SFB 649 Discussion Paper 2005-054

Aid Effectiveness and Limited Enforceable Conditionality

Almuth Scholl*

* Humboldt-Universität zu Berlin, Germany

This research was supported by the Deutsche Forschungsgemeinschaft through the SFB 649 "Economic Risk".

http://sfb649.wiwi.hu-berlin.de
ISSN 1860-5664

SFB 649, Humboldt-Universität zu Berlin
Spandauer Straße 1, D-10178 Berlin

Aid Effectiveness and Limited Enforceable Conditionality

Almuth Scholl*
Humboldt-University of Berlin
ascholl@wiwi.hu-berlin.de

First Version: January, 2005

This Version: August, 2005

Abstract

This paper analyzes optimal foreign aid policy in a neoclassical framework with a conflict of interest between the donor and the recipient government. Aid conditionality is modelled as a limited enforceable contract. We define conditional aid policy 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 the effectiveness of unconditional aid is low while self-enforcing conditional aid strongly stimulates the economy. However, increasing the welfare of the poor comes at high cost: to ensure aid effectiveness, less democratic political regimes receive permanently larger aid funds.

JEL: E13, F35, O11, O19.

*Address: Humboldt-University of Berlin, School of Business and Economics, Institute of Economic Policy, Spandauer Str. 1, 10178 Berlin. This research was supported by the Deutsche Forschungsgemeinschaft through the SFB 649 "Economic Risk". I am especially grateful to Harald Uhlig for many helpful suggestions and comments. I thank Christian Stoltenberg, Ralf Brüggemann, Carsten Trenkler, Mirko Wiederholt and seminar participants at Humboldt-University for helpful comments. All errors are mine.

1 Introduction

Foreign aid has been a substantial source of income in African countries. 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.

This paper develops a theoretical model to analyze how foreign aid should be optimally designed to stimulate developing economies. We take into account that there is a conflict of interest between the donor and the recipient government. 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, donors often impose conditions that specify how foreign aid funds should be allocated. However, since the recipient country is sovereign and aid funds are fungible, donors face the problem that the government may not be willing to keep the conditions. Therefore, donors should choose aid policies that induce the recipient government to cooperate and to devote aid funds to effective policies. In our theoretical model aid conditionality is described as an imperfectly enforceable contract between the donor and the recipient country. To ensure that the recipient government fulfills the conditions, the donor threatens with aid sanctions. We define conditional aid policy 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.

We develop a neoclassical framework that allows us to analyze aid effectiveness in the light of different political regimes in the recipient country. The government of the developing economy finances unproductive government consumption by raising distortionary taxes on households' income and by using aid funds. Taking the tax policy as given, Ramsey style households make optimal consumption and investment choices. The donor decides about costly aid transfers and cares solely about the welfare of the households. In contrast, government's preferences are assumed to depend on unproductive government consumption. Our specification of government's preferences uses a weight on households' welfare to measure benevolence. Political regimes

associated with a low weight on households' utility and a high valuation of unproductive government consumption are interpreted as non-democratic. Given the recipient's political regime, the donor designs aid conditionality as a contract: the donor offers to transfer aid funds and, in return, expects the government to reduce the tax burden of the households. We assume that the conditions, i.e. the tax cuts, are feasible, if they are enforceable by the threat of a permanent aid cutoff from then onward.

The theoretical literature on aid effectiveness is limited. There are two main directions of research. Studies of the first direction focus primarily on the link of foreign aid and growth, e.g. Chenery and Strout (1966), Chatterjee, Sakoulis and Turnovsky (2003) and Dalgaard, Hansen and Tarp (2004). Svensson (1999) and Boone (1996) study the impact of unconditional aid in the presence of different political institutions.[1] The second direction uses game-theoretic models to study aid effectiveness in the light of incentive compatibility, moral hazard and informational problems, e.g. Cordella, Dell'Ariccia and Kletzer (2003), Kletzer (2005), Federico (2001), Svensson (2000a, 2000b, 2003), Murshed and Sen (1995), Azam and Laffon (2003) and Tornell and Lane (1999).

This paper attempts to link the two directions of research by analyzing aid effectiveness and incentive compatibility in a neoclassical framework. We follow Cordella et al. (2003) and Kletzer (2005) who model conditional aid as an imperfectly enforceable contract in a repeated agency model. Considering an endowment economy, Cordella et al. (2003) focus on the connection of imperfectly enforceable conditional aid and debt relief while Kletzer (2005) stresses the credibility of aid sanctions. In contrast, we study the impact of imperfectly enforceable conditional aid on tax policies and capital accumulation in the presence of different political regimes. Our neoclassical framework is similar to the one in Boone (1996), however, he does not analyze the impact of conditional aid but focuses on unconditional aid.

In order to study steady state distributions and transition paths we solve the model numerically using projection methods based on Judd (1992, 1998)

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

and Christiano and Fisher (2000). Following Marcet and Marimon (1992, 1998) we introduce an additional co-state variable that measures the binding pattern of the enforcement constraint.[2]

In accordance to the results in Boone (1996), we find that aid effectiveness is very low if aid is unconditionally transferred. Steady state distributions are the same or similar to those that arise if no aid is given to the country. The less democratic the political regime the less foreign aid is used to decrease distortionary taxes. Instead, aid funds increase the size of the recipient government. Imposing conditionality strongly boosts the economy as considerable tax cuts increase the incentives to invest in capital. Household consumption rises substantially and welfare gains are large. However, increasing household consumption comes at high cost, particularly in less democratic political regimes. To ensure the enforceability of aid conditionality, the donor has to pay large amounts of aid. If aid transfers are not sufficiently high, a permanent aid cutoff does not pose a severe threat to the recipient government. Since the capital stock built up so far cannot be seized, the government has no incentive to fulfill the conditions imposed by the donor. Hence, tax cuts are not implemented and aid has no or only minor effect on the welfare of the poor. We find that the less democratic the political regime the lower are the incentives to implement economic policies that coincide with the donor's intention. Consequently, to ensure aid effectiveness, the donor has to transfer permanently more aid to countries that suffer from less democratic regimes.

Remarkably, the pattern of self-enforcing conditional aid crucially depends on the initial capital stock in the recipient country. Suppose the initial capital stock is given 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. Now suppose a sudden switch to a less democratic political regime takes place, such that the initial capital stock is larger than the steady state that occurs if no aid is given to the

[2]In Giovannetti, Marcet and Marimon (1993) the theoretical model developed in Marcet and Marimon (1992) is applied to the case of Africa. Other papers that apply the solution approach of Marcet and Marimon (1992, 1998) are e.g. Cooley, Marimon and Quadrini (2001), Kehoe and Perri (2002) and Klein and Rios-Rull (2003).

new government. How should optimal self-enforcing conditional aid policy respond if the intention is to improve the welfare of the poor? Since the initial capital stock is high, a permanent aid cutoff does not pose a threat to the recipient government. Moreover, 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 increasing capital. This counter-intuitive effect is particularly pronounced in non-democratic political regimes.

While the theoretical literature on aid effectiveness, economic policies and growth is limited, the empirical literature is evolving quickly. The extensive empirical debate about the interaction of foreign aid and economic policies in recipient countries is summarized in Section 2. Moreover, some empirical facts concerning foreign aid flows and economic growth are discussed with special attention to African countries. The remainder of this paper is structured as follows. 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 effectiveness of unconditional and conditional aid by studying transition paths and steady state distributions. Finally, Section 6 concludes with policy implications.

2 Empirical Evidence on Aid Effectiveness

To set the stage, we briefly summarize the empirical evidence and the econometric literature concerning the following questions: How do African countries perform in terms of economic growth? How large are foreign aid flows to African countries and how effective are they? Do the data show a significant interaction of foreign aid effectiveness and recipient's economic policies?

2.1 Foreign Aid and Growth

The left panel of Figure 1 shows the pattern of average annual per capita GDP in constant US $ (2000 = 100) of 32 African countries for the time

period 1972 to 2000. The annual data series for GDP, price indices and population are taken from the International Monetary Fund. First note the low level of per capita GDP. Moreover, though there are short periods of growth (1975-1980 and 1985 to 1990), the overall average growth pattern across African countries is one of stagnation or decline (see also Ndulu and O'Connell (1999)). The bad growth performance of African countries has led to massive aid programs with the stated goal to reduce poverty. The right panel of Figure 1 shows that average foreign aid funds given to 35 African countries measured in percent of recipient's GDP have been increasing until 1995. As measure of foreign aid we use the definition of the Development Assistance Committee of the OECD that views aid as the sum of nonmilitary grants and concessional loans net of repayment of previous aid loans, called total net Official Development Assistance (ODA). Remarkably, there is a huge drop in foreign aid flows from 1995 on. Roughly at the same time, critical studies on aid effectiveness attracted attention, like e.g. Boone (1996).

Table 1 takes a closer look at individual countries and distinguishes between total ODA and the grant component of ODA. The numbers vary between 2 and 30 percent of recipient's GDP. On average the African countries in our sample received official development assistance of about 11 percent of GDP in the time period from 1972 to 2000. The larger part was given as grants. About 37 percent of total net ODA were provided by multilateral donors and the remaining part by bilateral donors. These numbers indicate that from 1972 to 2000 foreign aid was a substantial source of income for African countries. The last two columns of Table 1 compare average annual growth rates from 1972 to 2000 across countries. Though most of the African countries in this sample received non-negligible amounts of foreign aid, their GDP was declining or stagnating. Two notable exceptions are Botswana and Mauritius who experienced substantial growth in both, GDP and per capita GDP. Botswana can be viewed as a success story of foreign aid since total net ODA declined from around 20 percent in 1972 to 5 percent in 2000. Mauritius shows high average annual growth rates, too, however, foreign aid assistance was low throughout the period.

