economic deterioration.

Using (6), (10), (11), and (12), combined with a bit of algebra, $\Omega^C(W_t) - \Omega^D(W_t)$ may be written as an explicit function of current wealth W_t in the economy and of current aid Z, which is also the difference between the pre-cut-off and post-cut-off level of aid, that is, zero. One obtains:

$$
\begin{aligned}
\Omega^C(W_t,Z) - \Omega^D(W_t,Z) &= \frac{1}{1-\beta}[\gamma \ln(rW_t) - \ln(rW_t - \frac{Z}{R})] \\
&+ \frac{1}{1-\beta}[\ln\phi - \gamma\ln\gamma - (1-\gamma)\ln(1-\gamma) + \frac{\beta}{1-\beta}]
\end{aligned}
\tag{13}
$$

On the basis of (13), one can show a number of technical results, which serve to demonstrate our main economic results under the appropriative regime. We summarize the technical results as:

Proposition 1: $\Omega^C(W,Z) - \Omega^D(W,Z)$ is a continuous, monotonically decreasing function of W and a continuous, monotonically increasing function of Z, which is be negative for $W > W^*(Z)$ and positive for $W < W^*(Z)$, where the critical value $W^*(Z)$ is increasing in Z. (Proof in Appendix)

The characteristics of the function $\Omega^C(W,Z) - \Omega^D(W,Z)$, as summarized in the proposition, combined with the evolution of W_t under appropriation, as given by (9) can be used to address the key questions with which we started the section on the possible beneficial role of selective lending when powerful interest groups have the propensity and ability to appropriate resources. To

repeat those questions: Can giving aid in a selective way induce socially optimal behavior on the part of otherwise irresponsible governments, or at least hasten this behavior? Will selective aid programs be integral to appropriative governments adopting social-welfare maximizing behavior? If selective aid can induce socially optimal behavior on the part of appropriative governments, will it do so only after a period of economic deterioration?

Let's begin with the crucial role of economic deterioration. For a high enough value of W_t, cooperative behavior in the absence of institutional restraints is *not* sustainable. There are just too many resources to be appropriated. "Rational" appropriative behavior, however, leads to economic deterioration, that is a steady decline in the economy's wealth W_t. Eventually, wealth becomes low enough that the promise of aid conditional on the government not appropriating the economy's resources is sufficient to induce a potentially appropriative government not to engage in appropriative behavior. Such good behavior is sustainable in this environment, in that interest groups would not revert to appropriative behavior, even though it was not sustainable earlier on. Hence, economic deterioration (*i.e.*, "crisis") is necessary for there to be a change in the behavior of appropriative governments and interest groups.

What is the role of selective lending in inducing non-appropriative behavior? In the absence of selectivity in lending, the first term in (13) is $\frac{\gamma - 1}{1 - \beta} \ln r W_t$, so that deterioration in the economy (that is, the fall in wealth W_t would eventually imply that appropriation would no longer be optimal. However, this deterioration would need to be quite extreme. Selective lending can induce a switch away from appropriative behavior when deterioration is far less extreme. The steeper is the aid or loan cut-off induced by appropriative behavior, that is, the larger is Z in our example, the less the economy must deteriorate for cooperative behavior to be optimal. (Technically, the critical value W^* below which cooperation becomes the preferred strategy is increasing in Z.) Hence giving aid or loans selectively, that is, only when the government begins to act cooperatively and withholding it otherwise, is integral not simply to ensuring nonappropriative behavior will end, but also to stopping the deterioration in economies where governments are appropriative.[16]

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[16] In contrast, Casella and Eichengreen (1996), using a war-of-attrition model of Alesina and Drazen (1991), argue that aid conditioned on the adoption of policy reform can delay the

One can make an even stronger statement. If aid were non-selective (that is, , that is, if Z_t = Z for all t) given independently of whether behavior is appropriative or not, deterioration would be larger and utility could be even lower. Non-selective aid implies a higher value of $\Omega^N(\cdot)$ and hence a lower cost of defecting from the cooperative equilibrium. Appropriative behavior will continue longer leading to greater deterioration. (Giving more aid as the country becomes poorer only exacerbates the problem if the root is appropriative behavior.) Intuitively, withholding aid in the presence of appropriative behavior allows groups to coordinate sooner on the cooperative equilibrium than if there were no selectivity. In short, in extreme political situations characterized by widespread appropriation, selectivity may play a welfare-improving role.

