Aid Effectiveness and Limited Enforceable Conditionality

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First Version: January, 2005

This Version: July, 2007

Abstract

This paper analyzes optimal foreign aid policy in a neoclassical growth framework with a conflict of interest between the donor and the recipient government. Aid conditionality is modeled as a limited enforceable dynamic contract. We define the contract to be self-enforcing if, at any point in time, the conditions imposed on aid funds are supportable by the threat of a permanent aid cutoff from then onward. Quantitative results show that optimal self-enforcing conditional aid strongly stimulates the developing economy and substantially increases welfare. However, aid effectiveness comes at a high cost: to ensure enforceability, less benevolent political regimes receive permanently larger aid funds in return for a less intense conditionality.

JEL: E13, F35, O11, O19.

*I am especially grateful to Harald Uhlig for many suggestions and comments. Moreover, I am indebted Michael Burda for very helpful discussions. I thank Christian Stoltenberg, Ralf Brüggemann, Carsten Trenkler, Mirko Wiederholt and seminar participants at Humboldt-University Berlin, University of Mannheim, the 2006 SED meetings in Vancouver, the 2006 EEA meetings in Vienna and the 2006 German Workshop in Macroeconomics in Frankfurt for helpful comments. Financial support by the National Research Center SFB 649 is gratefully acknowledged. All errors are mine. Address: University of Frankfurt, School of Business and Economics, Department of Money and Macroeconomics, Mertonstr. 17, PF 96, 60054 Frankfurt am Main.

1 Introduction

Foreign aid has been a substantial source of income in developing economies. As an example consider the case of Africa: on average aid funds amount to 11 % of recipient's GDP.[1] The stated intention of development assistance programs is to reduce poverty and to promote economic growth. However, the stagnating growth pattern in African countries calls the effectiveness of aid into question.[2]

This paper analyzes optimal foreign aid policy in a neoclassical growth framework with a conflict of interest between the donor and the recipient government. We take into account that, instead of implementing economic policies that coincide with the donor's intention, the recipient government may follow 'bad' policies and use aid funds e.g. to assist political supporters or to finance military interventions. To prevent the government from doing so, it has become a common donor policy to impose conditions that specify how foreign aid funds should be allocated. However, since the recipient country is sovereign, its government may not be willing to keep the conditions.

The focus of this paper is to analyze the optimal design of incentive compatible aid conditionality. We follow the recent literature on limited commitment in dynamic macroeconomic settings and describe aid conditionality as an imperfectly enforceable dynamic contract between the donor and the recipient country.[3] To ensure that the recipient government cooperates, the donor threatens with aid sanctions. Conditional aid policy is defined to be self-enforcing if, at any point in time, the conditions are supportable by the threat of a permanent aid cutoff from then onward.

Our paper builds on recent studies that analyze foreign aid policy in the light

[1] Based on annual data from 1972 to 2000 and a sample of 33 sub-saharan African countries.

[2] See e.g. Easterly, Levine and Roodman (2004), Easterly (2001) and the references therein, who do not find robust evidence that aid has led to increased growth.

[3] Papers that deal with limited enforceable dynamic contracts in different areas of research are e.g. Kocherlakota (1996), Kehoe and Levine (1993, 2001), Thomas, Ligon and Worrall (1997, 2000), Alvarez and Jermann (2001), Cooley, Marimon and Quadrini (2004), Kehoe and Perri (2002), Krüger and Perri (2005) and Krüger and Uhlig (2005). In particular, Marcet and Marimon (1992) analyze external financing opportunities under limited commitment in a stochastic growth model. In Giovannetti, Marcet and Marimon (1993) the theoretical model developed in Marcet and Marimon (1992) is applied to the case of Africa. This paper is also related to the sovereign debt literature, see e. g. Kletzer and Wright (2000) and the references therein.

of incentive compatibility problem, in particular Cordella, Dell'Ariccia and Kletzer (2003) and Kletzer (2005) who model conditional aid as an imperfectly enforceable contract in repeated agency models. Considering endowment economies, Cordella et al. (2003) focus on the connection of aid and debt relief while Kletzer (2005) stresses the credibility of aid sanctions. In contrast, this paper develops a neoclassical growth model to study the dynamic properties of optimal self-enforcing conditional aid policy and its impact on fiscal policy reforms and capital accumulation. In particular, our theoretical framework allows us to analyze the short-run properties of optimal aid policies during transitions paths as well as the long-run properties.

Our model focuses on the connection of aid, incentives and growth in the light of different political regimes in the recipient country. The developing economy is characterized by a government that finances unproductive government consumption by raising distortionary taxes and by using aid funds. While the donor cares solely about the welfare of the households, the recipient government may be non-benevolent. We define aid conditionality as an imperfectly enforceable dynamic contract that maximizes the donor's preferences subject to the optimal decision rules of the households and the government budget constraints. Thereby, the donor offers to transfer aid funds and, in return, expects the government to implement fiscal policy reforms that reduce the tax burden of the households. In order to study the dynamic short-run behavior of the economy on its transition path we solve the model numerically using projection methods based on Judd (1992, 1998), Den Haan and Marcet (1990) and Christiano and Fisher (2000).

We find that self-enforcing conditional aid strongly stimulates the economy as considerable tax cuts increase the incentives to invest in capital. Hence, aid flows foster economic growth and household consumption rises substantially implying large welfare gains. However, increasing household consumption comes at a high cost in the short- as well as the long-run, particularly in less benevolent political regimes. To ensure the enforceability of the aid contract, the donor has to pay large amounts of aid in return for a less intense conditionality. If aid transfers are not sufficiently high, a permanent aid

cutoff does not pose a threat and the recipient government has no incentives to fulfill the conditions imposed by the donor. As a consequence, tax cuts are not implemented and aid has no or only minor impact on the developing economy. Since less benevolent recipient governments have lower incentives to implement the aid conditions, to ensure enforceability, the donor has to permanently transfer more aid to countries that suffer from less benevolent political regimes.

With respect to the dynamic short-run properties of self-enforcing conditional aid, suppose the initial situation is described by the steady state that occurs if no aid is given to the developing economy. Then optimal self-enforcing conditional aid is characterized by large transfers in the early periods to stimulate the economy. As capital grows, the amount of aid decreases until a long-run positive value of development assistance is reached. Importantly, aid cannot decrease to zero as the economy grows because that would induce the recipient government to break the aid conditions and to increase distortionary taxes.

Now suppose a switch to a less benevolent political regime takes place. Without development assistance the new government finances high government consumption by implementing distortionary tax policies that deplete the capital stock until a low long-run value is reached. What are the dynamic properties of optimal self-enforcing conditional aid given the donor wants to continue the aid relationship? It turns out that in the short-run optimal self-enforcing conditional aid follows a hump-shaped pattern. This counter-intuitive effect is particularly pronounced in less benevolent political regimes and can be explained as follows. Since the initial capital stock is high compared to the steady state that occurs if no aid is given, a permanent aid cutoff does not pose a severe threat to the recipient government. In addition, foreign aid funds increase the capital stock in such a way that the punishment threat gets even less severe. Hence, the recipient government has high incentives to break the aid contract. In order to prevent the government from doing so, the donor has to temporarily raise foreign aid funds with growing capital.

The paper is structured as follows. Section 2 provides a comparison with the lit-

erature. In section 3 a neoclassical framework is developed that considers different political regimes and allows us to analyze the effectiveness of aid programs in the light of enforceability problems. Section 4 deals with the numerical solution. In section 5 we analyze quantitatively the dynamic properties and the effectiveness of self-enforcing conditional aid by studying transition paths and long-run properties. Moreover, we compare the impact of conditional aid as opposed to unconditional aid. Finally, section 6 concludes with some critical remarks and an outlook on future research.

2 Comparisons with the Literature

There is an ongoing major debate about how aid agencies should design aid programs, primarily based on empirical evidence. However, the empirical literature concerning the impact of foreign aid on growth and the connection between aid effectiveness and recipient's economic policies is controversial: there seems to be no robust evidence concerning the interaction of foreign aid, sound economic policies and growth.[4]

Rather than drawing on empirical arguments, the objective of our study is to contribute to the debate by theoretically deriving implications for optimal conditional foreign aid policy. The theoretical literature on aid effectiveness is limited and there are two main directions: the first direction focuses on the impact of aid on growth while the second emphasizes incentive compatibility problems.

To study the link between aid and economic growth, studies of the first direction take aid flows as exogenously given, e.g. Chenery and Strout (1966), Chatterjee, Sakoulis and Turnovsky (2003), Dalgaard, Hansen and Tarp (2004) and Mourmouras and Rangazas (2006).[5] Svensson (1999) and Boone (1996) account for distortions within the recipient country and study the impact of unconditional aid in the presence of different political institutions. The latter shows that the effectiveness of unconditional

[4]See e.g. Burnside and Dollar (2000, 2004), Hansen and Tarp (2000, 2001), Dalgaard and Hansen (2001), Guillaumont and Chauvet (2001), Lensink and White (2001), Devarajan, Dollar and Holmgren (2000), Collier and Dollar (2001, 2002), Easterly, Levine and Roodman (2003) and Easterly (2003).