These stylized facts call the effectiveness of aid into question. In an influential econometric study Boone (1996) confirms the basic message of Figure

1 and Table 1: using a variety of macroeconomic variables and development indicators he does not find any significant positive effect of foreign aid on investment or growth. However, he does not control for economic policies in the recipient countries.

2.2 Foreign Aid and Recipient's Policies

It has been argued that foreign aid effectiveness crucially depends on the political institutions and economic policies in recipient countries. A measure of political liberties used in the empirical literature is the so-called Gastil index provided by the House of Freedom. To construct the index different categories are scored: political rights, civil liberties, the rule of law, human rights and personal and economic rights. The examined countries are then given scores and rated as 'free' (score 1-2.5), 'partly free' (score 3.5-5.5) or 'not free' (score 5.5-7). Alesina and Dollar (2000) call countries with a Gastil index larger than 5 'less democratic'. Table 2 lists the Gastil index for the countries in our sample. Benin, Burkina Faso, Central Africa, Gambia, Ghana, Guinea Bissau, Malawi and the Seychelles are rated as 'not free' until the 1990s and as 'partly free' from then on. All other African countries in our sample are rated as 'not free' or 'less democratic' during the whole time period. Notable exceptions are Botswana and Mauritius who are classified as 'free' and are also the two countries in the sample who show a good growth performance.

The empirical literature concerning the connection between foreign aid effectiveness and recipient's economic policies is large and controversial. One influential paper is Burnside and Dollar (2000) who analyze the relationship between foreign aid, economic policy and growth of per capita GDP. In contrast to Boone (1996), Burnside and Dollar (2000) include measures of institutional and policy distortions and find that the interaction of foreign aid and sound economic policies has a positive significant relationship with growth. This result is often cited by aid agencies as a general argument in favor of increasing foreign aid. However, several studies followed that use variations of the specification of Burnside and Dollar and either confirm or reject the finding of a positive significant interaction between foreign aid and

good economic policies, e.g. Hansen and Tarp (2000, 2001), Dalgaard and Hansen (2001), Guillaumont and Chauvet (2001), Lensink and White (2001) and Collier and Dollar (2001, 2002). Easterly, Levine and Roodman (2003) and Easterly (2003) strongly criticize Burnside and Dollar (2000) by finding an insignificant effect when using the same specification but adding more data that have become available by the time. Recently, Burnside and Dollar (2004) find that the interaction of aid and policies exhibits a robust positive relationship with growth when using a new data set focusing only on the 1990s.

Alesina and Weder (2002) and Dollar and Levin (2004) follow a different route and analyze whether there is selectivity in giving foreign aid to countries with sound economic policies. The latter show that aid was allocated indiscriminately before 1989 and argue that selectivity is a recent phenomena while Alesina and Weder (2002) find no evidence that less corrupt governments receive more foreign aid. Another direction of the empirical research is whether foreign aid has a beneficial impact on recipient's policies. Dollar and Svensson (2000) and the references therein do not find robust evidence that foreign aid has a positive impact on institutions or reforms.

To summarize, the data indicate that foreign aid is an important source of income in African countries, however, the effectiveness of aid programs seems to be low. Most of the African countries in our sample perform badly in terms of democracy. Yet, there is no empirical evidence that donors show selectivity in giving foreign aid to more democratic countries. Moreover, there is considerable uncertainty about the connection of aid effectiveness and recipient's economic policies.

3 The Model

Based on the empirical evidence, there is an ongoing major debate about how aid agencies should design aid programs. Rather than drawing on empirical arguments, the objective of our study is to contribute to the debate by theoretically deriving optimal foreign aid policy. Our theoretical model is based on three 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-democratic political regimes such that a conflict of interest between the donor and the recipient government is generated. Third, 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.

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. α measures the benevolence of the government and is interpreted as an indicator of the political regime in the recipient country. Low values of α imply that the welfare of the households is of minor importance to the government. We call the associated political regime non-democratic since the government puts large weight on the utility of unproductive government expenditures that are financed by taxes on households' income. In contrast, high values of α characterize benevolent political regimes. 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 $h(a_t) < 0$, $h_a(a_t) < 0$ and $h_{aa}(a_t) < 0$. h_a and h_{aa} denote the first and second derivatives of h with respect to aid.

3.2 Unconditional Foreign 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 $k_{-1} > 0$.

3.3 Conditional Foreign Aid as Self-Enforcing Contract

Donors want to choose an aid policy that induces the government to devote aid funds to policies that coincide with the donor's intention. One way to ensure the implementation of effective policies is to impose conditions on foreign aid funds. We define aid conditionality as a contract between the donor and the recipient country that specifies foreign aid funds 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 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. $\{\tilde{c}_{h,t+j}, \tilde{c}_{g,t+j}\}_{j=0}^{\infty}$ solve 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. Hence, the righthand-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 $\{c_{h,t}, c_{g,t}, k_t\}_{t=0}^{\infty}$. The contract is self-enforcing since (11) has to be fulfilled: foreign aid contracts are only feasible if, at any point in time, they are enforceable by the threat of permanent aid cutoff from then onwards.

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 $\tilde{a}_{t+j} = 0 \; \forall \; j \geq 0$:

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

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

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

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 foreign aid con-

tract (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 $v(c_{g,t})$. The donor's weight on households' and government's utility is dependent on the co-state variable μ_t that determines 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 $(1+\alpha\mu_t)u_{c_h}(c_{h,t})$.[3] Assume that the enforcement constraint is binding, $\gamma_t > 0$ (see the complementary slackness condition (21)). Then μ_t and, hence, the weight $(1+\alpha\mu_t)$ increase which implies that the donor raises $c_{h,t}$. Now consider the donor's optimality condition (18) with respect to $c_{g,t}$. Optimal government consumption satisfies that the cost ζ_t of a marginal increase in consumption is dependent on 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 a larger weight has to be assigned to $v(c_{g,t})$.

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

How strongly household consumption and government consumption are affected by μ_t depends on the value of α. Consider the extreme case $\alpha = 0$ and the enforcement constraint is binding. Then μ_t enters solely as 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 steady state distributions and study the impact of unconditional and 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: $\beta = 0.96$, $\theta = 0.3$, $\delta = 0.10$. 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 choose ν by normalizing the model 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 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 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 $\forall\, i$.

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: $\chi_i' \approx \chi_i$, $\forall\, i$.

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 by using 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 discussion 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. In Section 5.3 we discuss the impact of the benchmark aid policy if aid funds are unconditionally given to the developing economies. We show that aid effectiveness is low because the recipient government implements policies that do not coincide with the donor's intention. Section 5.4 derives aid conditionality that is self-enforcing. In this case aid effectiveness can be greatly improved. However, it comes at a high cost since permanently large aid funds have to be transferred to the developing economies. In Section 5.5 we analyze the characteristics of optimal self-enforcing conditional aid if a sudden political regime switch takes place in the recipient country.

5.1 No Foreign 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 3, 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-democratic political regimes 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 Aid Policy

We consider the following scenario as the benchmark of optimal foreign aid policy and refer to this scenario as 'Aid Policy A'. Suppose, at any point in time, the donor can perfectly enforce $c_{g,t} = 0$ in the recipient country. Given the 'No Aid Steady State' capital stocks as initial situation and given $c_{g,t} = 0$, what are the characteristics of optimal foreign aid policy?

To design optimal aid policy 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 or as a productivity increase. Figure 2 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' tax rate and the tax as percentage deviations from the 'No Aid Steady State' tax. Moreover, household consumption, government consumption, capital and production are presented as percentage deviations from the 'No Aid Steady State'.

The graphs show that optimal foreign aid policy is given by temporary transfers to stimulate the economy on its transition path to the steady state associated with $\overline{c}_g = 0$. The amount of aid yields a subsidy that can be inter-

preted 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 3. The steady state is characterized by a private consumption share of 79 percent and an investment share of 21 percent.

Panel I of Table 4 presents the impact of 'Aid Policy A' on households' welfare given $c_{g,t} = 0$. 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'. The welfare gain is contrasted with the costs of foreign aid funds given by $h(a_t)$. While the costs of aid are minimal, the welfare gain is substantial. As an example take the economy characterized by $\alpha = 0.5$: the welfare gain is equivalent to increasing 'No Aid Steady State' consumption by 35 percent. The welfare gain is larger for lower values of α since initially the economies suffer from lower capital stock.

5.3 Unconditional Aid Policy

Because there is a conflict of interest between the donor and the government, it is likely that the government does not implement the tax policy as described in the previous section. In this section we analyze how different political

regimes respond to 'Aid Policy A'.

Suppose at time $t = 0$ the donor commits to unconditionally transfer aid funds described by 'Aid Policy A'. The recipient government takes foreign aid as given and chooses tax rates by solving the maximization problem (9). Figure 3 shows the tax policy and the responses of the economy in percentage deviations from the 'No Aid Steady State'.

In contrast to the 'Benchmark' scenario, the tax cuts implemented by the government are minor for all values of α. Instead, foreign aid funds are used to increase government consumption. This effect is especially emphasized in less democratic regimes, i.e. for low values of α. Remarkably, household consumption increases though decreased tax rates should foster the incentive to invest in capital. However, realizing that foreign aid will only be given for few periods, households anticipate that the tax rate will quickly return to its initial 'No Aid Steady State' value. Therefore, households use the temporary higher income to increase consumption. This turns out to be optimal particularly in the least benevolent political regime, $\alpha = 0.3$. Here, due to low investment the capital stock decreases in the first periods. In the long-run all variables return to their 'No Aid Steady State' values (see Panel III of Table 3).

