Foreign aid and developing countries' creditworthiness

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Abstract

We explore whether foreign aid affects developing countries' creditworthiness, as proxied by the *Institutional Investor*'s measure of country credit risk. Based on a simple model of international borrowing and lending, we develop the hypothesis that current aid reduces the likelihood of future default. We then test this hypothesis, using a data set that covers a large number of developing countries in the 1980s and 1990s. While the size of the effect differs across types of aid and country groups, our empirical findings support the notion that aid improves countries' standing vis-a-vis international capital markets.

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1 Introduction

The goal of this paper is to explore whether aid affects developing countries' creditworthiness, as reflected by the *Institutional Investor*'s evaluation of credit risk. Our interest in this question is driven by the observation that credit ratings play an important role for countries' ability to borrow abroad: as various studies document, a lower rating – interpreted as a greater likelihood that borrowers will default on their debt – raises the yield that has to be offered to compensate lenders for higher credit risk (Cantor and Packer, 1996; Larrain et al., 1997; Eichengreen and Mody, 1998; Cunningham et al., 2001; Ciocchini et al., 2003). Moreover, a negative assessment by rating agencies may induce creditors to require higher collateral, which implicitly raises the costs of borrowing. Finally, legal constraints in several industrialized countries prevent potential lenders from investing in countries whose rating is below a critical threshold (Haque et al., 1996).[1]

We start our analysis by developing a simple model of international borrowing and lending to analyze how aid affects agents' demand for foreign credit and the likelihood that they will repay their debt. In this framework, a transfer in a given period lowers the net benefits of future default and therefore *raises* creditworthiness as perceived by international investors. The empirical results that we present in the second part of the paper provide support for this hypothesis: using a set of annual data for a large number of developing countries in the 1980s and 1990s, we find that larger aid inflows result in an improvement of the recipient country's *Institutional Investor* rating. However, different types of aid differ in their effects: while grants and technical assistance significantly raise a country's creditworthiness, we do not find a significant effect if we focus on the loan component of total aid flows.

[1]While we are taking the consequences of credit ratings as given, we are not trying to assess the success of rating agencies in accurately *predicting* default and currency crises. For a study that accomplishes this task see Reinhart (2002).

Our study fits into the – by now quite voluminous – empirical literature that analyzes the impact of foreign aid on growth, investment and capital flows.[2] More specifically, it is related to the recent work on IMF program effectiveness – in particular the study of Mody and Saravia (2003), who investigate the impact of IMF-supported programs on emerging market bond spreads.[3] There are two features that distinguish our study from these contributions: first, by considering a much broader set of aid types and aid sources, we are able to assess whether aid has an impact on creditworthiness even if it is not subject to IMF conditionality. Second, since few developing countries are completely neglected by foreign donors, we do not run into the sample selection problems that are prominent in the literature on program effectiveness (see Przeworski and Vreeland 2000).

The specification of our empirical model is influenced by earlier studies on the determinants of country ratings (Lee, 1993; Haque et al., 1996 and 1998; Reinhart et al., 2003) and by the literature that analyzes emerging market bond spreads (see Cunningham et al., 2001, for a recent survey). However none of the investigations in this field considers the role of foreign aid. While it might be argued that aid only matters indirectly – by influencing the current stock of foreign debt or foreign reserves – we find that aid flows have explanatory power even if we simultaneously include debt and reserve levels.

The rest of the paper is structured as follows: Section 2 presents a simple model of international borrowing and endogenous default risk. Section 3 describes our data set, empirical strategy, and results. Section 4 summarizes and concludes.

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[2]See Hansen and Tarp (2000, 2001), Easterly (2003), Roodman (2004) as well as Harms and Lutz (2004) for recent surveys on the aid-growth literature, and Harms and Lutz (2006) for a study of the relationship between aid and private foreign investment.

[3]Recent analyses of the growth effects of IMF programs are provided by Przeworski and Vreeland (2000) and by Barro and Lee (2004). Ramcharan (2003) offers a survey of this literature. Bird and Rowlands (2002) consider the effects of IMF programs on international capital flows.

Information on data definitions, sources and summary statistics are given in the data appendix.