[5]Studies like e.g. Arellano, Bulíř, Lane and Lipschitz (2007) study the effects of aid and its volatility and focus mainly on the short-run fluctuations in the developing economy.

aid is very limited in the presence of less democratic political regimes.[6]

Adam and O'Connel (1999) and Coate and Morris (1995) belong to the first papers that point out that conditionality can be interpreted as contracts between donors and recipient governments. The second direction of research focuses on this feature and uses stylized game-theoretic models to study aid effectiveness in the light of incentive compatibility, moral hazard and informational problems. Most papers in this literature assume static or simple two-period frameworks. There are two main issues raised. On the one side, Murshed and Sen (1995), Svensson (2000a, 2000b, 2003), Pedersen (1996, 2001), Federico (2001) and Hagen (2006) focus on the time inconsistency of the donor's behavior as explanation for limited aid effectiveness since policy conditionality is often criticized for a lack of credibility. In this literature the Samaritan's Dilemma is emphasized: the expectation of aid funds can lead countries to behave in a way that keeps them in poverty. Federico (2001) shows that there exists an inverse link between aid and reform. He argues that the Samaritan's Dilemma is more relevant for more altruistic donors which makes reforms more costly in return for less intense conditionality. On the other side, Azam and Laffon (2003), Cordella, Dell'Ariccia and Kletzer (2003) and Kletzer (2005) focus on limited commitment on the side of the recipient's government given that the donor is altruistic while the recipient government is selfish.

This paper attempts to link the two directions of research by analyzing conditional aid and incentive compatibility issues in a dynamic neoclassical growth model to study how transfers affect savings and capital accumulation. Our model framework is similar to the one in Boone (1996), however, he focuses on exogenous unconditional aid and limits the analysis to steady states while we determine self-enforcing conditional aid endogenously and analyze the short-run as well as the long-run properties. Mourmouras and Rangazas (2006) also develop a neoclassical growth model that incorporates different sources of poverty to study the impact of foreign aid. They calculate the costs

[6]Most papers in this area of research focus on distortions within the recipient country. One exception is Dalgaard (2004) who analyzes to what extent donor policies influence the effectiveness of aid.

of 'buying' fiscal policy reforms in the developing economy and, similarly to our paper, find that these costs are high. However, in our theoretical framework, donors optimally choose incentive-compatible aid policies over time whereas Mourmouras and Rangazas (2006) exogenously assume a constant aid stream that makes the recipient government indifferent to the fiscal policy reform.

Our theoretical framework aims to shed light on the conflict of interest between the donor and the government and the associated incentive problems but abstracts from important sources of poverty such as fertility, human capital etc. We concentrate our analysis on limited commitment on the side of the recipient's governments and abstract from credibility and time-inconsistency problems of the donor's policies. Because we assume that the donor threatens with a permanent cutoff from aid - the most severe punishment - the resulting optimal conditional aid policy is the best the donor can achieve. In combination with the assumption that the donor fully commits to future aid policies, we view this as the most optimistic scenario one can think of regarding the effectiveness of aid. We discuss the important question of credibility and limited commitment on the donor's side in the concluding section 6.

3 The Model

In the following we develop a neoclassical growth framework to analyze the connection of aid, incentives and growth in the light of different political regimes in the recipient country. Our model builds on four major assumptions. First, the intention of foreign aid programs is poverty reduction. It may be interesting to analyze objectives that are more of political nature, however, this is beyond the scope of this paper. Second, recipient countries may have non-benevolent political regimes such that a conflict of interest between the donor and the recipient government is generated. Third, the conditions imposed on aid funds are imperfectly enforceable while donors fully commit to their policies. Fourth, foreign aid flows do not change the institutions in the recipient

country, i.e. donors take the political regime as given when designing aid policy.[7]

3.1 The Environment

We consider a developing economy inhabited by a large number of infinitely-lived households who maximize utility. There is a government who finances its unproductive consumption by raising distortionary taxes on households' income and by using foreign aid funds.

Preferences of the representative household are given by

$$\sum_{t=0}^{\infty} \beta^t u(c_{h,t}), \qquad 0 < \beta < 1, \tag{1}$$

where $c_{h,t}$ denotes household consumption at time t. The utility function $u(c_{h,t})$ satisfies $u_{c_h}(c_{h,t}) > 0$ and $u_{c_h c_h}(c_{h,t}) < 0$. u_{c_h} and $u_{c_h c_h}$ denote the first and second derivatives of u with respect to household consumption. The households' budget constraint is given by

$$c_{h,t} + k_t = (1 - \tau_t) y_t + (1 - \delta) k_{t-1}, \tag{2}$$

$k_{-1} > 0$. The capital stock at time t is denoted by k_t, production y_t is given by a constant returns to scale production function, $y_t = F(k_{t-1}, n_t)$, and τ_t denotes the income tax rate raised by the government. $0 \leq \delta \leq 1$ is the capital depreciation rate. In the following we normalize labor $n_t \equiv 1$, for all t, such that $F(k_{t-1}, 1) \equiv f(k_t)$.

Preferences of the government are given by

$$\sum_{t=0}^{\infty} \beta^t [\alpha\ u(c_{h,t}) + (1 - \alpha)\ v(c_{g,t})], \tag{3}$$

where the utility function v satisfies $v_{c_g}(c_{g,t}) > 0$ and $v_{c_g c_g}(c_{g,t}) < 0$. v_{c_g} and $v_{c_g c_g}$ denote the first and second derivatives of v with respect to government consumption. We label unproductive government consumption by $c_{g,t}$ and interpret it as e.g. expenditures supporting the political elite. $\alpha \in (0, 1)$ measures the benevolence of the government and is interpreted as an indicator of the political regime in the recipient country. If

[7] This assumption is in line with empirical findings: Dollar and Svensson (2000) and the references therein do not find robust evidence that foreign aid has a positive impact on institutions or reforms.

$\alpha = 1$ there is no government consumption, and, hence, there are no distortions in the economy. Note that the political regime is assumed to be exogenous and cannot be influenced by foreign aid funds. The government's budget constraint is given by

$$c_{g,t} = \tau_t y_t + a_t, \tag{4}$$

where $a_t \geq 0$ denotes aid transfers given by the donor.

The representative donor makes costly aid transfers. The donor's preferences are dependent on the welfare of the households and are given by

$$\sum_{t=0}^{\infty} \beta^t [u(c_{h,t}) - h(a_t)], \tag{5}$$

where the cost function $h(a_t)$ satisfies $h(a_t) > 0$ for $a_t > 0$ and $h(a_t) = 0$ for $a_t = 0$. Moreover, $h_a(a_t) > 0$ and $h_{aa}(a_t) \geq 0$ where h_a and h_{aa} denote the first and second derivatives of h with respect to aid.

3.2 Unconditional Aid

Without any conditions imposed on foreign aid funds the recipient government chooses taxes and government consumption, such that government's preferences are maximized subject to the government budget constraint and the optimal decision rules of the households.

Given taxes and government consumption households maximize (1) subject to their budget constraint (2). The optimal decision rules of the households are given by:

$$\frac{u_{c_h}(c_{h,t})}{\beta} = u_{c_h}(c_{h,t+1}) R(c_{g,t+1}, k_t, a_{t+1}) \tag{6}$$

$$R(c_{g,t+1}, k_t, a_{t+1}) = \left(1 - \frac{c_{g,t+1} - a_{t+1}}{f(k_t)}\right) f_k(k_t) + 1 - \delta \tag{7}$$

$$c_{h,t} + c_{g,t} + k_t = f(k_{t-1}) + (1-\delta)k_{t-1} + a_t. \tag{8}$$

(6) is the usual Euler equation that connects the marginal rate of substitution between consumption today and tomorrow with the rate of return $R(c_{g,t+1}, k_g, a_{t+1})$. The tax is given by the government budget constraint $\tau_t = \dfrac{c_{g,t} - a_t}{f(k_{t-1})}$.

Given unconditional foreign aid funds the recipient government solves the following maximization problem:

$$\max_{\{c_{h,t},\, c_{g,t},\, k_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \beta^t [\alpha\ u(c_{h,t}) + (1-\alpha)\ v(c_{g,t})] \tag{9}$$

s.t.

(6), (7), and (8)

given $k_{-1} > 0$.

Suppose that the political regime is characterized by a high value of α. Since the recipient government is highly benevolent, aid funds are used to decrease the distortionary tax on households' income such that investment increases and the economy is stimulated. In contrast, for low values of α the recipient government uses large parts of aid funds to increase government consumption.