It is evident that the impact of transferring aid unconditionally is low and only temporary. Foreign aid funds are consumed by the government and by the households who decrease investments. The limited effectiveness is highlighted in Panel II of Table 4 that summarizes the welfare gain and the costs of aid. Obviously, since foreign aid transfers are the same as in the 'Benchmark' scenario, the costs remain unchanged. Imposing no conditions on aid yields minor welfare gains equivalent to increasing 'No Aid Steady State' consumption by 0.05 to 0.09 percent. The welfare gain is the lowest in the least benevolent political regime though it receives the largest amount of aid.

Since 'Aid Policy A' is characterized by temporary development assistance, assume that the donor unconditionally transfers aid funds as shown in Figure 4 to which we refer as 'Aid Policy B'.[4] Qualitatively 'Aid Policy

[4]Here we take 'Aid Policy B' as exogenously given. However, 'Aid Policy B' is the outcome of the maximization problem (26) which is explained in detail in Section 5.4.

B' is the same strategy as 'Aid Policy A': the donor transfers high amounts of aid in the early periods in order to stimulate the economy. In contrast to 'Aid Policy A', here the donor pays larger amounts and decreases foreign aid over time to a permanent level of assistance. Note that in the long-run the three economies get the same amount of aid and that only in the short-run the poorer economies are compensated for their low initial capital stocks. Figure 4 displays the tax policy by the government and the reactions of the economy as percentage deviations from the 'No Aid Steady State'.

In this scenario unconditional aid does have a permanent effect, yet, the long-run tax cuts implemented by the recipient government are rather low. Remarkably, the tax reductions are lower in less benevolent political regimes. As an example consider the non-democratic regime described by $\alpha = 0.3$. The donor transfers the largest amount of aid in return to the lowest tax cut of less than three percentage points, though the initial 'No Aid Steady State' tax level is the highest of the three economies considered here. Instead of weakening the tax distortion, the government uses foreign aid to increase its government consumption. The tax cut has some positive effect on the investment behavior of the households, such that production and household consumption increase compared to the 'No Aid Steady State'. However, the impact of foreign aid on the private sector of the developing economy is small as opposed to the impact on the government sector. Panel IV of Table 3 summarizes the steady state of 'Aid Policy B' if funds are unconditionally transferred. The steady state capital stock can be increased for all political regimes, but, as argued before, the increase is low given the large aid transfers. Moreover, the main characteristics remain unchanged compared to the 'No Aid Steady State'. In particular for $\alpha = 0.3$ tax rates are extremely high, financing a government consumption share that is larger than the private consumption share.

The welfare effects are summarized in Panel III of Table 4. Compared to 'Aid Policy A' in the 'Benchmark' scenario, higher amounts of development assistance produce higher costs while the welfare gain of the households is still rather low. Even for the country with the most benevolent government the welfare gain is equivalent to increasing 'No Aid Steady State' consumption by only about 5 percent. Nevertheless, the results indicate that aid

effectiveness is higher in environments with 'good' economic policies if funds are unconditionally transferred.

5.4 Conditional Aid Policy

The effectiveness of unconditional aid has turned out to be rather low. The implication for donors is either to reduce development assistance or to impose conditions on aid funds with the purpose of ensuring the implementation of economic policies that coincide with the donor's intention. This section analyzes the impact of conditional foreign aid on the recipient's economy and examines the enforceability of the conditions.

We start by considering 'Aid Policy A' once again and interpret aid conditionality as follows. The donor offers to transfer foreign aid a_t and, in return, expects the recipient government to implement the fiscal policy action τ_t as shown in Figure 2. 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 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. If the donor continues the aid payments, the developing economy will evolve as shown in Figure 3. If the donor decides to permanently stop development assistance, the developing economy remains in its 'No Aid Steady State'.

Figure 4 has shown that the impact of permanent aid as described by 'Aid Policy B' is low if funds are unconditionally transferred. Now assume that the donor is aware of government distortions in the recipient country and knows that tax cuts implying $c_{g,t} = 0$ are not enforceable. Suppose the donor designs aid conditionality that corresponds to the following maximization problem:

$$\max_{\{c_{h,t},\, k_t,\, c_{g,t},\, a_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \beta^t [u(c_{h,t}) + h(a_t) + \widehat{w}\; v(c_{g,t})] \qquad (26)$$

s.t.

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

$\widehat{w}$ is a constant relative weight given to $v(c_{g,t})$. It is important to see that the

donor does not account for different political regimes in this scenario. The solution to the maximization problem is an allocation $\{c_{h,t}(\widehat{w}), c_{g,t}(\widehat{w}), k_t(\widehat{w})\}_{t=0}^{\infty}$ and policy actions $\{a_t(\widehat{w}), \tau_t(\widehat{w})\}_{t=0}^{\infty}$ dependent on $\widehat{w}$. This can be interpreted as conditions on foreign aid funds: the donor offers to transfer $a_t(\widehat{w})$ at time t and, in return, expects the recipient government to implement the fiscal policy action $\tau_t(\widehat{w})$. However, by assigning the weight $\widehat{w}$, the donor does accept some government consumption in the recipient economy. We choose the relative weight $\widehat{w} = 0.25$, such that foreign aid flows correspond to those of 'Aid Policy B'. The left Panels of Figure 5 show the tax cuts that the donor expects the recipient's government to implement. Tax reductions are conditioned to be about 14, 30 and 45 percentage points for $\alpha = 0.7$, $\alpha = 0.5$ and $\alpha = 0.3$, respectively. Apparently, aid conditionality forces non-democratic governments to implement the highest tax decreases in percentage points. It is essential to check whether these conditions are enforceable. The last graph of the left Panels of Figure 5 focuses on the enforcement constraint (11) which is neglected by the donor when designing conditionality according to the maximization problem given in (26). If $D(k_{t-1}) - C(k_{t-1})$ is positive, the conditions imposed on foreign aid flows are not enforceable. In this case it is better for the government to break the aid contract and to forgo aid payments given that sovereignty insures that the capital stock cannot be seized by the donor. It is evident that for $\alpha = 0.5$ and $\alpha = 0.3$ the incentive to default on the aid contract is strongly positive. This implies that the allocation and policy proposed by the donor is not supportable and will not be implemented by the recipient government. Depending on the behavior of the donor, the recipient economy will either evolve as shown in Figure 4 or stay in the 'No Aid Steady State'. Considering $\alpha = 0.7$, it turns out that the value of implementing the tax cut is larger than not fulfilling the conditions, i.e. aid conditionality is enforceable. However, since the $D(k_{t-1}) - C(k_{t-1})$ is strictly negative, in principle, the donor could demand stronger conditions. This implies that for $\alpha = 0.7$ 'Aid Policy B' and the corresponding conditions are not optimal.

To design optimal conditional foreign aid policy, the donor takes into account the enforcement constraint (11) and solves the full maximization problem given in (10). 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, i.e. the threat of a permanent cutoff from aid is severe. Hence, the government implements the conditions, i.e the tax cuts, in return to foreign aid funds. The right Panels of Figure 5 plot the key variables of optimal conditional aid to which we refer as 'Aid Policy C'.

First note that the general pattern of foreign aid funds is the same as before: initially 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 for different political regimes: less benevolent receive permanently larger aid funds. To understand this, first focus on the last 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 and that $D(k_{t-1})$ is increasing with the capital stock. Due to foreign aid funds, capital grows to its new steady state value. 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. In contrast to 'Aid Policy B', the relative weight is endogenous rather than exogenous. In comparison with 'Aid Policy B', it is evident that for $\alpha = 0.3$ and $\alpha = 0.5$ the donor has to put a larger relative weight on the utility of the government to satisfy enforceability. This implies that the donor has to permanently pay larger amounts of foreign aid in return to higher government consumption. Moreover, for $\alpha = 0.3$, the tax cuts are lower. In contrast, considering $\alpha = 0.7$, 'Aid Policy C' assigns a lower relative weight to $v(c_{g,t})$ than 'Aid Policy B' and demands larger tax cuts.

Figure 6 shows the tax policy and the responses of the economy in percentage deviations from the 'No Aid Steady State'. It is evident that the large 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 non-democratic political regimes. E.g. in case of $\alpha = 0.3$ the capital stock and household consumption have

more than doubled compared to the 'No Aid Steady State'. However, in those economies tax cuts and the reduction of government consumption in percentage deviations are the lowest, i.e. large parts of government consumption are financed by aid.

In the long-run all variables reach a new steady state which is summarized in Panel V of Table 3. In the steady state taxes are reduced to fairly low levels such that the capital stock and production increase considerably. This is accompanied by increased private consumption. Note that for $\alpha = 0.3$ foreign aid payments are the highest and help to decrease the size of the government sector, such that the government consumption share is smaller than the private consumption share.

The positive impact of self-enforcing conditional aid is reflected in the welfare gain summarized in Panel IV of Table 4. The welfare gain is equivalent to raising 'No Aid Steady State' consumption up to 24 percent. Compared with 'Aid Policy B' that was unconditionally designed, the welfare gain for $\alpha = 0.3$ is multiplied approximately by the factor ten while the costs are approximately tripled. Note that the welfare gain shows a hump shape in α: for $\alpha = 0.5$ the gain is larger than for $\alpha = 0.3$ and $\alpha = 0.7$. For $\alpha = 0.3$ we have seen that the non-democratic government wastes a considerable amount of foreign aid for non-productive government consumption. For $\alpha = 0.7$ distortions are already low in the 'No Aid Steady State', such that the economy works quite efficiently without aid.