2 A simple model of aid and default risk

Our goal is to develop a simple model which highlights how aid flows affect agents' consumption and investment decisions and thus the likelihood that they will repay their debt in the future.[4] We consider a small open economy that is populated by a continuum of identical agents whose total mass we normalize to one. The representative agent lives for two periods and maximizes

$$\mathrm{E}[U] = u(C_1) + \beta \mathrm{E}[C_2]. \tag{1}$$

In (1), C_t is consumption in period t, β is the agent's subjective discount factor, E is the expectations operator, and u is a continuous function with $u' > 0$ and $u'' < 0$.

The agent's first-period consumption is subject to the constraints

$$C_1 = Y_1 + A_1 + D_2 - I_1 - R_1 D_1, \tag{2}$$

$$K_2 = I_1. \tag{3}$$

In (2), Y_1 is (exogenous) first-period income, A_1 is a grant ("foreign aid") received from abroad in period 1, $R_1 D_1$ is a payment on (exogenous) initial foreign debt (interest and principal), D_2 represents *new* debt accumulated during period 1, and I_1 denotes first-period investment, which determines the average capital stock in period 2. We assume that the agent does not default in period 1, and to save on notation we define $Y_1^{net} \equiv Y_1 - R_1 D_1$. We also assume that the sum of

[4]Our theoretical framework is related to Asiedu and Villamil (2002) who explicitly consider the effect of aid on the sustainability of international lending. In their model it is the fear of losing access to *future* aid flows that prevents countries from defaulting on their debt. By contrast, we focus on the *instantaneous* effect of aid on creditworthiness.

net income and aid, $Y_1^{net} + A_1$, is low enough to guarantee that D_2 is strictly positive. Accordingly, the representative agent is a "borrower" on international capital markets. In the second period, the borrower uses the capital stock to produce $Y_2 = \phi G(K_2)$, where $\phi > 0$, $G' > 0$, $G'' < 0$, $\lim_{K_2 \to 0} G'(K_2) = \infty$, and $\lim_{K_2 \to \infty} G'(K_2) = 0$.

Before consumption takes place at the end of period 2, the agent decides whether to pay back his debt or not. We exclude the possibility of a partial default. Hence he repays his *entire* debt or nothing at all. Due to the risk of default, international investors charge an interest rate $\rho \in (r, \infty)$ whose implicit premium above the risk-free international interest rate r depends on the (endogenous) likelihood of repayment. If the borrower defaults on his debt, he faces a punishment Π, which can be expressed as a pure loss in income, i.e. the income of defaulting borrowers is reduced without raising the income of lenders. We assume that the punishment has the following form:[5]

$$\Pi = s(1 + \rho)\gamma K_2. \tag{4}$$

In (4), $s \in [0, \infty)$ is a random variable with distribution function $F(s)$ which is realized after production in period 2, and γ is a strictly positive constant. The assumption that Π is unknown in period 1 is meant to reflect the fact that the response of creditors to a default depends on a host of random political and economic factors, which cannot be perfectly anticipated. Moreover, we argue that richer economies are more vulnerable to debtor retaliation – e.g. because of their deeper integration with the world economy –, and we therefore make Π dependent on K_2. Finally, our assumption that the punishment in case of default is proportional to the gross interest rate (including the risk premium) guarantees the existence and uniqueness of an equilibrium.[6]

[5] This specification is inspired by Eaton et al. (1986) as well as Aizenman (1989a, 1989b). It gets some empirical support from Rose (2005) who demonstrates that, in the past, defaulting countries suffered substantial declines in their international trade.

[6] Without this assumption, the incentive to deny repayment would depend on the risk pre-

It follows from (4) that the borrower strictly prefers to default on his debt in the second period if $Y_2 - (1+\rho)D_2 < Y_2 - s(1+\rho)\gamma K_2$. Hence, default takes place if $s < D_2/\gamma K_2$: a high level of debt relative to the onus of punishment makes it unattractive to honor one's payment obligations. Using this result and defining $\omega_2 \equiv D_2/\gamma K_2$, we can rewrite the borrower's expected utility as

$$\begin{aligned} \mathrm{E}[U] &= u(Y_1^{net} + A_1 + D_2 - K_2) + \beta \int_0^{\omega_2} [\phi G(K_2) - s(1+\rho)\gamma K_2] dF(s) \\ &\quad + \beta \int_{\omega_2}^{\infty} [\phi G(K_2) - (1+\rho)D_2] dF(s). \end{aligned} \tag{5}$$