3.3 Conditional Aid as Self-Enforcing Contract

Donors want to choose aid policies that induce the government to devote aid funds to policies that coincide with the donor's intention. To do so, it has become common to impose conditions on aid funds. The crucial question is how to design incentive compatible conditionality. We define aid conditionality as a dynamic contract between the donor and the recipient country that specifies foreign aid and tax policies in such a way that the donor's preferences are maximized subject to the optimal decision rules of the households and the government budget constraints. However, the contract is imperfectly enforceable since the sovereign recipient government can always dishonor the conditions and implement ineffective tax policies. We assume that in this case the donor responds with aid sanctions.

In the following we assume that conditional foreign aid policy constitutes a self-enforcing contract between the donor and the recipient government only if, at any point in time, the conditions are supportable by the threat of permanent aid sanctions from then onwards. Aid conditions are defined to be feasible only if, at any point in time, the government's utility of fulfilling the conditions is larger than the utility in

case of a permanent aid cutoff. Note that we assume that the threat is fully credible and that there is full commitment on the donor's side. Since a permanent aid cutoff is the worst possible scenario for the recipient government, the associated self-enforcing allocation is the best the donor can achieve.

The self-enforcing contract is defined to be given by the solution to the following maximization problem of the donor:

$$\max_{\{c_{h,t},\, c_{g,t},\, k_t,\, a_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \beta^t [u(c_{h,t}) - h(a_t)] \tag{10}$$

s.t.

$$\sum_{j=0}^{\infty} \beta^j [\alpha\ u(c_{h,t+j}) + (1-\alpha)\ v(c_{g,t+j})] \geq D(k_{t-1}) \tag{11}$$

(6), (7) and (8)

given $k_{-1} > 0$. $D(k_{t-1}) = \sum_{j=0}^{\infty} \beta^j [\alpha u(\tilde{c}_{h,t+j}) + (1-\alpha) v(\tilde{c}_{g,t+j})]$ is the government's utility if no foreign aid funds are given from t onwards, i.e. $\{\tilde{c}_{h,t+j}, \tilde{c}_{g,t+j}\}_{j=0}^{\infty}$ solves the government maximization problem (9) under the assumption that $a_{t+j} = 0\ \forall\ j \geq 0$. Note that even if the consequence of default is a permanent cutoff of development assistance, the recipient country is still endowed with the capital that has been built up using past aid payments. Sovereignty ensures that the capital stock cannot be seized by the donor. Hence, the right-hand side of (11) depends on the capital stock k_{t-1}. The solution to (10) is an allocation $\{c_{h,t}, c_{g,t}, k_t\}_{t=0}^{\infty}$ and policy actions $\{a_t, \tau_t\}_{t=0}^{\infty}$ that can be interpreted as the outcome of aid conditionality. The donor offers to transfer a_t at time t and in return expects the recipient government to implement the fiscal policy action τ_t that is associated with the allocation $\{c_{h,t}, c_{g,t}, k_t\}_{t=0}^{\infty}$.

3.4 Analysis

The maximization problem (10) contains the enforcement constraint (11) that includes future realizations of the decision variables. To solve the problem we follow Marcet and Marimon (1992, 1998) and introduce an additional co-state variable that measures the binding pattern of the enforcement constraint:

$$\mu_t = \mu_{t-1} + \gamma_t, \qquad \mu_{-1} = 0. \tag{12}$$

$\gamma_t \geq 0$ denotes the Lagrange-multiplier on the enforcement constraint. If the enforcement constraint is not binding at time t, $\gamma_t = 0$ and μ_t is determined by past binding patterns. If the enforcement constraint is binding at time t, the multiplier γ_t is strictly greater than zero and μ_t increases. Setting up the Lagrangian, using (12) and simple algebra the donor's maximization problem (10) can be transformed into the following saddle-point formulation:

$$\begin{aligned} \min_{\{\gamma_t \geq 0\}_{t=0}^{\infty}} \max_{\{c_{h,t}, c_{g,t}, k_t, a_t\}_{t=0}^{\infty}} & \sum_{t=0}^{\infty} \beta^t [u(c_{h,t}) - h(a_t) \\ & + \mu_t \left(\alpha\, u(c_{h,t}) + (1-\alpha)\, v(c_{g,t})\right) \\ & - \gamma_t D(k_{t-1})] \end{aligned} \tag{13}$$

s.t.

(6), (7), (8) and (12).

This formulation shows clearly that the additional co-state variable μ_t enters as a weight on government's preferences.

Given k_{t-1} the allocation $\{\tilde{c}_{h,t+j}, \tilde{c}_{g,t+j}, \tilde{k}_{t+j}\}_{j=0}^{\infty}$ of the outside option $D(k_{t-1})$ solves the government's maximization problem (9) and satisfies the following optimality conditions with $\tilde{a}_{t+j} = 0 \; \forall \; j \geq 0$:

$$\tilde{\zeta}_{t+j} = \alpha u_{c_h}(\tilde{c}_{h,t+j}) + u_{c_h c_h}(\tilde{c}_{h,t+j}) \left(\tilde{\lambda}_{t+j-1} R(\tilde{c}_{g,t+j}, \tilde{k}_{t+j-1}, \tilde{a}_{t+j}) - \tilde{\lambda}_{t+j}\right) \tag{14}$$

$$\tilde{\zeta}_{t+j} = (1-\alpha) v_{c_g}(\tilde{c}_{g,t+j}) + \tilde{\lambda}_{t+j-1} u_{c_h}(\tilde{c}_{h,t+j}) R_{\tilde{c}_g}(\tilde{c}_{g,t+j}, \tilde{k}_{t+j-1}, \tilde{a}_{t+j}) \tag{15}$$

$$\begin{aligned} \frac{\tilde{\zeta}_{t+j}}{\beta} = & \; \tilde{\zeta}_{t+j+1}\Big(f_k(\tilde{k}_{t+j}) + 1 - \delta\Big) \\ & + \tilde{\lambda}_{t+j} u_{c_h}(\tilde{c}_{h,t+j+1}) R_{\tilde{k}}(\tilde{k}_{t+j}, \tilde{c}_{g,t+j+1}, \tilde{a}_{t+j+1}) \end{aligned} \tag{16}$$

and (6) to (8). $\tilde{\lambda}_{t+j}$ denotes the Lagrange multiplier on the Euler equation of the households (6) and enters as a state variable. $\tilde{\zeta}_{t+j}$ is the multiplier associated with the resource constraint. $R_{\tilde{c}_g}$ and $R_{\tilde{k}}$ denote the partial derivatives of R with respect to $\tilde{c}_g$ and $\tilde{k}$, respectively.

The optimal allocation associated with the self-enforcing aid contract (13) satisfies

the optimality conditions

$$\begin{aligned}
\zeta_t &= (1+\alpha\mu_t)u_{c_h}(c_{h,t}) + u_{c_h c_h}(c_{h,t})\Big(\lambda_{t-1}R(k_{t-1},c_{g,t},a_t) - \lambda_t\Big) && (17)\\
\zeta_t &= (1-\alpha)\mu_t v_{c_g}(c_{g,t}) + \lambda_{t-1}u_{c_h}(c_{h,t})R_{c_g}(k_{t-1},c_{g,t},a_t) && (18)\\
-\zeta_t &= -h_a(a_t) + \lambda_{t-1}u_{c_h}(c_{h,t})R_a(k_{t-1},c_{g,t},a_t) && (19)\\
\frac{\zeta_t}{\beta} &= \zeta_{t+1}\Big(f_k(k_t)+1-\delta\Big) + \lambda_t u_{c_h}(c_{h,t+1})R_k(c_{g,t+1},k_t,a_{t+1})\\
&\quad -\gamma_{t+1}D_k(k_t) && (20)\\
0 &= \gamma_t\left(\sum_{j=0}^{\infty}\beta^j[\alpha u(c_{h,t+j}) + (1-\alpha)v(c_{g,t+j})] - D(k_{t-1})\right) && (21)
\end{aligned}$$

together with (6) to (8) and (12). R_a denotes the partial derivative of R with respect to a. λ_t denotes the Lagrange multiplier on the Euler equation and measures its tightness. ζ_t is the Lagrange multiplier of the resource constraint. (21) is the complementary slackness condition.