5.5 Aid Policy and a Sudden Political Regime Switch

So far we have assumed that the political regime in the recipient country is constant over time. In this section we address the question how foreign aid policy should respond to a sudden switch of the political regime. As initial situation we consider an economy without government distortions that is located on the transition path with a capital stock equal to 40 percent of its steady state value. Assume that a sudden political regime switch takes place and that a new government introduces income taxes to finance non-productive government consumption. We analyze the evolution of the developing economy if no aid is given and how self-enforcing conditional aid

should be optimally designed if the intention is to increase the welfare of the poor.

Figure 7 plots foreign aid, the associated tax policy, capital, household and government consumption on the transition path. 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 non-democratic political regime, $\alpha = 0.3$, that is characterized by a government consumption share that is larger than the private consumption share if no aid is given. 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 characteristics 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 'Benchmark' aid policy. For $\alpha = 0.5$, the tax can be substantially reduced and capital and household consumption increase considerably. Consider the non-democratic political regime, $\alpha = 0.3$. Interestingly, optimal self-enforcing foreign aid shows a hump shape in the early periods. To understand this remember that the initial capital stock is above the 'No Aid Steady State'. 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, 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 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. These results show that there exist scenarios where foreign aid policy increases the recipient's incentives to follow 'bad' economic policies. Yet, self-enforcing conditional aid does help to increase the welfare of the poor: the declining transition path is turned into an increasing one and household consumption rises substantially.

6 Conclusions

This paper has analyzed how foreign aid should be optimally designed. Using a neoclassical framework that accounts for different political regimes, it has been argued that recipient governments may not implement economic policies that coincide with the donors' intention. We have modelled aid conditionality as imperfectly enforceable contract between the donor and the recipient government that specifies the allocation of aid funds. Aid conditionality has been assumed to be supportable by the threat of a permanent aid cutoff.

We have found that unconditional aid works better in environments with 'good' economic policies. However, in all political regimes, aid effectiveness is rather low if no conditions are imposed. In contrast, self-enforcing conditional aid strongly stimulates the economy and increases the welfare of the poor. The enforceability has turned out to be crucial for the effectiveness of foreign aid funds.

Optimal self-enforcing conditional aid appears to be critically dependent on the political regime in the recipient country. In our theoretical framework, to reduce poverty, the donor transfers permanently the largest aid funds to the least benevolent government and, in return, has to accept the highest tax rates and the highest government consumption. If aid funds are not sufficiently high, the recipient government has no incentives to keep the conditions and aid effectiveness is low.

It is debatable whether donors should pursue this foreign aid policy. However, if the donor decides to provide development assistant to a country that suffers from a non-democratic political regime and the intention is to reduce poverty, then the donor has no other choice than accepting such a deal with the recipient government. Otherwise foreign aid funds are very likely to be wasted.

The major policy implication of this paper is that donors need to be aware of the political regimes in the recipient countries and carefully account for incentives when designing aid conditionality. Importantly, a lot of effort should be allocated to verifying whether the imposed conditions are implemented by the recipient governments. In case of default, aid agencies should be highly selective in the allocation of future aid funds among recipient countries in order to maintain credibility.

This research can be extended in different ways. It might be interesting to analyze the connection of aid and trade policies since developing countries are small open economies. Moreover, it seems to be promising to take into account that developing countries are highly indebted. Another avenue of research is to introduce several recipient countries in order to model aid selectivity. All these points are, however, left for future research.

References

[1] Alesina, A. and D. Dollar (2000),"Who Gives Foreign Aid to Whom and Why?", Journal of Economic Growth 5, 33-63.

[2] Alesina, A. and B. Weder (2002), "Do Corrupt Governments Receive less Foreign Aid?", The American Economic Review 92(4), 1127-1137.

[3] Azam, J.-P. and J.-J. Laffont (2003), "Contracting for Aid", Journal of Development Economics 70, 25-58.

[4] Boone, P. (1996), "Politics and the Effectiveness of Foreign Aid", European Economic Review 40, 289-329.

[5] Burnside, C. and D. Dollar (2000), "Aid Policies and Growth", The American Economic Review 90(4), 847-68.

[6] Burnside, C. and D. Dollar (2004), "Aid, Policies and Growth: Revisiting the Evidence", World Bank Policy Research Working Paper 3251.

[7] Cordella, T., G. Dell'Ariccia and K. M. Kletzer (2003), "Conditional Aid, Sovereign Debt, and Debt Relief", mimeo, University of California, Santa Cruz.

[8] Chatterjee, S., G. Sakoulis and S. J. Turnovsky (2003), "Unilateral Capital Transfers, Public Investment and Economic Growth", European Economic Review 47, 1077-1103.

[9] Chenery, H. B. and A. M. Strout (1966), "Foreign Assistance and Economic Development", The American Economic Review 56(4), 679-733.

[10] Christiano, L. J. and J. D. M. Fisher (2000), "Algorithms for Solving Dynamic Models with Occasionally Binding Constraints", Journal of Economic Dynamics and Control 24(8), 1179-1232.

[11] Collier P. and D. Dollar (2001), "Can the World Cut Poverty in Half? How Policy Reform and Effective Aid Can Meet International Development Goals", World Development 29, 1787-1802.

[12] Collier P. and D. Dollar (2002), "Aid Allocation and Poverty Reduction", European Economic Review 45, 1470-1500.

[13] Cooley, T., R. Marimon and V. Quadrini (2001), "Aggregate Consequences of Limited Contract Enforceability", mimeo, New York University.

[14] Dalgaard, C.-J. (2004), "Donor Policies and Aid Effectivness", mimeo, University of Copenhagen.

[15] Dalgaard, C.-J. and H. Hansen (2001), "On Aid, Growth and Good Policies", Journal of Development Studies 37(6), 17-41.

[16] Dalgaard, C.-J. and H. Hansen and F. Tarp (2004), "On the Empirics of Foreign Aid and Growth", Econmic Journal 114, 191-216.

[17] Dollar, D. and J. Svensson (2000), "What Explains the Success or Failure of Structural Adjustment Programmes?", The Economic Journal 110(127), 894-917.

[18] Dollar, D. and V. Levin (2004), "The Increasing Selectivity of Foreign Aid, 1984-2002", World Bank Policy Research Working Paper 3299.

[19] Easterly, W. (2003), "Can Foreign Aid Buy Growth?", Journal of Economic Perspectives 17(3), 23-48.

[20] Easterly, W., R. Levine and D. Roodman (2003), "New Data, New Doubts: A Comment on Burnside and Dollar's 'Aid Policies and Growth (2000)' ", National Bureau of Economic Research Working Paper 9846.

[21] Federico, G. (2001), "Samaritans, Rotten Kids and Policy Conditionality", mimeo, Nuffield College Oxford.

[22] Giovannetti, G., A. Marcet and R. Marimon (1993), "Growth, Capital Flows and Enforcement Constraints", European Economic Review 37, 418-425.

[23] Guillaumont, P. and L. Chauvet (2001), "Aid and Performance: A Reassessment", Journal of Development Studies 37(6), 66-92.

[24] Hansen, H. and F. Tarp (2000), "Aid Effectiveness Disputed", Journal of International Development 12(3), 375-98.

[25] Hansen, H. and F. Tarp (2001), "Aid and Growth Regressions", Journal of Development Economics 64(2), 547-70.

[26] Judd, K. (1992), "Projection Methods for Solving Aggregate Growth Models", Journal of Economic Theory 58, 410-452.

[27] Judd, K. (1998), "Numerical Methods in Economics", MIT Press, Cambrige MA.

[28] Kehoe, P. J. and F. Perri (2002), "International Business Cycles with Endogenous Incomplete Markets", Econometrica 70(3), 907-928.

[29] Klein, P. and J. V. Rios-Rull (2003), "Time-Consistent Optimal Fiscal Policy", International Economic Review 44(4), 1217-1245.

[30] Kletzer, K. (2005), "Aid and Sanctions", mimeo, University of California, Santa Cruz.

[31] Lensink, R. and H. White (2001), "Are There Negative Returns to Aid?", Journal of Development Studies 37(6), 42-65.

[32] Marcet, A. and R. Marimon (1992), "Communication, Commitment, and Growth", Journal of Economic Theory 58, 219-249.

[33] Marcet, A. and R. Marimon (1998), "Recursive Contracts", mimeo, Universitat Pompeu Fabra, Barcelona.

[34] McGrattan, E. (1996), "Solving the Stochastic Growth Model with a Finite Element Method", Journal of Economic Dynamics and Control 20, 19-42.

[35] Murshed, M. and S. Sen (1995), "Aid Conditionality and Military Expenditure Reduction in Developing Countries: Models of Asymmetric Information", Economic Journal 105, 498-505.

[36] Ndulu, B. J. and S. A. O'Connell (1999), "Governance and Growth in Sub-Saharan Africa", The Journal of Economic Perspectives 13(3), 41-66.

[37] Svensson, J. (1999), "Aid, Growth and Democracy", Economics and Politics 11(3), 275-297.

[38] Svensson, J. (2000a), "Foreign Aid and Rent-Seeking", Journal of International Economics 51, 437-461.