The structure of the dynamic equilibrium summarized in proposition 1 also helps us put in better perspective the criticism that this approach is tantamount to simply waiting for the crisis. In the appropriative regime, institutions and incentives are such that appropriative behavior will take place when $W_t > W^*$. Why not give aid earlier, that is before W_t hits W^*, to try to avert the deterioration and crisis? If the amount of aid to be given is held fixed, early resumption of lending will not avert a crisis, as long as the appropriative regime itself does not change. On the other hand, since W^* is increasing in Z, higher levels of aid will end deterioration sooner.

To summarize, the extreme solution here reflects the extreme nature of aid appropriation within the recipient country. When the political regime is such that interest groups engage in widespread appropriative behavior (and hence have strong incentives to evade conditionality), donors may have quite limited options to enforce good behavior. Deterioration become part of the process not because it is "optimal," but because appropriative behavior will continue in its absence. Selectivity may be an important tool to address politically-motivated misuse of aid.

4.4 *Changes in the Political Regime*

Discussion so far has taken as given the appropriative nature of the recipient country. As

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expected date of a stabilization. This result is dependent on their specification of the aid package, whereby the amount of aid is fixed in real terms as a fixed fraction of debt outstanding at the date of stabilization, though delivered at a later date. A country may thus be able to get more aid if it reforms closer to the later date of actual receipt. See Fernandez-Arias (1997) for an argument that in this war of attrition framework, conditional aid provided if and when a successful reform is implemented unambiguously accelerates reform.

long as a government has both the incentive and ability to appropriate, selectivity can have a role in ensuring cooperative behavior, but there are limitations to what can be achieved. Specifically, as long as the regime is appropriative, cooperative behavior is consistent with equilibrium only if wealth is no greater than $W^*(Z)$. Hence, deterioration and selectivity can lead to aid being channeled to the consumption of average citizens rather than special interests in an appropriative regime, but cannot allow growth above $W^*(Z)$. Higher Z will imply higher $W^*(Z)$, but in the absence of a switch away from an appropriate regime to a "property rights" regime, $W^*(Z)$ is still a constraint.

In contrast, suppose that the switch away from appropriative behavior following severe economic deterioration and non-receipt of aid means a regime switch, so that limits on the possibility of appropriative behavior were instituted. If a crisis induced a shift in regime, rather than simply a shift in behavior within a regime, it would allow resumption of growth above $W^*(Z)$ without a problem of interest groups defecting.[17] (This distinction reflects the difference between the changes in the incentive to appropriate for a given political or institutional structure, and changes in the underlying structure so that the incentive of interest groups to appropriate cannot be realized.) Economic dynamics would then be characterized by three "stages" abetted by the structure of foreign assistance: appropriation and economic deterioration; crisis and a switch to non-appropriation cemented by structural or institutional reform; and, growth in the new regime. Although the model is literally about a switch in behavior within a regime rather than a switch in the institutional regime, it is consistent with either interpretation. We suggest that a less literal interpretation is more sensible, viewing a cessation of appropriative behavior brought on by economic deterioration and crisis as generally accompanied by political and institutional changes that make appropriation more difficult in the future.

The association of crisis and significant economic reform is a major area of research in itself, with many arguing that crises induce or at least facilitate economic reform. (See for

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[17] Tornell (1997) considers a Markov-switching model of endogenous property rights in which there is a switch from common to private property when the economy's capital stock grows to some critical level, and then a switch back to common property when the capital stock hits a higher level. In the terminology used here, the establishment of property rights is not a change in the political regime, but a change in behavior within a regime.

example Drazen and Grilli [1993] or Tommasi and Velasco [1996].)[18] It takes us too far afield to address this issue here, except to say that there is suggestive evidence. (See Lora [1998] for an econometric study linking economic deterioration and structural reform.) Moreover, Drazen and Easterly (1999), in their empirical study of whether crisis induces reform, suggest that in cases where extremely poor economic performance does *not* appear generally to induce reform (for example, with large current account or government budget deficits), aid inflows that are significantly positively correlated with these indicators may help explain the absence of reform.

5. Empirical Evidence

Two sorts of evidence seem relevant for the argument we have presented. First, what is the importance of the type of regime for the effectiveness of foreign aid? Second, given the nature of the political regime, how successful are remedies other than selectivity? As we discussed the limitations of conditionality at the end of section 2, arguing it was not very successful in ensuring the effectiveness of aid, we concentrate on the first question.