Note that the first order conditions of the donor with respect to $c_{h,t}$ and $c_{g,t}$ given by (17) and (18) are similar to those of the government (14) and (15). They differ only in the weight on households' utility $u(c_{h,t})$ and government's utility $v(c_{g,t})$. Initially, the donor puts full weight on households' utility while government's preferences are characterized by a weight α on $u(c_{h,t})$ and $(1-\alpha)$ on $v(c_{g,t})$. Over time, the donor's weight on households' and government's utility is dependent on the co-state variable μ_t that measures the binding pattern of the enforcement constraint. Consider first the donor's optimality condition (17) with respect to $c_{h,t}$. Optimal household consumption connects the cost ζ_t of a marginal increase in consumption with the weighted marginal utility $(1+\alpha\mu_t)u_{c_h}(c_{h,t})$.[8] The donor's optimality condition (18) relates optimal government consumption to the cost ζ_t of a marginal increase and to the weighted marginal utility $(1-\alpha)\mu_t v_{c_g}(c_{g,t})$. If the government has an incentive to default on the aid conditions, μ_t increases and the weights $(1+\alpha\mu_t)$ and $(1-\alpha)\mu_t$ on $u(c_{h,t})$ rise. How strongly household consumption and government consumption are affected by μ_t depends on the value of α. Consider the extreme case $\alpha = 0$. Then μ_t enters solely as

[8] The remaining term of (17) is related to the tightness of the Euler equation.

a weight on government utility: government consumption has to increase in order to decrease the inventive to break the aid contract.

Substituting equation (18) in (19) and using $R_{c_g} = -R_a$ yields $h_a(a_t) = (1 - \alpha)\mu_t v_{c_g}(c_{g,t})$ which determines optimal foreign aid funds by equating marginal costs of aid and weighted marginal utility of the government. It is evident that the donor has to adjust aid funds to increase government consumption if the enforcement constraint is binding. Foreign aid becomes more costly to the donor because higher government consumption has to be accepted to ensure the enforceability of aid conditionality.

Equation (20) is the first order condition with respect to capital. A marginal increase in capital raises the outside option in $t+1$ and influences the binding pattern of the enforcement constraint in $t+1$ which is captured by the term $-\gamma_{t+1} D_k(k_t)$.

Given an initial capital stock k_{-1} and given (12), the co-state variable μ_t grows until it reaches its steady state $\overline{\mu}$, such that the enforcement constraint (11) is satisfied and $\overline{\gamma} = 0$. Since the model assumes no exogenous growth, the steady state is characterized by a constant weight $\overline{\mu}$, a constant allocation $(\overline{c}_h, \overline{c}_g, \overline{k})$ and constant policy $(\overline{\tau}, \overline{a})$ that fulfill the optimality conditions (17) to (21) and the constraints (6) to (8).

In the following we analyze transition paths and the properties of the steady state and study the impact of self-enforcing conditional aid in different political regimes in the recipient country. Since the constraints (6) to (8), the law of motion for the co-state variable (12) and the optimality conditions (17) to (21) form a system of highly nonlinear equations that depend on the state variables k_t, λ_t and μ_t, we solve the model numerically.

4 Numerical Solution

4.1 Functional Forms and Calibration

In our numerical simulations we consider different political regimes, $\alpha = 0.3$, $\alpha = 0.5$ and $\alpha = 0.7$, where the latter denotes the most benevolent.

We assume logarithmic utility functions: $u(\cdot) = v(\cdot) = \log(\cdot)$. The production function is considered to be $f(k_{t-1}) = \nu k_{t-1}^{\theta}$, $\nu > 0$. $0 < \theta < 1$ denotes the capital

share. The donor's cost function $h(a_t)$ is assumed to be quadratic, $h(a_t) = \kappa a_t^2$, where $\kappa > 0$ is a parameter.

We calibrate the model on an annual basis and assume values that are consistent with the usual neoclassical growth model: $\beta = 0.96$, $\theta = 0.3$, $\delta = 0.10$.[9] κ is chosen such that for $\alpha = 0.5$ the steady state foreign aid share is 10 percent which is the median in the data. Calibrating κ differently leads to qualitatively similar results. We normalize the model by choosing ν such that for $\alpha = 0.5$ steady state production under aid autarky equals 1.

4.2 Numerical Algorithm

The numerical algorithm makes use of projection methods particularly well described in Judd (1992, 1998). In order to appropriately take into account the occasionally binding enforcement constraint, we follow Christiano and Fisher (2000) and use some flexible parameterized functions of the state variables to approximate those parts of the optimality conditions that are determined by future realizations of the decision variables. The method is related to the parameterized expectations approach by Marcet and Marimon (1992). The basic structure of the algorithm is as follows.

Define the state $s = (k, \lambda, \mu)$. Let the optimal decision rules for capital, private and government consumption, foreign aid and Lagrange multipliers be a set of time invariant functions of s satisfying the conditions (6) to (8), (12) and (17) to (21). Define the future state $s' = (k'(s), \lambda'(s), \mu'(s)) = g(s)$. Consider the optimality conditions that include future realizations of the decision variables (6), (20) and the enforcement

[9]Note that we do not aim to match the stylized facts of e.g. sub-saharan African countries since our theoretical framework is far too stylized to mimic the characteristic features of these developing economies. Instead, since no analytical closed-form solution can be derived, we use our numerical exercise to understand the main mechanisms of our model.

constraint (11) and define the right-hand sides by m_1, m_2 and m_3 as follows:

$$\frac{u_{c_h}(c_h(s))}{\beta} = m_1(s, g(s)) \tag{22}$$

$$\frac{\zeta(s)}{\beta} = m_2(s, g(s)) \tag{23}$$

$$\alpha\, u(c_h(s)) + (1-\alpha)\, v(c_g(s)) \geq m_3(s, g(s)). \tag{24}$$

Our numerical approach assumes that m_i can be approximated by some parameterized function $\widehat{e}_{\chi_i}$ of the state variables

$$m_i(s, g(s)) \approx \exp[\widehat{e}_{\chi_i}(s)] \qquad \forall\, i. \tag{25}$$

The functions $\widehat{e}_{\chi_i}$ are good approximations if the residuals

$$\text{Residual}_i = \exp[\widehat{e}_{\chi_i}(s)] - m_i(s, g(s))$$

are close to zero for all i.

Given a fixed set of grid points and given an initial guess for the parameter vectors $\chi = (\chi_1, \chi_2, \chi_3)$, inserting (25) in (22) to (24) can be used to determine the time invariant policy functions $\widehat{g}_\chi$ that are dependent on χ. New parameter vectors χ' are found by performing linear regressions:

$$\widehat{e}_{\chi_i'}(s) = \log[m_i(s, \widehat{g}_\chi(s))] \qquad \forall\, i.$$

The algorithm is iterated until the parameter vectors converge: $\chi_i' \approx \chi_i$ for all i.

In practice we take Chebyshev polynomials as approximating functions and use the Chebyshev nodes as grid points. The numerical advantages of Chebyshev polynomials are described in Judd (1992). Christiano and Fisher (2000) point out that the method can be viewed as a weighted residual method. Here the Chebyshev polynomials are the approximating functions and the collocation method is used as the weighting method.

To correctly take into account the complementary slackness condition, we follow Marcet and Marimon (1992) and proceed as follows. At each iteration, in a first step, we

assume that the enforcement constraint is not binding, $\gamma(s) = 0$, and calculate $c_h(s)$ and $\zeta(s)$ by using the approximating functions $\widehat{e}_{\chi_1}(s)$ and $\widehat{e}_{\chi_2}(s)$. $c_g(s)$ is calculated with the help of the first order condition (18). Next, it is checked whether the enforcement constraint is satisfied. If the enforcement constraint is not satisfied, we recalculate $c_g(s)$ and $\gamma(s)$ by using $\alpha u(c_h(s)) + (1-\alpha)v(c_g(s)) = \widehat{e}_{\chi_3}(s)$ and (18), respectively. $a(s)$, $k'(s)$ and $\lambda'(s)$ are then calculated using the first order conditions (17), (19) and the constraints constraints (7) and (8).

5 Quantitative Properties of Aid Policies

We structure the description of the results as follows. In section 5.1 we first analyze the economic outcome of different political regimes that receive no development assistance. Section 5.2 studies the characteristics of optimal foreign aid policy if the donor is able to perfectly enforce $c_{g,t} = 0$, independently of the political regime. This is our benchmark aid policy since this is the best that the donor can achieve. Section 5.3 analyzes the quantitative short and long run characteristics of optimal self-enforcing conditional aid flows. We compare the effectiveness of conditional aid and unconditional aid in section 5.4. In section 5.5 we study the dynamic properties of optimal self-enforcing conditional aid if a switch to a less benevolent government takes place in the recipient country.

5.1 No Aid

To study the effectiveness of foreign aid, we first analyze the situation of a developing country that receives no foreign aid funds. We focus on the impact of different political regimes on the overall economy.

Without any development assistance the government in the developing country chooses income tax rates and government consumption by solving the maximization problem (9) with $a_t = 0$ for all t. We consider different political regimes and summarize the steady state values of the main economic indicators in table 1, panel I. In the following we refer to this scenario as the 'No Aid Steady State'.