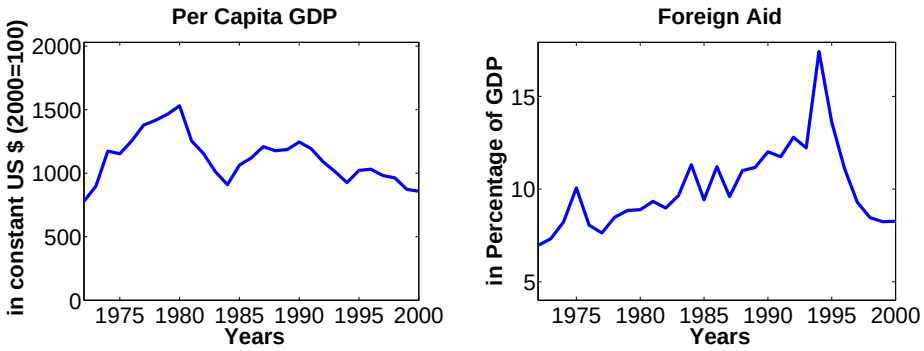
[39] Svensson, J. (2000b), "When is Foreign Aid Policy Credible? Aid Dependence and Conditionality", Journal of Development Economics 61, 61-84.

[40] Svensson, J. (2003), "Why Conditional Aid Does Not Work and What Can Be Done About It?", Journal of Development Economics 70, 381-402.

[41] Tornell, A. and P. R. Lane (1999), "The Voracity Effect", The American Economic Review 89(1), 22-46.

Tables and Figures

Figure 1: Growth Performance and Foreign Aid in Africa



Notes: The left panel refers to the average of per capita GDP in 32 African countries individually listed in Table 1. GDP has been converted into constant US \$, 2000 = 100. The right panel refers to the average of foreign aid as a percentage fraction of GDP of 35 African countries listed in Table 1. Foreign aid is measured by total net Official Development Assistance.

Table 1: Official Development Assistance (ODA) as Fraction of GDP in % and Growth, 1972-2000

	ODA Total Net		ODA Grants		GDP Growth	
Recipient	All Donors	Multi. Donors	All Donors	Multi. Donors	abs.	per Cap.
Benin	10.06	4.31	7.25	2.03	1.84	-0.80
Botswana	8.68	1.78	6.80	1.33	7.47	4.15
Burkina Faso	15.45	5.35	12.77	3.27	0.84	-1.65
Burundi	15.67	7.58	12.15	4.48	-1.50	-3.33
Cameroon	4.04	1.17	2.57	0.57	1.70	-0.87
Central Afr. Rep.	13.27	5.12	10.90	3.02	0.36	-1.94
Chad	13.09	5.83	10.52	3.49	-0.15	-2.68
Congo	6.62	1.44	4.87	0.84	2.51	-0.51
Cote d'Ivoire	4.38	1.45	2.74	0.64	0.77	-2.78
Egypt	6.12	0.80	3.83	0.27	3.57	1.48
Gabon	2.11	0.34	1.88	0.31	3.72	2.95
Gambia	6.07	2.94	3.16	0.64	–	–
Ghana	25.65	11.44	18.74	5.85	–	–
Guinea Bissau	24.63	9.26	17.86	5.06	–	–
Kenya	7.65	2.36	5.36	0.90	0.83	-2.38
Lesotho	20.54	8.35	17.16	8.35	3.19	0.93
Madagascar	9.25	3.69	6.57	1.48	-0.24	-3.02
Malawi	20.36	9.97	13.52	4.46	-1.22	-4.27
Mali	18.47	7.01	13.71	3.79	1.77	-0.88
Mauritius	2.75	0.84	1.87	0.59	4.89	3.65
Morocco	2.91	0.42	1.46	0.29	1.76	-0.32
Niger	13.82	5.52	11.64	3.01	-0.59	-3.84
Nigeria	0.32	0.12	0.23	0.08	-1.43	-3.17
Rwanda	17.21	6.75	14.59	4.42	-0.32	-2.63
Senegal	11.16	3.40	8.34	1.49	0.00	-2.56
Seychelles	8.89	1.54	6.96	1.16	–	–
Sierra Leone	12.85	6.15	8.68	2.83	-2.65	-4.21
Swaziland	6.27	2.20	5.01	1.74	3.02	0.52
Tanzania	15.38	4.16	12.34	1.58	1.15	-2.02
Togo	10.07	4.05	7.51	1.82	-0.39	-3.09
Tunisia	2.72	0.52	1.50	0.35	2.60	0.50
Zambia	29.99	11.50	20.08	2.90	–	–
Mean	11.45	4.29	8.52	2.29	1.24	-1.21
Median	10.07	3.87	7.38	1.66	0.84	-1.94

Notes: Data are annual from the IMF and OECD. The sample period is 1972 to 2000. Entries are mean values. For Gambia, Ghana, Guinea Bissau, Seychelles and Zambia data are not available for the whole period.

Table 2: Gastil Index: 1972-2001

Recipient	1972	1982	1992	2001
Benin	7.50	7.50	2.30	3.20
Botswana	3.40	2.30	1.20	2.20
Burkina Faso	3.40	6.50	5.50	4.40
Burundi	7.70	6.60	6.50	6.60
Cameroon	6.40	6.60	6.60	6.60
Central Afr. Rep.	7.70	7.50	6.50	6.50
Chad	6.70	6.70	6.60	6.60
Congo	7.60	6.70	6.50	6.60
Cote d'Ivoire	7.60	6.70	6.40	5.40
Egypt	6.60	5.50	5.60	6.60
Gabon	6.60	5.50	5.60	6.60
Gambia	2.20	3.30	1.20	5.50
Ghana	6.60	6.50	5.50	2.30
Guinea Bissau	-	6.60	6.50	4.50
Kenya	5.40	5.50	4.50	6.50
Lesotho	7.40	5.50	6.40	4.40
Madagascar	5.30	5.50	4.40	2.40
Malawi	7.60	7.60	2.30	2.30
Mali	7.60	7.60	2.30	2.30
Mauritius	3.20	2.20	2.20	1.20
Morocco	5.40	4.50	6.50	5.50
Niger	6.60	7.60	5.40	4.40
Nigeria	6.40	2.30	5.40	4.50
Rwanda	7.60	6.40	6.50	7.60
Senegal	6.60	4.40	4.30	3.40
Seychelles	-	6.60	6.40	3.30
Sierra Leone	4.50	5.50	7.60	4.50
Swaziland	4.20	5.50	6.50	6.50
Tanzania	6.60	6.60	6.50	5.50
Togo	7.50	7.60	6.50	5.50
Tunisia	6.50	5.50	6.50	6.50
Zambia	5.50	5.60	2.30	5.40

Notes: Data is from the House of Freedom. Countries with score 1-2.5, 3.5-5.5 and 5.5-7 are rated as 'free', 'partly free' and 'not free', respectively.

Table 3: Steady State Values

	$\overline{a}$	$\overline{\tau}$	$\overline{k}$	$\overline{c}_h$	$\overline{c}_g$	$\overline{\mu}$	$\frac{\overline{a}}{\overline{y}}$	$\frac{\overline{c}_h}{\overline{y}}$	$\frac{\overline{c}_g}{\overline{y}}$
				No Aid					
I				$f_t = 0 \; \forall \; t$					
$\alpha = 0.7$	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
$\alpha = 0.3$									
				Unconditional Aid					
III				Aid Policy A					
$\alpha = 0.7$	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
				Unconditional Aid					
IV				Aid Policy B					
$\alpha = 0.7$	0.08	0.19	1.95	0.72	0.29	-	0.07	0.64	0.26
$\alpha = 0.5$	0.08	0.36	1.40	0.52	0.44	-	0.08	0.51	0.43
$\alpha = 0.3$	0.08	0.53	0.90	0.34	0.55	-	0.09	0.37	0.61
				Self-Enforcing Conditional Aid					
V				Aid Policy C					
$\alpha = 0.7$	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

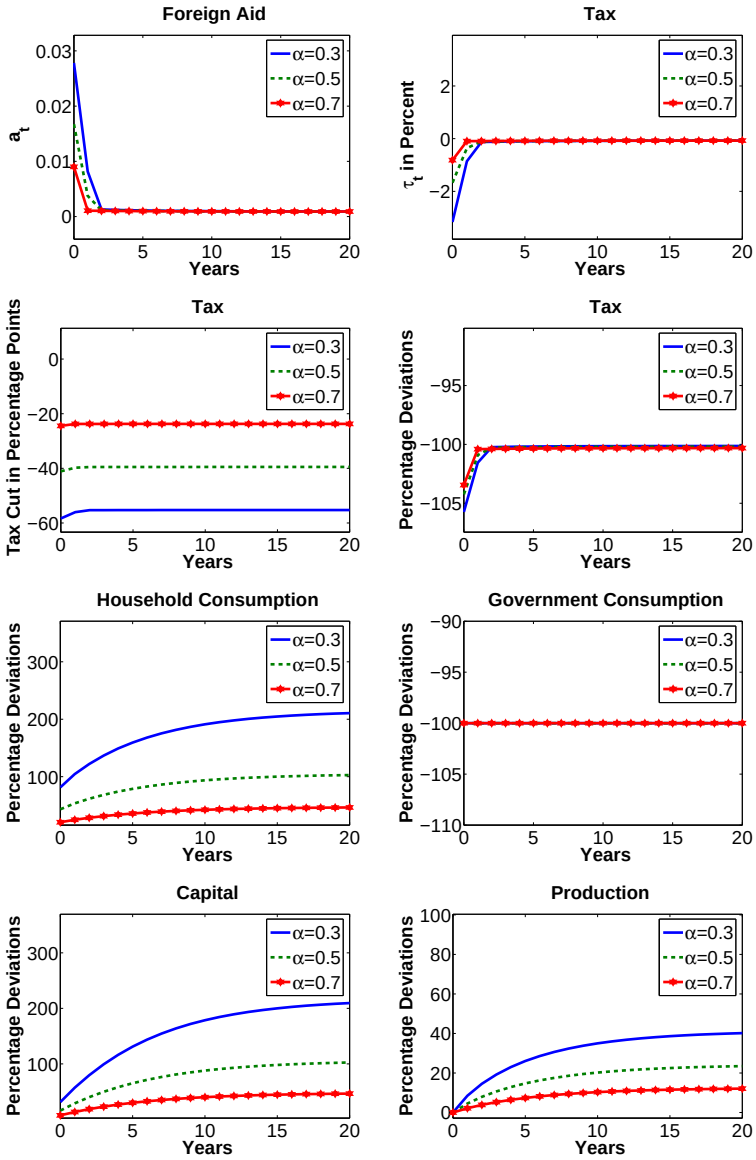
Notes: $\overline{a}$, $\overline{\tau}$, $\overline{k}$, $\overline{c}_h$, $\overline{c}_g$ and $\overline{\mu}$ denote steady state values of aid, tax, capital, household consumption, government consumption and the co-state variable, respectively.