When choosing the optimal values of D_2 and K_2 in period 1, the individual borrower takes into account how his decision affects the likelihood of future default. Straightforward maximization of (5) with respect to D_2 and K_2 therefore yields the following first-order conditions:

$$u'(Y_1^{net} + A_1 + D_2 - K_2) = \beta(1+\rho)[1 - F(\omega_2)] \tag{6}$$

$$u'(Y_1^{net} + A_1 + D_2 - K_2) = \beta[\phi G'(K_2) - (1+\rho)\gamma \int_0^{\omega_2} s dF(s)]. \tag{7}$$

The LHS in (6) reflects the marginal utility of additional debt in period 1, while the RHS gives the marginal cost of borrowing, adjusted for the likelihood of future default, which is $F(\omega_2)$. Expression (7) equates the marginal disutility of saving in period 1 with the expected marginal return on investment, which is lower than the marginal product of capital since the agent anticipates the possibility of default and the associated costs.

To close the model, we consider the supply side of the international capital market. We assume that loans are provided by risk-neutral foreign investors who are aware of domestic agents' incentives to repay their debt, and who are willing to supply credit as long as the yield compensates them for the possibility of default:

$$(1+\rho)[1 - F(\omega_2)] = 1 + r, \tag{8}$$

mium which, in turn, depends on the likelihood of default. As a consequence, there might be a unique equilibrium, multiple equilibria or no equilibrium at all.

where r represents the risk-free interest rate offered by international capital markets. Combining (6) and (8) yields

$$\omega_2 = \frac{\Omega - A_1}{\gamma K_2} + \frac{1}{\gamma}, \tag{9}$$

where $\Omega \equiv u'^{-1}(\beta(1+r)) - Y_1^{net}$. Using (6) – (9) we get

$$(1+r) = \phi G'(K_2) - \gamma[1 + \rho(K_2, A_1)] \int_0^{\omega_2(K_2,A_1)} s dF(s), \tag{10}$$

where it follows from (8) and (9) that ω_2 and ρ are decreasing in K_2 and A_1. The RHS in (10) can be written as a function $\Lambda(K_2, A_1)$. Due to the properties of the production function and our assumption that ρ is finite, we have $\lim_{K_2 \to 0} \Lambda = \infty$. Moreover, we know that $\lim_{K_2 \to \infty} \Lambda = 0$. We can thus draw Λ as a function of K_2 as in Figure 1. Optimal first-period investment is given by the point of intersection of this curve with a horizontal line at $(1+r)$.[7] For a given level of K_2, an increase in A_1 raises Λ, shifting the curve upward and resulting in a higher equlibrium value of K_2. It follows from (9) that this reduces the likelihood of default.

The economic intuition behind these results is straightforward: for a given second-period capital stock, raising aid in period 1 reduces the amount agents wish to borrow relative to their investment. By lowering ω_2, this reduces the likelihood of future default. Since default is associated with costs that are proportional to the capital stock, a higher likelihood of repayment raises the expected return on investment, thus increasing the optimal level of the second-period capital stock. Note that higher aid may (but need not) result in *both* higher investment *and* in higher second-period debt. If A_1 raises the equilibrium value of D_2 while

[7]Note that we cannot be sure that Λ is monotonically decreasing, as drawn in Figure 1, and there may be multiple values of K_2 satisfying (10). However, since expected lifetime utility of borrowers is increasing in K_2, we will focus on the equilibrium that entails the highest second-period capital stock.

reducing the likelihood of default, aid acts as a catalyst for private capital flows while improving recipient countries' creditworthiness.