First, consider a government that puts a large weight on the welfare of the households, $\alpha = 0.7$, but also finances some unproductive government consumption by raising a distortionary tax on households' income. In the steady state the income tax rate amounts to 24 percent to finance a 24 percent government consumption share. The household consumption share and the investment share are 60 and 16 percent, respectively. A government that puts a lower weight on the welfare of the households, $\alpha = 0.5$, increases its government consumption share by increasing the income tax rate to 39 percent. The households have lower incentives to invest, such that the steady state capital stock decreases from 1.79 to 1.28. In the least benevolent political regime, $\alpha = 0.3$, income taxes of 55 percent decrease the capital stock and consumption to a very low level. This political scenario is characterized by a government consumption share that is larger than the private consumption share.

The results indicate that developing countries with non-benevolent governments suffer from low levels of capital and consumption due to strong distortions generated by the government. In the following we analyze to what extent foreign aid policy helps to improve the economic situation of developing countries. We assume that the donor observes the 'No Aid Steady State' capital stocks as the initial situations.

5.2 Benchmark

Before we turn to the analysis of limited enforceable conditionality, we first construct a scenario that assumes that the donor can perfectly enforce the conditions imposed on aid. In particular, suppose, at any point in time, the donor can perfectly enforce $c_{g,t} = 0$ and the recipient government cannot reject this condition, i.e. there is no incentive constraint. We refer to this scenario as 'Aid Policy A' and consider it as our benchmark of the effectiveness of foreign aid since this is the best the donor can achieve in our theoretical setup.

Given the 'No Aid Steady State' capital stocks as initial situation and given $c_{g,t} = 0$, what are the characteristics of optimal perfectly enforceable conditional aid policies? To design optimal aid policies the donor maximizes his preferences (5) subject to the

optimality conditions of the households (6), (7) and (8). Since $c_{g,t} = 0$, the tax on income is given by $\tau_t = -a_t/y_t$ and can be understood as a subsidy. Figure 1 plots optimal aid transfers and the associated tax policy. We show the level of tax rates, the tax cut in percentage points relative to the 'No Aid Steady State' and the tax as percentage deviations from the 'No Aid Steady State'. Figure 2 presents government consumption, capital and household consumption in levels and in percentage deviations from the 'No Aid Steady State'.

The graphs show that optimal foreign aid policy is characterized by temporary transfers to stimulate the economy on its transition path to the steady state associated with $\overline{c}_g = 0$. On impact, the amount of aid yields a subsidy that can be interpreted as a three, two and one percent increase in productivity for $\alpha = 0.3$, $\alpha = 0.5$ and $\alpha = 0.7$, respectively. The subsidy raises households' incentives to invest in capital. As capital grows, aid funds revert to zero, such that in the long-run $\overline{\tau} = 0$. The economy with the least benevolent political regime, $\alpha = 0.3$, receives the largest development assistance because it is the poorest country with the lowest initial capital stock. The economy characterized by $\alpha = 0.7$ gets low development assistance since the 'No Aid Steady State' capital stock is close to the efficient one. The tax cuts in percentage points are larger than the 'No Aid Steady State' taxes for all values of α because foreign aid funds are used to turn the tax into a subsidy. Since the economy associated with $\alpha = 0.3$ receives the largest payment and the tax cut is the biggest, the capital stock increases most in terms of percentage deviations from the 'No Aid Steady State'. Household consumption can be considerably increased. Because the donor can enforce $c_{g,t} = 0$, independently of the political regime, the three economies converge to the same new steady state summarized in panel II of table 1. The steady state is characterized by a private consumption share of 79 percent and an investment share of 21 percent.

Panel I of table 2 presents the impact of 'Aid Policy A' on welfare. For reasons of interpretation we use compensating variations to formulate differences in lifetime utility and express the welfare gain in terms of percentage deviation in certainty-equivalence consumption relative to the 'No Aid Steady State'. For example households' consump-

tion equivalents Δ can be calculated as

$$\sum_{t=0}^{\infty} \beta^t u((1+\Delta)\bar{c}_h^{\text{no aid}}) = \sum_{t=0}^{\infty} \beta^t u(c_{h,t}) \tag{26}$$

Let V_h denote the households' welfare gain and let V_d be the donor's welfare gain accounting for the costs of foreign aid transfers. Panel I of table 2 shows that the welfare gain is larger for lower values of α since, initially, the economies with the least benevolent governments suffer from the lowest capital stocks and the highest tax rates. As an example take the economy characterized by $\alpha = 0.5$: the welfare gain of households is equivalent to increasing 'No Aid Steady State' consumption by 91 percent. The donor's welfare gain is of approximately the same size since only temporary aid transfers are made such that the costs of aid are low.

5.3 Self-Enforcing Conditional Aid

In our benchmark scenario the donor is able to perfectly enforce $c_{g,t} = 0$. However, since there is a conflict of interest between the donor and the recipient government, the recipient government may not be willing to implement the tax policy as shown in figure 1. In order to enforce the conditions, the donor threatens with a permanent aid cutoff if the government does not honor the aid contract. The recipient government only fulfills the conditions if, at any point in time t, its utility of doing so $C(k_{t-1}) = \sum_{j=0}^{\infty} \beta^j [\alpha u(c_{h,t+j}) + (1-\alpha) v(c_{g,t+j})]$ is larger than the utility in case of a permanent aid cutoff $D(k_{t-1}) = \sum_{j=0}^{\infty} \beta^j [\alpha u(\tilde{c}_{h,t+j}) + (1-\alpha) v(\tilde{c}_{g,t+j})]$. Since 'Aid Policy A' demands tax cuts such that $c_{g,t} = 0$, obviously, the recipient's government has no incentive to keep the conditions.

To design optimal foreign aid policy with supportable conditions the donor has to take into account the incentive constraint (11) of the recipient government. The solution to the maximization problem (10) fulfills, that given the political regime, at any point in time, the optimal aid contract is self-enforcing: the recipient government is worse off without development assistance. Hence, in return to foreign aid funds the government fulfills the conditions and implements the tax cuts. Figure 3 plots the key

variables describing optimal self-enforcing conditional aid transfers to which we refer as 'Aid Policy B'.

First note that the general pattern of foreign aid funds is the same as before: in the short run the donor transfers high aid funds to stimulate the economy on its transition path to the new steady state. Yet, the quantitative properties are different across political regimes. Less benevolent governments receive permanently larger aid funds. Moreover, foreign aid funds do not revert to zero but remain at a positive value. In return, the lower α the less intense are the conditions imposed on aid flows. The tax levels in percent are higher and tax cuts measured in percentage deviations from the 'No Aid Steady State' are lower for less benevolent political regimes. As an example take $\alpha = 0.3$ and $\alpha = 0.5$. For $\alpha = 0.3$ the long-run tax is given by 23 percent compared to 12 percent in the more benevolent political regime. This translates into percentage deviations from the 'No Aid Steady State' of 60 and 70 percent, respectively.

To understand this finding, focus on the graph that shows the evolution of the co-state variable μ_t over time. Remember that μ_t measures the binding pattern of the enforcement constraint. Due to foreign aid funds capital grows to its new steady state value. However, the incentives to deviate increase since $D(k_{t-1})$ is growing with the capital stock. To fulfill the enforcement constraint, μ_t increases during the early periods and then reaches its steady state value. Note that there is a jump increase in $t = 0$. Let w_t be the relative weight that the donor puts on $v(c_{g,t})$:

$$w_t = \frac{\mu_t - \alpha\mu_t}{1 + \alpha\mu_t}.$$

w_t depends on μ_t and shows the same pattern. It is evident that for lower values of α the donor has to put a larger relative weight on the utility of the government since these governments have high incentives to deviate from the aid contract. This implies that the donor has to permanently pay larger amounts of foreign aid in return for lower tax cuts. Moreover, the reductions in government consumption are the lowest across the political regimes considered here, see figure 4. Compared to the 'No Aid Steady State' government consumption can be decreased by approximately 20 percent for $\alpha = 0.3$ while for $\alpha = 0.5$ a 40 percent reduction can be reached.

However, tax cuts measured in percentage points relative to the 'No Aid Steady State' are large for less benevolent governments because, initially, taxes have been on a high level. This explains the substantial effectiveness of aid funds in less benevolent political regimes as shown in figure 4. We plot the responses of capital and household consumption in levels and in percentage deviations from the 'No Aid Steady State'. It is evident that the huge tax cuts strongly stimulate capital accumulation and household consumption increases. The percentage deviations from the 'No Aid Steady State' are largest for economies that suffer from less benevolent political regimes. E.g. consider $\alpha = 0.3$: the capital stock and household consumption have more than doubled compared to the 'No Aid Steady State'. Yet, inspecting the level responses, it is evident that economies that suffer from less benevolent governments are still the poorest.

In the long-run all variables reach a new steady state which is summarized in panel III of table 1. In the steady state taxes are reduced to fairly low levels (between 3 and 23 percent) such that the capital stock increases considerably. This is accompanied by increased private consumption. Note that for $\alpha = 0.3$ foreign aid payments are the highest and amount to 12 percent of recipients' GDP. They help to decrease the size of the government sector, such that the government consumption share is 35 percent and smaller than the private consumption share of 61 percent.