In the introduction, we mentioned work by Burnside and Dollar (1997, 1998) that found that both for growth and for social indicators (infant mortality, to be precise), aid has a positive impact if a country is pursuing good fiscal, monetary, and trade policies, but no effect in the presence of poor policies.[19] Hence, in the absence of a commitment to sound policies, aid will be ineffective. But what sort of regimes are associated with poor policy choices? (Burnside and Dollar further argue that as it is now given, aid does not appear to affect policy choice.) In cross-country gross regressions, Svensson (1998b) finds that aid is effective in democracies, ineffective

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[18] On the other hand, Rodrik (1996) among others argues that the view that reform follows crisis is a tautology, as reform only becomes an important issue when current policies are perceived not to be working. Drazen (forthcoming) discusses this argument, suggesting that the crisis view has content as it examines why economic failure and deterioration may need to *extremely* bad before reform takes place.

[19] Collier and Dollar (1998) argue that if aid were redirected towards countries with good policies, more than twice as many people could be lifted out of poverty without increasing the aggregate quantity of aid.

otherwise. As a measure of democracy he uses the (admittedly imperfect) Freedom House index of political and civil liberties. He then enters aid, the democracy index, an interactive aid and democracy term, and other explanatory variables into a standard growth regression. Whereas aid or the democracy index have little explanatory power individually, the interactive aid is significant at the 5% level, suggesting that aid is more effective when given to a more democratic regime.

Perhaps the most striking evidence in support of our argument is due to Dollar and Svensson (1998). As discussed at the end of section 2, they use internal World Bank data from the Operations Evaluation Department that evaluates the success or failure of individual adjustment loans. To recap, the OED classifies adjustment loans as successes or failures on the basis of their assessment of whether the broad reform objectives of the loan have been met. In the period 1980-95, the OED assessed about one-third of adjustment loans as failures. In addition to the World Bank "loan input" variables discussed in section 2, Dollar and Svensson investigate the effects of political variables in explaining loan success or failure. These include: whether the government is democratically elected; political instability (the number of government crises according to Banks (1994) during the implementation of the adjustment program); the degree of social divisions (as measured by the amount of ethnic fragmentation); and the length of government tenure (the number of years the incumbent that signed the loan agreement has been in power). Using probit analysis, Dollar and Svensson find that political variables are quite important in explaining the probability of loan success, in contrast to the Bank input variables that they found to have no explanatory power once political variables are included.

Two results seem especially relevant for our argument on the relation between aid effectiveness and the political regime. First, loans given to democratically-elected governments have a higher probability of success (about 20% higher in their sample) than loans given to governments that were not democratically chosen, a difference independent of other factors such as ethnic fractionalization and number of years in power. To the extent that non-democratically-chosen governments are more appropriative, this supports our basic argument. Second, length of tenure matters, for both types of governments, but especially for those governments that were not democratically elected. The longer a government has been in power the lower is the probability of loan success. A loan that was signed by a newly democratically elected government has a 95%

probability of success according to Dollar and Svensson, while one signed with a new non-democratically installed government has an 85% success probability. For the non-democratic government, this probability falls steadily over its tenure, reaching 65% after 13 years in power. It seems reasonable to assume that the appropriative ability of a non-democratic government may rise with the length of time it has been in office, so that these results would support the argument that aid failure in part reflects the appropriative nature of the regime.

Dollar and Svensson draw a clear conclusion from their results. As they put it (p. 4-5)

These results have clear implications for how to manage policy-based lending. They suggest that the role of adjustment lending is to identify reformers, not to create them. Development agencies need to devote resources to understanding the political economy of different countries and to find promising candidates for support. ...To improve the success rate of adjustment programs, the World Bank needs to be more selective and discerning in providing this kind of assistance.

6. Conclusions

In this paper, we have attempted to make the case for what may appear to be an extreme measure, namely selectively denying foreign assistance. The goal was not simply to present conceptual, model-based, and empirical arguments to support the case, but to use a formal model to help illuminate some of these arguments. Providing no aid to a country for some time may play a role in a switch away from the appropriative behavior responsible for aid failure, a change which could not be accomplished by continuing to provide aid or make it conditional. Selectivity is not meant as a permanent cut-off of lending, but to provide an incentive to improved loan management that simple conditionality itself may not provide. A key element of this view of selectivity is a dynamic process leading to changes in the way a country responds to the provision of aid.