Table 4: Welfare Gain and Costs of Foreign Aid Policy

	Welfare Gain	Costs of Aid
	Benchmark	
I	Aid Policy A	
$\alpha = 0.7$	27.15	-0.001
$\alpha = 0.5$	35.29	-0.002
$\alpha = 0.3$	36.31	-0.006
	Unconditional Aid	
II	Aid Policy A	
$\alpha = 0.7$	0.09	-0.001
$\alpha = 0.5$	0.06	-0.002
$\alpha = 0.3$	0.05	-0.006
	Unconditional Aid	
III	Aid Policy B	
$\alpha = 0.7$	5.22	-1.24
$\alpha = 0.5$	3.78	-1.29
$\alpha = 0.3$	2.24	-1.38
	Conditional Aid	
IV	Aid Policy C	
$\alpha = 0.7$	21.33	-2.04
$\alpha = 0.5$	24.03	-2.82
$\alpha = 0.3$	23.30	-3.77

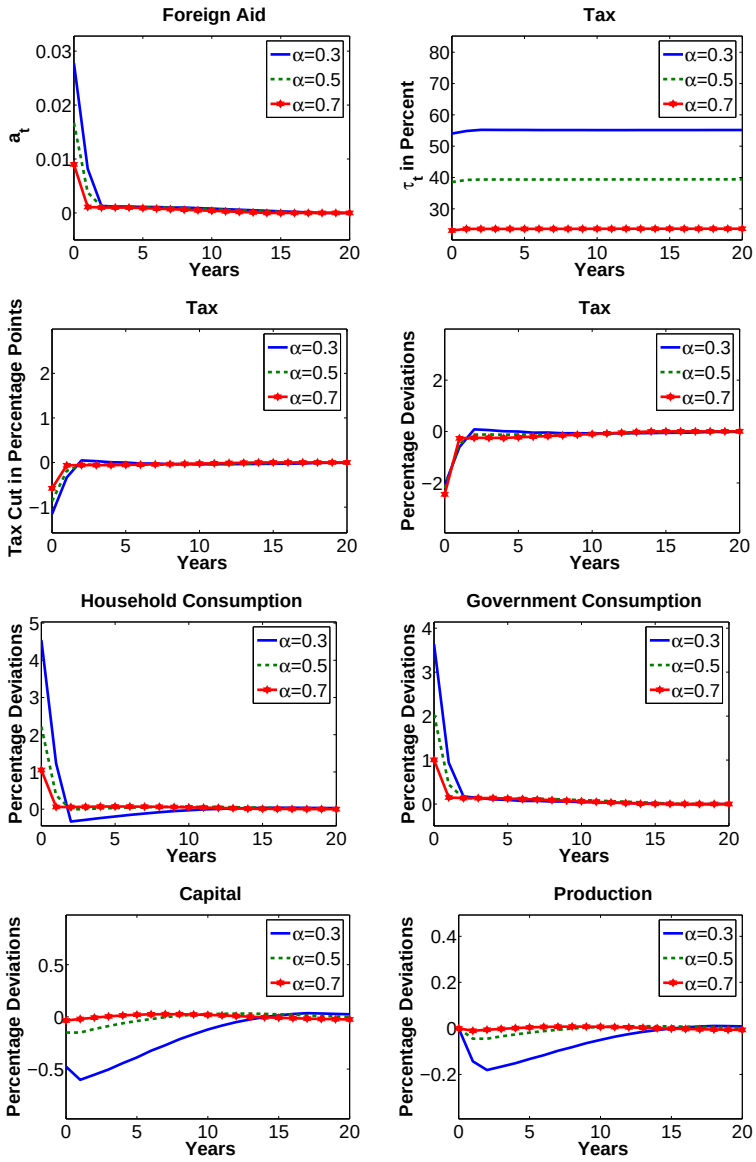
Notes: Welfare gains are measured in terms of percentage deviation in certainty-equivalence consumption relative to the 'No Aid Steady State'. Cost of foreign aid is given by $h(a_t)$. The initial capital stock is assumed to be the 'No Aid Steady State' capital stock.

Figure 2: Benchmark: Aid Policy A



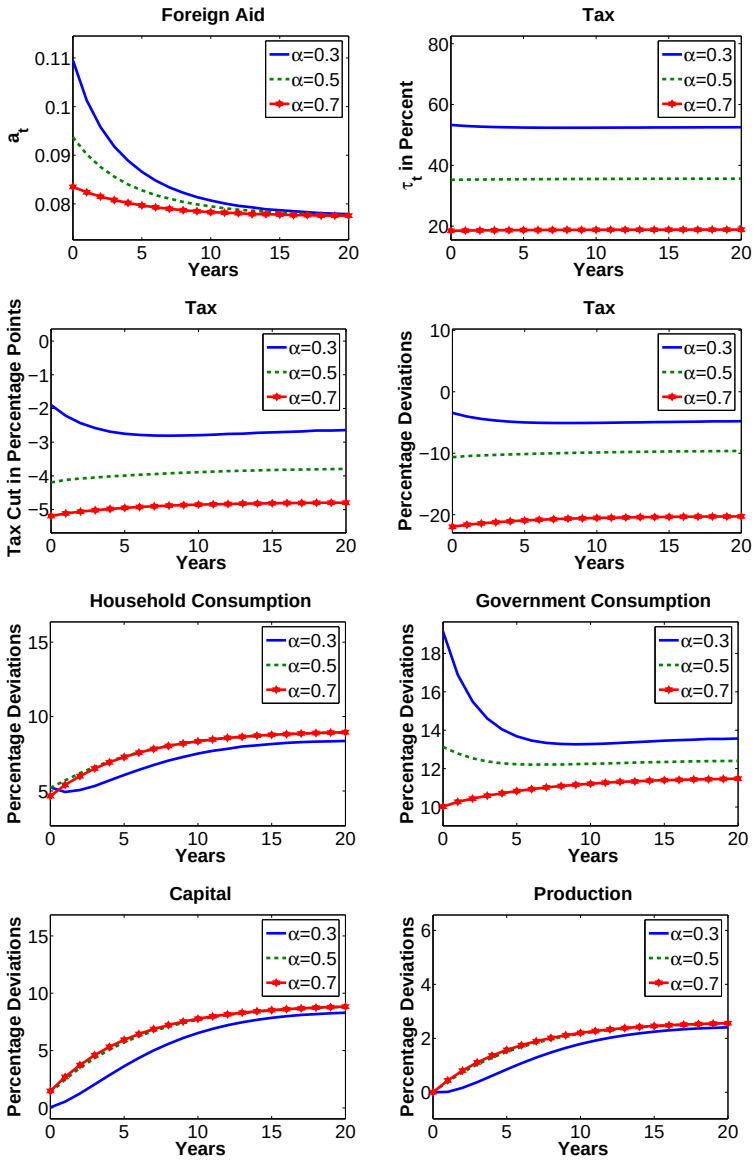
Notes: This figure shows optimal foreign aid policy and its effectiveness given that the donor is able to enforce $c_{g,t} = 0 \; \forall \; t$. The initial capital stock is assumed to be the 'No Aid Steady State' capital stock. Percentage deviations from the 'No Aid Steady State' are presented for the tax, household consumption, government consumption, capital and production.