The positive impact of self-enforcing conditional aid is reflected in the welfare gain summarized in panel II of table 2. The welfare gain is equivalent to raising 'No Aid Steady State' consumption up to 38, 65 and 110 percent for α equal to 0.7, 0.5 and 0.3, respectively. These results show that designing aid conditionality in a way that ensures the recipient's cooperation yields huge impacts. There is also a large increase in the donor's welfare though the gain is considerable lower compared to households' welfare reflecting the costs of foreign aid. This is particularly true for low values of α, i.e. in cases where aid is given to 'bad' governments.

The large gains in the donor's welfare indicate that 'Aid Policy B' is incentive compatible for the donor, too, though we have not explicitly included a participation constraint but instead focused on one-sided limited commitment only. However, since

the donor's welfare is much lower under aid autarky, it seems to be the case that an additional participation constraint for the donor would never be binding.

5.4 Unconditional Aid

What would have been the impact of aid flows described by 'Aid Policy B' if they would have been unconditionally transferred to the developing economy? Without any conditions imposed on aid flows the recipient government solves maximization problem (9). Panel IV of table 1 summarizes the steady states and shows how different political regimes respond to unconditional aid. It is evident that unconditional aid does have a permanent effect, yet, the long-run tax cuts implemented by the recipient government are very limited. Tax reductions are the lowest in the least benevolent political regime. As an example consider the less benevolent political regime described by $\alpha = 0.3$. The donor transfers the largest amount of aid in return for the lowest tax cut of 4 percentage points, though the initial 'No Aid Steady State' tax level is the highest of the three economies considered here. In terms of percentage deviations from the 'No Aid Steady State' tax reductions amount to -25.9, -14.6 and -8.3 percent for α equal to 0.7, 0.5 and 0.3, respectively. Instead of weakening the tax distortion less benevolent governments use foreign aid to increase unproductive government consumption. Government consumption is raised by 14.9, 19.20 and 24.5 percent for α equal to 0.7, 0.5 and 0.3, respectively. Unconditional aid does stimulate the economy, however, the impact on capital and household consumption is rather low given the large amounts of aid. Note that the percentage increases in capital and household consumption relative to the 'No Aid Steady State' are larger the smaller the value of α: the responses of household consumption measured in percentage deviations range between 11.6 and 14.9 percent. This is due to the fact that less benevolent political regimes are poorer in the initial situation and, therefore, receive greater aid funds. If instead we assume that all developing economies receive the same amount of aid, then aid effectiveness is the lowest in the least benevolent political regimes.

Panel III in table 2 summarizes the effectiveness of unconditional aid in terms of

welfare gains measured in households' consumption equivalents. Compared to self-enforcing conditional aid welfare gains are small. In particular the welfare gain of the donor is minimal indicating that the costs of aid are high. If the donor is transferring 'Aid Policy B' to the least benevolent political regime considered here, $\alpha = 0.3$, the donor even experiences a welfare loss since the amount of aid is large but the increase in households' welfare is low. Note that such an aid policy would not be incentive compatible for the donor.

5.5 Political Regime Switch and Optimal Foreign Aid Policy

In this section we address the question how foreign aid policy should respond to a political regime switch in the recipient country under the assumption that the donor wants to continue the aid relationship. As the initial situation we consider an economy without government distortions that is located on the transition path endowed with a capital stock equal to 40 percent of its steady state value. Assume that the new government introduces distortionary tax policies to finance non-productive government consumption. We start by analyzing the dynamic properties of the developing economy if no aid is given and then study the dynamic properties of self-enforcing conditional aid.

Assuming different political regimes, figure 5 plots foreign aid, the associated tax policy, capital, household and government consumption on the transition paths to the steady states. First, consider political regimes associated with $\alpha = 0.5$ and $\alpha = 0.7$. If no aid is given, in the long-run, the income tax rates are 39 and 24 percent to finance government consumption shares of 39 and 24 percent, respectively. Since higher tax rates lower the incentives to invest in capital, the economies converge to a lower steady state compared to the one that would have occurred without government distortions. Now consider the less benevolent political regime, $\alpha = 0.3$. Without development assistance the government raises high income taxes, such that investments strongly decrease. Government distortions are so severe that the economy converges to a new steady state capital stock that is below the initial one.

Given the political regime, what are the dynamic properties of optimal self-enforcing conditional aid? For $\alpha = 0.5$ and $\alpha = 0.7$ optimal foreign aid shows the same pattern as before: initially, large transfers are given to stimulate the economy. For $\alpha = 0.7$, the tax rate is initially below zero, such that subsidies are given to the households. The economy grows quickly and converges to a steady state that is similar to the one without distortions. For $\alpha = 0.5$, the tax can be substantially reduced and capital and household consumption increase considerably. Now consider the less benevolent political regime, $\alpha = 0.3$. Interestingly, optimal self-enforcing foreign aid shows a hump-shaped pattern in the early periods. To understand this finding, remember that the initial capital stock is above the 'No Aid Steady State' associated with the new political regime. Because a permanent cutoff from aid does not pose a severe threat, the recipient government has low incentives to implement tax policies as proposed by the donor. The enforcement constraint is strongly binding in $t = 0$, such that the jump increase in μ_0 is very large. In order to ensure enforceability and to prevent the recipient government from depleting the capital stock, the donor has to transfer high amounts of foreign aid which increase the capital stock in the economy. However, since sovereignty of the recipient ensures that the capital stock cannot be seized by the donor, the increasing capital stock makes aid sanctions even less severe. The government's incentives to deviate from the aid contract become larger. The consequence is that the donor has to increase aid funds even more. At some point, μ_t is so large that government consumption is high enough and foreign aid can be slowly reduced. Yet, self-enforcing conditional aid does help to increase the welfare of the poor: the declining transition path associated to the 'No Aid' scenario is turned into an increasing one and household consumption rises substantially.

6 Discussion and Concluding Remarks

This paper has analyzed the optimal design of incentive compatible aid conditionality and the dynamic properties of the associated aid policies. In a neoclassical framework that accounts for different political regimes, we have argued that sovereign recipient

governments may not implement economic policies that coincide with the donors' intention. We have modeled aid conditionality as an imperfectly enforceable dynamic contract between the donor and the recipient government. Aid conditions have been assumed to be supportable by the threat of a permanent aid cutoff.

We have concentrated on enforceability problems due to the behavior of the recipient government and abstracted from time-consistency problems of donors' policies as possible explanation for the failure of conditionality. Our quantitative findings are based on the assumption that the donor's threat of a permanent aid cutoff is fully credible. However, this may not be the case since the gains that created the original aid contract still exist, i.e. the donor can gain by relaxing the punishment. In an endowment economy with limited enforceable dynamic contracts Cordella et al. (2003) and Kletzer (2005) argue that a renegotiation-proof equilibrium is characterized by aid inflows in punishment that are smaller than those made in equilibrium. We decided to leave the important question concerning the credibility of punishment threats for future research. Instead, in this paper we argue that since a permanent cutoff from aid is the most severe punishment, the resulting self-enforcing aid contract and the associated welfare gain is the best the donor can achieve. If we allow for aid inflows in punishment or relax the assumption of an infinite stay in punishment, the value of the outside option becomes larger. This implies that the recipient government's incentives to deviate increase, and it is likely that the self-enforcing contract is described by larger aid flows and less intense conditionality.

Moreover, it is an important question how limited commitment on the donor's side affects optimal aid policies, the design of conditionality and aid effectiveness in a dynamic macroeconomic framework. Our welfare analysis in our simple economic framework has indicated that the optimal self-enforcing conditional aid contract is incentive-compatible for the donor, too, however this may not be true if additional features are introduced in the current setup. As an example consider a positive productivity shock in the developing economy making a permanent aid cutoff a less severe punishment. Hence, in order to prevent the recipient government from breaking the

contract, the donor has to increase aid flows in return for a less intense conditionality.[10] However, as the positive productivity shock dies out, this aid policy might not be incentive compatible for the donor anymore.

We argue that considering limited commitment on the recipient's side only, in combination with the most severe punishment threat, generates the most optimistic scenario one can think of regarding the effectiveness of foreign aid. Nevertheless, distortions on the donor's side are important when studying the impact of development assistance. It seems to be a particularly promising avenue for future research to develop a dynamic macroeconomic framework to analyze to what extent limited commitment on the donor's side and time-inconsistency issues serve as explanations for limited aid effectiveness.

Another interesting direction is to study the dynamic macroeconomic effects of informational asymmetries regarding recipient government types. In our analysis so far, we have assumed that the donor has perfect information about the recipient's degree of benevolence. However, the optimal self-enforcing conditional aid flows generate a somewhat perverse incentive for the recipient to pretend to be a 'bad' government. The question then is: how do hidden government types influence the dynamic properties of self-enforcing conditional aid flows?