Throughout the paper, we presented a number of caveats, concerning the importance of other reasons for the failure of aid, the crucial importance of political factors in making the case for selectivity, and the care with which the remedy of selectivity should be used. Our goal was not to make a blanket case for selectivity, but to try to better understand the role of selectivity when appropriative behavior of governments appears to be central to the failure of aid programs.

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The notion of selectivity for which concerned economists like Michael Bruno argued so strongly had at its heart the concern to improve the welfare of individuals in poor countries, tempered with the realization that this may require strong medicine if the failure of previous aid programs reflects socially adverse behavior on the part of recipients.

Mathematical Appendix

1. Derivation of equations (7) and (8) in the text: To derive an appropriator's optimal strategy, we begin by assuming that it is a linear strategy of the form:

$$X_t^i = (1 - \gamma)\phi r W_t ,$$

(A.1)

where ϕ is a coefficient to be determined, and then verify this conjecture, when the other group is following this strategy. Consider group 1 choosing its optimal behavior under the assumption that group 2 follows a rule of the form (A.1). An appropriator's optimal decision is to choose sequences of C_t and X_t^1 to maximize its infinite-horizon objective (1). Using (A.1) and (4) for the evolution of W_t, the decision problem may be represented as a dynamic programming problem:

$$\Omega_1^N[W_t] = \max \{ \gamma \ln C_t + (1 - \gamma)\ln X_t^G +$$
$$\beta \Omega_1^N[R W_t - C_t - X_t^1 - (1 - \gamma)\phi r W_t] \} ,$$

(A.2)

where the maximization is taken over C_t and X_t^1. Taking the first-order conditions for C_t and X_t^1 and using the envelope theorem, one obtains:

$$X_{t+1}^1 = (1 - (1 - \gamma)\phi \frac{R - 1}{R})X_t^1$$

(A.3)

$$C_t = \frac{\gamma}{1 - \gamma}X_t^1 .$$

(A.4)

Using (A.1) in (A.3), one obtains:

$$W_{t+1} = (1 - (1 - \gamma)\phi \frac{R - 1}{R})W_t .$$

(A.5)

Substituting (A.1) and (A.4) into (4), one obtains:

$$W_{t+1} = R W_t - 2(1 - \gamma)\phi(R - 1)W_t - \gamma\phi(R - 1)W_t .$$

(A.6)

Equating (A.5) and (A.6) one obtains $\phi = R/(R + (1-\gamma)r)$, which, together with (A.1) yields (7) and (8) in the text.

2. Derivation of equation (10) in the text: Substituting (7) into the definition of $\Omega^N(W_t,0)$ in (10), one obtains:

$$\Omega^{\mathrm{N}}(W_t,0) =$$

$$\sum_{s=0}^{\infty} \beta^s (\gamma \ln[\gamma \phi r W_{t+s}] + (1-\gamma)\ln[(1-\gamma)\phi r W_{t+s}]) \quad \text{(A.7)}$$

Substituting (9) into (A.7) and rearranging, one obtains the second line of (10), where one uses

the expansion $\displaystyle\sum_{s=0}^{\infty} s\beta^s = \beta/(1-\beta)^2$.

3. Derivation of equation (13) in the text: One obtains $\Omega^{\mathrm{D}}(W_t,Z)$ as an explicit function of W_t and Z by substituting (12) and the solution in (10) for $\Omega^{\mathrm{N}}(W_t,0)$ into (11). Similarly, (6) yields $\Omega^{\mathrm{C}}(W_t,Z)$ as an explicit function of W_t and Z. Using the equations for the evolution of W_t under defection and cooperation and expanding the resulting expression, as in the derivation of (10) above, one obtains (13).

4. Proof of Proposition 1: For ease of exposition, define $\Delta(W,Z) \equiv \Omega^{\mathrm{C}}(W,Z) - \Omega^{\mathrm{D}}(W,Z)$. Continuity of $\Delta(W,Z)$ is immediate, as is the fact that $\Delta(W,Z)$ is monotonically decreasing in W and monotonically increasing function in Z. As $rW \to \infty$, $\Delta(W,Z) \to -\infty$, while as $rW \to Z/R$, $\Delta(W,Z) \to \infty$. Continuity and monotonicity of $\Delta(W,Z)$ in W then implies the existence of a $W^*(Z)$ such that $\Delta(W^*,Z) = 0$. $W^*(Z)$ increasing in Z follows from application of the implicit function theorem.

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