Figure 3: Effectiveness of Unconditional Aid: Aid Policy A



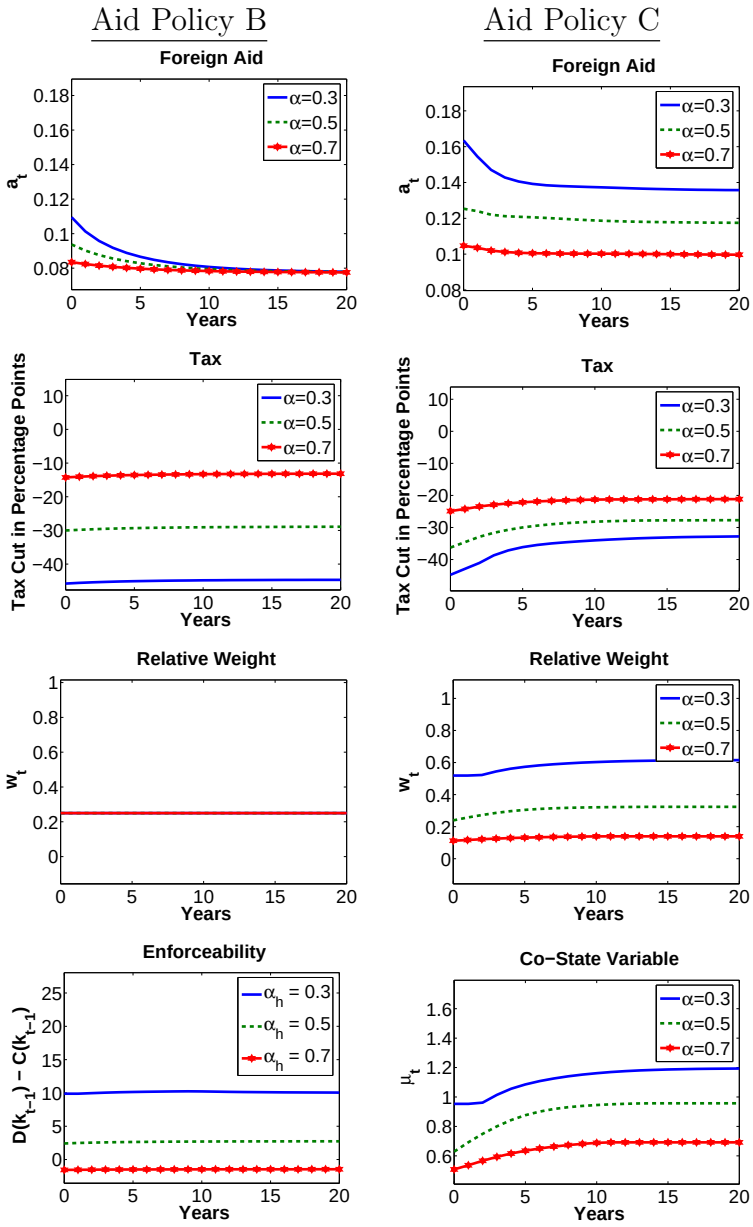
Notes: This figure shows 'Aid Policy A' and its effectiveness if funds are unconditionally transferred given that there are government distortions in the recipient economy. The initial capital stock is assumed to be the 'No Aid Steady State' capital stock. Percentage deviations from the 'No Aid Steady State' are presented for the tax, household consumption, government consumption, capital and production.

Figure 4: Effectiveness of Unconditional Aid: Aid Policy B



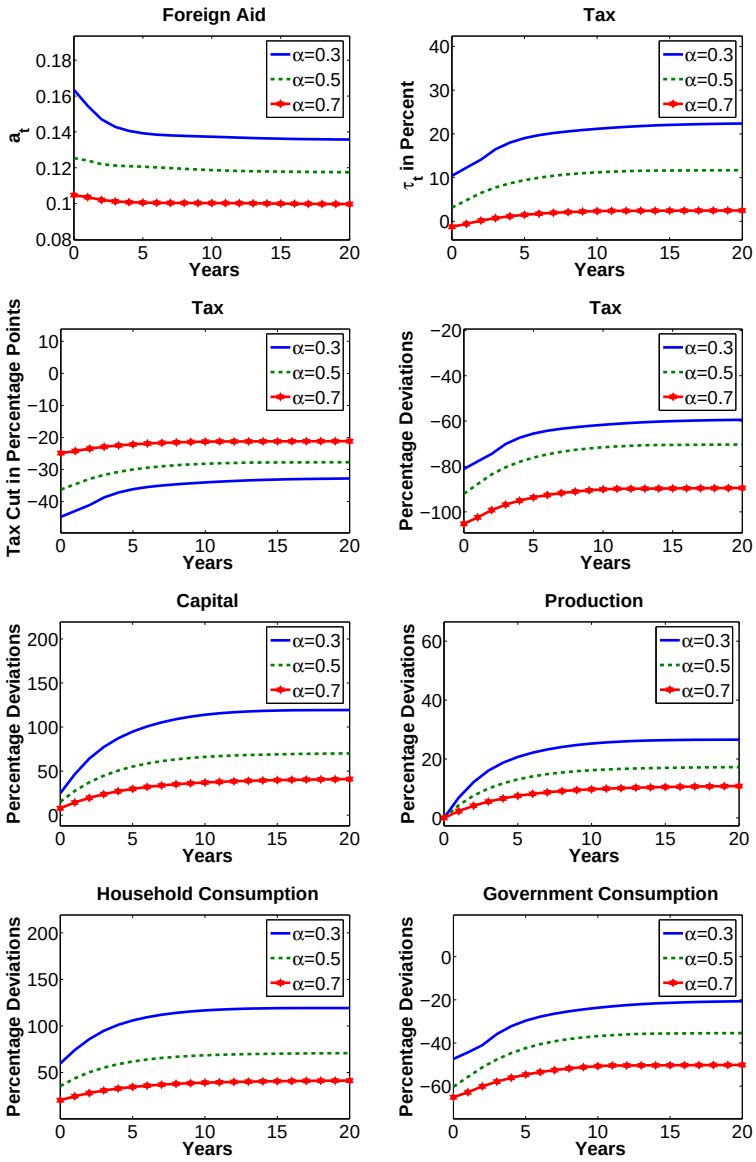
Notes: This figure shows 'Aid Policy B' and its effectiveness if funds are unconditionally transferred given that there are government distortions in the recipient economy. The initial capital stock is assumed to be the 'No Aid Steady State' capital stock. Percentage deviations from the 'No Aid Steady State' are presented for the tax, household consumption, government consumption, capital and production.

Figure 5: Non-Enforceable and Self-Enforcing Conditional Aid Policies



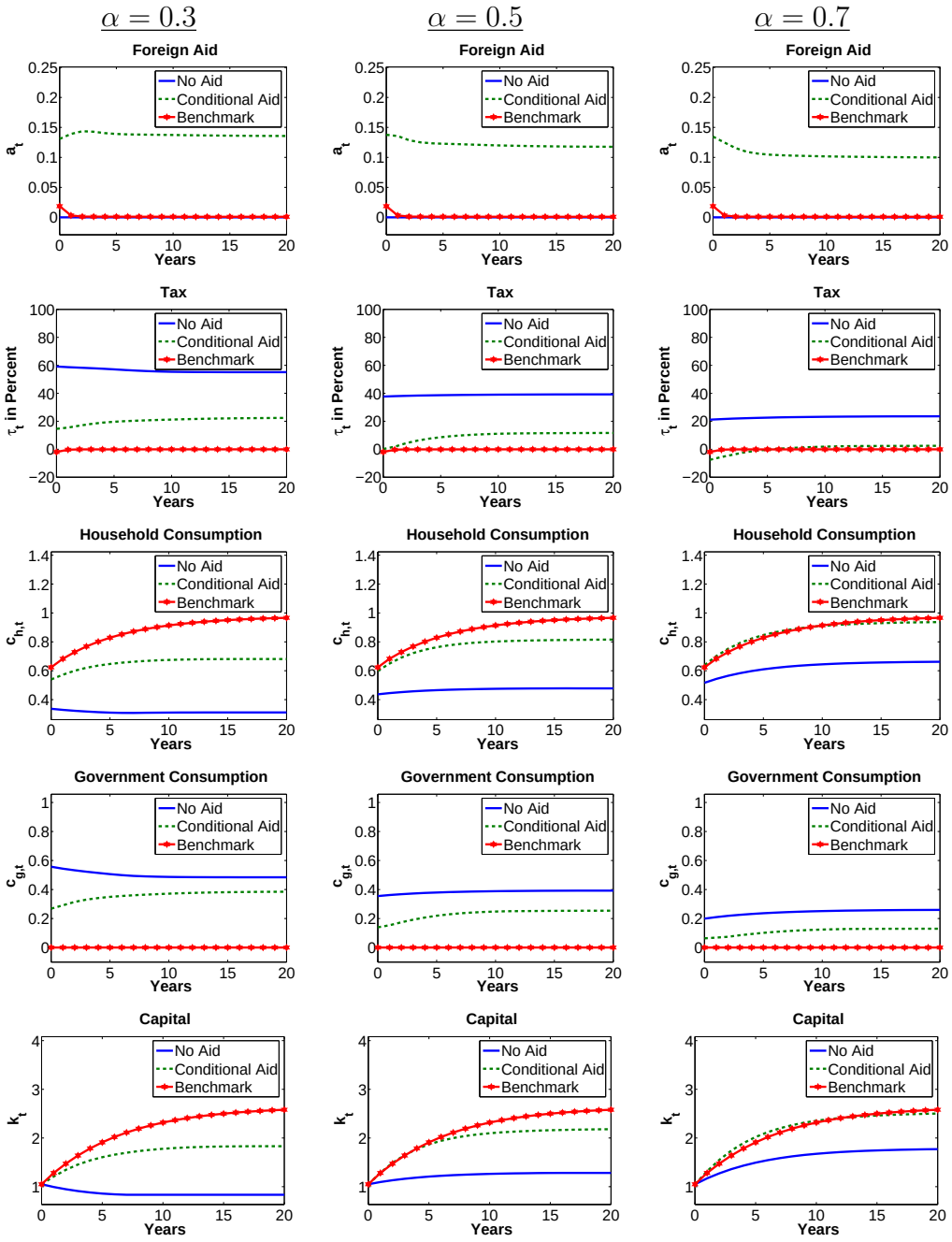
Notes: This figure shows 'Aid Policy B' and 'Aid Policy C' and the corresponding conditional tax cuts. 'Aid Policy B' is characterized by an exogenous relative weight $w_t = \widehat{w}$ while 'Aid Policy C' is characterized by an endogenous relative weight $w_t = ((1-\alpha)\mu_t)/(1+\alpha\mu_t)$. $C(k_{t-1}) = \sum_{j=0}^{\infty} \beta^j [\alpha\ u(c_{h,t+j}) + (1-\alpha)\ v(c_{g,t+j})]$, $D(k_{t-1}) = \sum_{j=0}^{\infty} \beta^j [\alpha\ u(\tilde{c}_{h,t+j}) + (1-\alpha)\ v(\tilde{c}_{g,t+j})]$. μ_t is the additional co-state variable that ensures that $C(k_{t-1}) \leq D(k_{t-1})$. The initial capital stock is assumed to be the 'No Aid Steady State' capital stock.