Other possible extensions of this research are the following. It could be interesting to include alternative tax schemes and government investment in the current setup. Moreover, it seems to be promising to introduce several recipient countries to analyze aid selectivity. Similarly, a multi-donor setup can give insights about coordination among donors. Another avenue of research is to think about different donor instruments, e.g. tied aid projects or debt relief. All these points are, however, left for future research.

[10]Note that this implies that the correlation between foreign aid flows and output is positive, as also noted by Cordella et al. (2003). Pallage and Robe (2001) provide some empirical evidence in favor of this finding.

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Tables and Figures

Table 1: Steady State Properties of Foreign Aid Policies

	$\overline{a}$	$\overline{\tau}$	$\overline{k}$	$\overline{c}_h$	$\overline{c}_g$	$\overline{\mu}$	$\frac{\overline{a}}{\overline{y}}$	$\frac{\overline{c}_h}{\overline{y}}$	$\frac{\overline{c}_g}{\overline{y}}$
				No Aid					
I				$a_t = 0 \; \forall \; t$					
$\alpha = 0.7$	0	0.24	1.79	0.66	0.26	-	0	0.60	0.24
$\alpha = 0.5$	0	0.39	1.28	0.48	0.39	-	0	0.48	0.39
$\alpha = 0.3$	0	0.55	0.83	0.31	0.48	-	0	0.35	0.55
				Benchmark					
II				Aid Policy A					
$\alpha = 0.7$									
$\alpha = 0.5$	0	0	2.62	0.98	0	-	0	0.79	0
$\alpha = 0.3$									
				Self-Enforcing Conditional Aid					
III				Aid Policy B					
$\alpha = 0.7$	0.10	0.03	2.53	0.94	0.13	0.69	0.08	0.76	0.11
$\alpha = 0.5$	0.12	0.12	2.20	0.82	0.26	0.96	0.10	0.70	0.22
$\alpha = 0.3$	0.14	0.23	1.82	0.68	0.39	1.20	0.12	0.61	0.35
				Unconditional Aid					
IV				Aid Policy B					
$\alpha = 0.7$	0.10	0.18	1.99	0.74	0.29	-	0.09	0.65	0.26
$\alpha = 0.5$	0.12	0.34	1.46	0.54	0.47	-	0.12	0.52	0.45
$\alpha = 0.3$	0.14	0.51	0.96	0.36	0.60	-	0.15	0.39	0.66

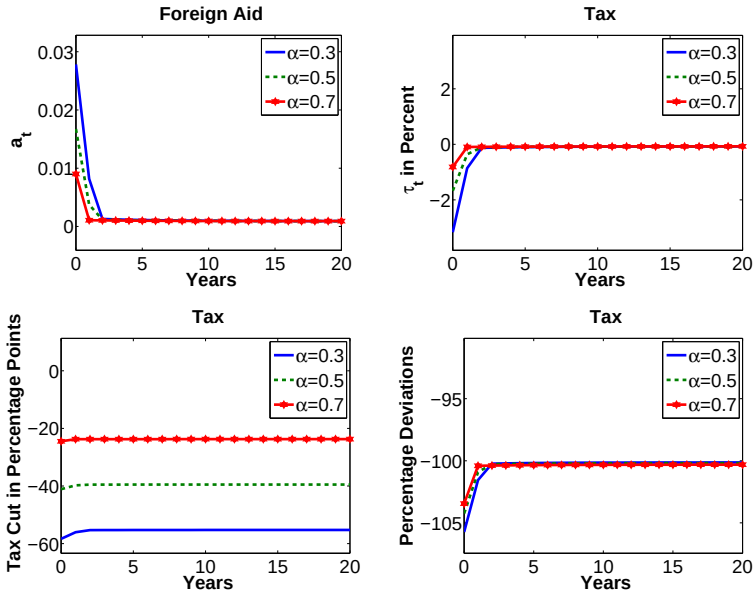
Notes: $\overline{a}$, $\overline{\tau}$, $\overline{k}$, $\overline{c}_h$, $\overline{c}_g$ and $\overline{\mu}$ denote steady state values of aid, tax, capital, household consumption, government consumption and the co-state variable, respectively. 'Aid Policy A' assumes that the donor can perfectly enforce $c_{g,t} = 0, \forall t$. 'Aid Policy B' is the outcome of the donor's maximization problem (10).

Table 2: Welfare Gains of Foreign Aid Policies

	V_h	V_d
	Benchmark	
I	Aid Policy A	
$\alpha = 0.7$	41.46	41.45
$\alpha = 0.5$	91.15	91.12
$\alpha = 0.3$	184.62	184.54
	Conditional Aid	
II	Aid Policy B	
$\alpha = 0.7$	37.89	27.08
$\alpha = 0.5$	65.38	47.68
$\alpha = 0.3$	110.15	80.04
	Unconditional Aid	
III	Aid Policy B	
$\alpha = 0.7$	10.40	1.87
$\alpha = 0.5$	12.10	0.12
$\alpha = 0.3$	12.45	-3.86

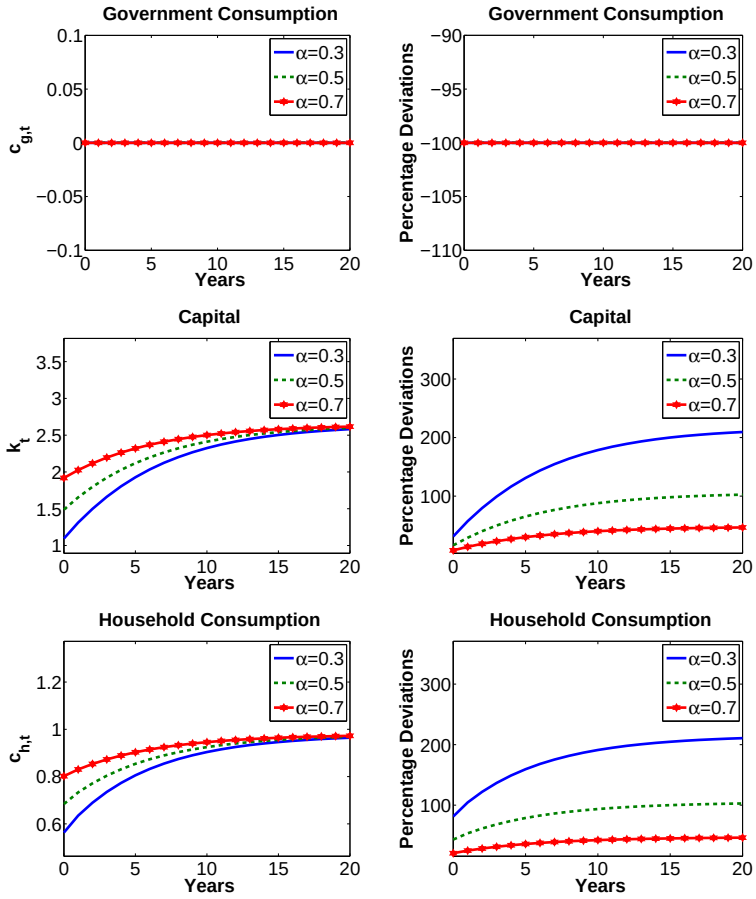
Notes: Welfare gains are measured in terms of percentage deviation in certainty-equivalence consumption relative to the 'No Aid Steady State'. V_h denotes the households' welfare gain while V_d denotes the donor's welfare gain. The initial capital stock is assumed to be the 'No Aid Steady State' capital stock.

Figure 1: Benchmark: Aid Policy A



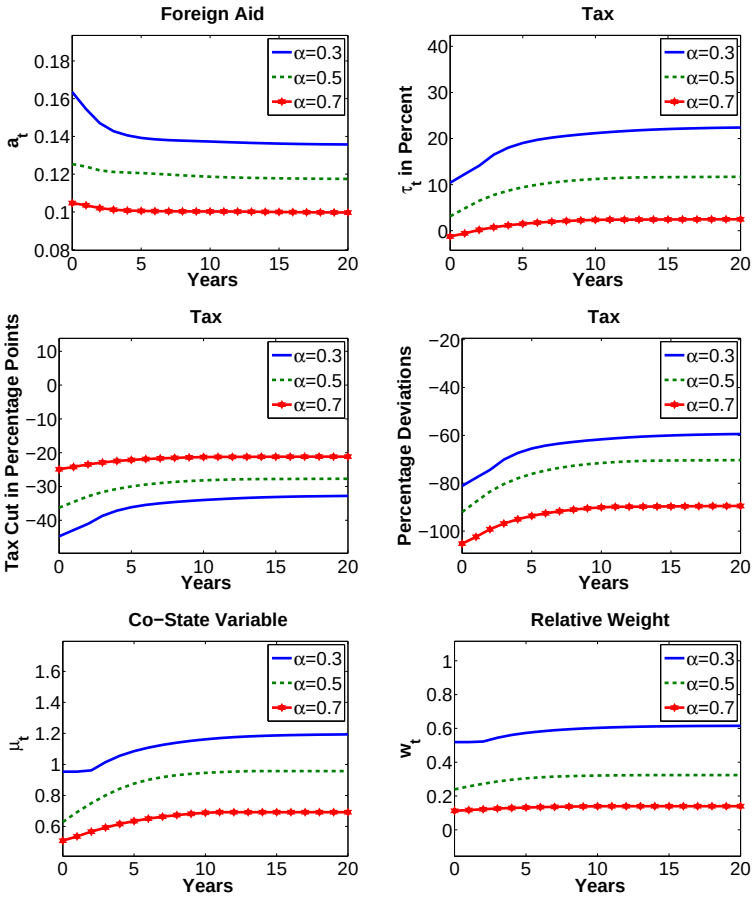
Notes: This figure shows optimal foreign aid policy and the tax policy given that the donor can perfectly enforce $c_{g,t} = 0 \ \forall \ t$. The initial capital stock is assumed to be the 'No Aid Steady State' capital stock.

Figure 2: Effectiveness of the Benchmark: Aid Policy A



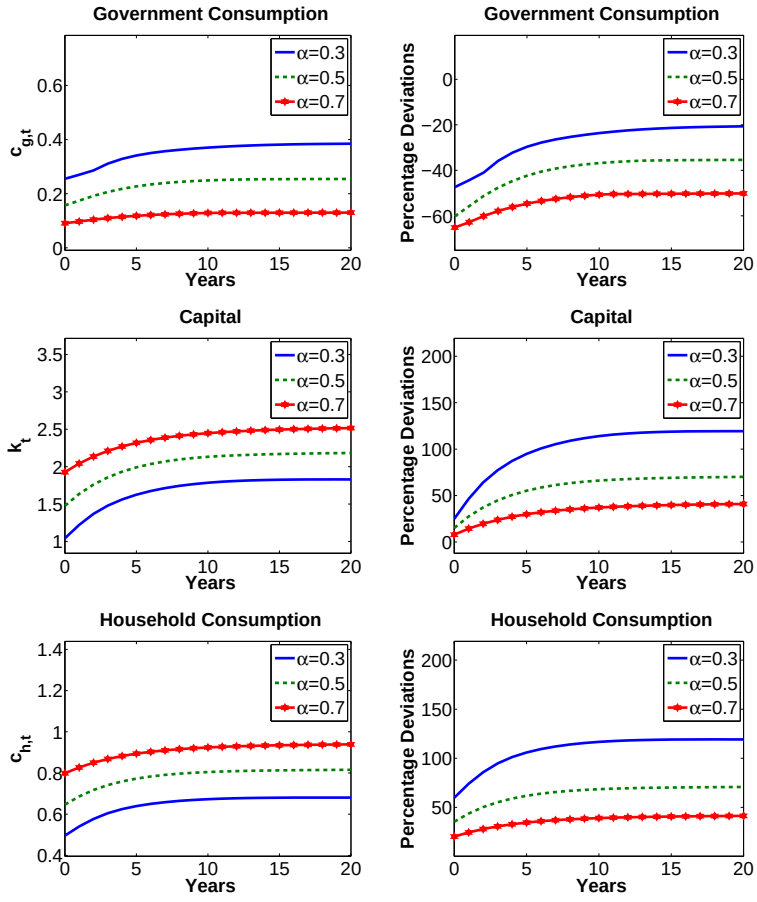
Notes: This figure shows the effectiveness of 'Aid Policy A' given that the donor can perfectly enforce $c_{g,t} = 0$. The initial capital stock is assumed to be the 'No Aid Steady State' capital stock. The left panels show the level responses while the right panels show percentage deviations from the 'No Aid Steady State'.

Figure 3: Self-Enforcing Conditional Aid: Aid Policy B



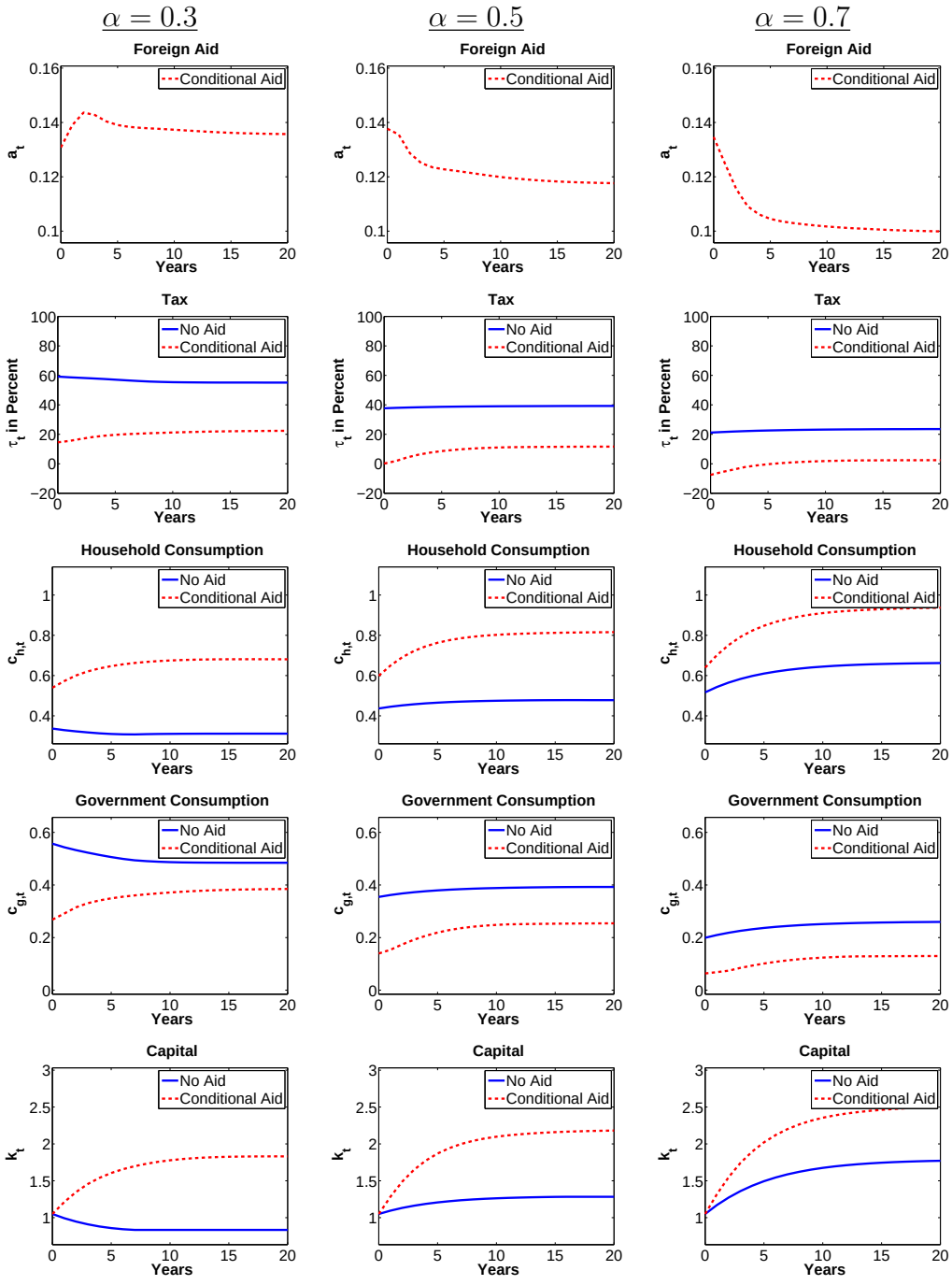
Notes: This figure shows 'Aid Policy B' and the tax policy as associated conditions. The tax policy is shown in level, in tax cuts in percentage points and in percentage deviations from the 'No Aid Steady State'. Moreover, the co-state variable μ_t and the relative weight w_t are shown in levels.

Figure 4: Effectiveness of Self-Enforcing Conditional Aid: Aid Policy B



Notes: This figure shows the effectiveness of 'Aid Policy B' if funds are conditionally transferred given that there are government distortions in the recipient economy. The initial capital stock is assumed to be the 'No Aid Steady State' capital stock. The left panels show the level responses while the right panels show percentage deviations from the 'No Aid Steady State'.

Figure 5: Political Regime Switch and Optimal Conditional Foreign Aid Policy



Notes: This figure shows the transition to the steady state given the initial capital stock $k_{-1} = 1.05$ which corresponds to 40 % of the steady state capital stock if $c_g = 0$ and $a = 0$.