Figure 6: Effectiveness of Self-Enforcing Conditional Aid: Aid Policy C



Notes: This figure shows 'Aid Policy C' and its effectiveness 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. Percentage deviations from the 'No Aid Steady State' are presented for the tax, household consumption, government consumption, capital and production.

Figure 7: Political Regime Switch and Optimal Foreign Aid Policy



Notes: This figure shows the transition to the steady state given an initial capital stock $k_{-1} = 1.05$ which corresponds to 40 % of the steady state capital stock if $c_{g,t} = 0$ and $a_t = 0$ $\forall t$. 'Benchmark' refers to 'Aid Policy A' while 'Conditional Aid' refers to 'Aid Policy C'.

SFB 649 Discussion Paper Series

For a complete list of Discussion Papers published by the SFB 649, please visit http://sfb649.wiwi.hu-berlin.de.

001 "Nonparametric Risk Management with Generalized Hyperbolic Distributions" by Ying Chen, Wolfgang Härdle and Seok-Oh Jeong, January 2005.
002 "Selecting Comparables for the Valuation of the European Firms" by Ingolf Dittmann and Christian Weiner, February 2005.
003 "Competitive Risk Sharing Contracts with One-sided Commitment" by Dirk Krueger and Harald Uhlig, February 2005.
004 "Value-at-Risk Calculations with Time Varying Copulae" by Enzo Giacomini and Wolfgang Härdle, February 2005.
005 "An Optimal Stopping Problem in a Diffusion-type Model with Delay" by Pavel V. Gapeev and Markus Reiß, February 2005.
006 "Conditional and Dynamic Convex Risk Measures" by Kai Detlefsen and Giacomo Scandolo, February 2005.
007 "Implied Trinomial Trees" by Pavel Čížek and Karel Komorád, February 2005.
008 "Stable Distributions" by Szymon Borak, Wolfgang Härdle and Rafal Weron, February 2005.
009 "Predicting Bankruptcy with Support Vector Machines" by Wolfgang Härdle, Rouslan A. Moro and Dorothea Schäfer, February 2005.
010 "Working with the XQC" by Wolfgang Härdle and Heiko Lehmann, February 2005.
011 "FFT Based Option Pricing" by Szymon Borak, Kai Detlefsen and Wolfgang Härdle, February 2005.
012 "Common Functional Implied Volatility Analysis" by Michal Benko and Wolfgang Härdle, February 2005.
013 "Nonparametric Productivity Analysis" by Wolfgang Härdle and Seok-Oh Jeong, March 2005.
014 "Are Eastern European Countries Catching Up? Time Series Evidence for Czech Republic, Hungary, and Poland" by Ralf Brüggemann and Carsten Trenkler, March 2005.
015 "Robust Estimation of Dimension Reduction Space" by Pavel Čížek and Wolfgang Härdle, March 2005.
016 "Common Functional Component Modelling" by Alois Kneip and Michal Benko, March 2005.
017 "A Two State Model for Noise-induced Resonance in Bistable Systems with Delay" by Markus Fischer and Peter Imkeller, March 2005.
018 "Yxilon – a Modular Open-source Statistical Programming Language" by Sigbert Klinke, Uwe Ziegenhagen and Yuval Guri, March 2005.
019 "Arbitrage-free Smoothing of the Implied Volatility Surface" by Matthias R. Fengler, March 2005.
020 "A Dynamic Semiparametric Factor Model for Implied Volatility String Dynamics" by Matthias R. Fengler, Wolfgang Härdle and Enno Mammen, March 2005.
021 "Dynamics of State Price Densities" by Wolfgang Härdle and Zdeněk Hlávka, March 2005.
022 "DSFM fitting of Implied Volatility Surfaces" by Szymon Borak, Matthias R. Fengler and Wolfgang Härdle, March 2005.

SFB 649, Spandauer Straße 1, D-10178 Berlin
http://sfb649.wiwi.hu-berlin.de

This research was supported by the Deutsche Forschungsgemeinschaft through the SFB 649 "Economic Risk".

023 "Towards a Monthly Business Cycle Chronology for the Euro Area" by Emanuel Mönch and Harald Uhlig, April 2005.
024 "Modeling the FIBOR/EURIBOR Swap Term Structure: An Empirical Approach" by Oliver Blaskowitz, Helmut Herwartz and Gonzalo de Cadenas Santiago, April 2005.
025 "Duality Theory for Optimal Investments under Model Uncertainty" by Alexander Schied and Ching-Tang Wu, April 2005.
026 "Projection Pursuit For Exploratory Supervised Classification" by Eun-Kyung Lee, Dianne Cook, Sigbert Klinke and Thomas Lumley, May 2005.
027 "Money Demand and Macroeconomic Stability Revisited" by Andreas Schabert and Christian Stoltenberg, May 2005.
028 "A Market Basket Analysis Conducted with a Multivariate Logit Model" by Yasemin Boztuğ and Lutz Hildebrandt, May 2005.
029 "Utility Duality under Additional Information: Conditional Measures versus Filtration Enlargements" by Stefan Ankirchner, May 2005.
030 "The Shannon Information of Filtrations and the Additional Logarithmic Utility of Insiders" by Stefan Ankirchner, Steffen Dereich and Peter Imkeller, May 2005.
031 "Does Temporary Agency Work Provide a Stepping Stone to Regular Employment?" by Michael Kvasnicka, May 2005.
032 "Working Time as an Investment? – The Effects of Unpaid Overtime on Wages, Promotions and Layoffs" by Silke Anger, June 2005.
033 "Notes on an Endogenous Growth Model with two Capital Stocks II: The Stochastic Case" by Dirk Bethmann, June 2005.
034 "Skill Mismatch in Equilibrium Unemployment" by Ronald Bachmann, June 2005.
035 "Uncovered Interest Rate Parity and the Expectations Hypothesis of the Term Structure: Empirical Results for the U.S. and Europe" by Ralf Brüggemann and Helmut Lütkepohl, April 2005.
036 "Getting Used to Risks: Reference Dependence and Risk Inclusion" by Astrid Matthey, May 2005.
037 "New Evidence on the Puzzles. Results from Agnostic Identification on Monetary Policy and Exchange Rates." by Almuth Scholl and Harald Uhlig, July 2005.
038 "Discretisation of Stochastic Control Problems for Continuous Time Dynamics with Delay" by Markus Fischer and Markus Reiss, August 2005.
039 "What are the Effects of Fiscal Policy Shocks?" by Andrew Mountford and Harald Uhlig, July 2005.
040 "Optimal Sticky Prices under Rational Inattention" by Bartosz Maćkowiak and Mirko Wiederholt, July 2005.
041 "Fixed-Prize Tournaments versus First-Price Auctions in Innovation Contests" by Anja Schöttner, August 2005.
042 "Bank finance versus bond finance: what explains the differences between US and Europe?" by Fiorella De Fiore and Harald Uhlig, August 2005.
043 "On Local Times of Ranked Continuous Semimartingales; Application to Portfolio Generating Functions" by Raouf Ghomrasni, June 2005.
044 "A Software Framework for Data Based Analysis" by Markus Krätzig, August 2005.
045 "Labour Market Dynamics in Germany: Hirings, Separations, and Job-to-Job Transitions over the Business Cycle" by Ronald Bachmann, September 2005.

This research was supported by the Deutsche Forschungsgemeinschaft through the SFB 649 "Economic Risk".

046 "Paternal Uncertainty and the Economics of Mating, Marriage, and Parental Investment in Children" by Dirk Bethmann and Michael Kvasnicka, September 2005.
047 "Estimation and Testing for Varying Coeffcients in Additive Models with Marginal Integration " by Lijian Yang, Byeong U. Park, Lan Xue and Wolfgang Härdle, September 2005.
048 "Zeitarbeit in Deutschland: Trends und Perspektiven" by Michael C. Burda and Michael Kvasnicka, September 2005.
049 "Courtesy and Idleness: Gender Differences in Team Work and Team Competition" by Radosveta Ivanova-Stenzel and Dorothea Kübler, September 2005.
050 "Do Factor Shares Reflect Technology?" by Benjamin Bental and Domonique Demougin, September 2005.
051 "Optimal investments for risk- and ambiguity-averse preferences: A duality approach" by Alexander Schied, September 2005.
052 "Relational Contracts and Job Design" by Anja Schöttner, September 2005.
053 "Explicit characterization of the super-replication strategy in financial markets with partial transaction costs" by Imen Bentahar and Bruno Bouchard, October 2005.
054 "Aid Effectiveness and Limited Enforceable Conditionality" by Almuth Scholl, August 2005.

SFB 649, Spandauer Straße 1, D-10178 Berlin
http://sfb649.wiwi.hu-berlin.de

This research was supported by the Deutsche Forschungsgemeinschaft through the SFB 649 "Economic Risk".