Our model has been designed to highlight a particular channel through which aid affects creditworthiness – namely, by lowering the expected net benefits of future default. We are aware that we have neglected several important aspects: first, while we have focused on the impact of aid on countries' *willingness to pay*, a default may also be triggered by a low *ability to pay*: due to exogenous shocks, countries may fail to honor their foreign debt even if the costs of default outweigh the benefits. We could have accounted for this aspect by assuming that second-period income is random, thus allowing for the possibility that available resources fail to cover repayment obligations. Without spelling out this extension, we believe that it would not change our key result: aid would still raise creditworthiness, both by reducing future debt and by expanding future production possibilities. Moreover, we have not considered the potential role of aid as a *signal* to foreign investors: on the one hand, aid may raise creditworthiness by indicating that a countries' economic policies are approved by international donors. On the other hand, large aid flows may be a sign of financial trouble and may thus be associated with lower credit ratings. While these effects are beyond the scope of our model, they should be taken into account when we interpret the empirical findings presented in the following section.

3 Aid and country creditworthiness: An empirical exploration

3.1 Data

3.1.1 Country creditworthiness

Our aim is to test whether foreign aid actually has a positive effect on countries' creditworthiness, as measured by the country credit ratings published in the *Institutional Investor* (in what follows, we will use the abbreviation IICCR).[8] The use of the IICCR allows us to consider a much broader set of countries than related studies on the determinants of emerging market spreads. As documented by Gelos et al. (2003), many low-income countries do not have access to international bond markets, but it would be wrong to conclude that perceived creditworthiness is irrelevant in these cases: the likelihood of default may still affect the availability of bank loans, trade credit etc.

The IICCR ranks countries on a scale from 0 to 100, with a lower rating reflecting a higher likelihood that borrowers in this country will default on their debt. The ratings are "...based on information provided by senior economists and sovereign risk analysts at leading global banks and money management and securities firms" (Institutional Investor, 2002:170).[9] The scores have been published regularly since 1979, and the number of countries covered has increased from 96 in 1980 to 145 in 2000. When we started to assemble our data set, availability of

[8]While Haque et al. (1996) consider the indexes published by *Euromoney* and the *Economist Intelligence Unit* as alternative measures of creditworthiness, they observe that there is a "substantial degree of cross-sectional agreement among the ratings" (Haque et al. 1996:699). We therefore use the IICCR as a "representative" proxy for international lenders' assessment of default risk.

[9]As reported by Haque et al. (1996), the individual criteria used by banks to assess default risk are not specified. Hence, we have no information on whether observed aid flows directly enter the ratings.

the IICCR was a prerequisite for accepting a country in the sample.[10]

The IICCR is published every six months (in the March and September issues of the *Institutional Investor*), while most regressors are only available on an annual basis. We decided to transform the original time series into annual data by computing the (unweighted) average of the March and September scores. However, our results are not driven by this choice: although the IICCR of a given country may vary between March and September, the estimated coefficients and significance levels did not change by much when we used only March (or September) values instead of averages.

Finally, the fact that the IICCR is bounded from below and above suggests to transform the data. The transformation we chose follows Haque et al. (1996) as well as most of the other predecessor studies:

$$IICT_{it} = 100 \cdot ln\left(\frac{IICCR_{it}}{100 - IICCR_{it}}\right). \tag{11}$$

However, this logistic transformation does not drive our qualitative results, and our main conclusions still hold if we use the untransformed IICCR.

3.1.2 Aid

The aid variable used in our analysis is provided by the OECD's Development Assistance Committee (DAC) data base (OECD 2005), and is referred to as "official development assistance and net official aid" (henceforth ODA). It consists of grants and of loans with a grant element of at least 25 percent; deducted from this are repayments of loan principal.[11] We control for country size by dividing

[10]The other criteria were that a country was classified as a middle-income or low-income country in 2000, and that its population exceeded one million in the year 2000.

[11]Chang et al. (1998) have created an alternative measure – *effective development assistance* (EDA) – which only includes the grant component of concessionary loans. Unfortunately, the Chang et al. (1998) data are only available through 1995. In order to make use of a larger

through total population, and nominal aid flows are transformed into constant international dollars by using the World Bank's (2005) PPP-conversion factors and the US GDP deflator. Since a log-linear specification turned out to best fit the data, we decided to transform the original aid-per-capita data into natural logarithms.[12]

Later on we will replace ODA per capita by less aggregate variables, namely the loan component of aid, pure grants, and technical assistance. We will also differentiate between aid offered by multilateral donors and "bilateral" aid received from individual countries.

3.1.3 Control variables

Apart from establishing a positive effect of aid on $IICT$, our model suggests that countries' creditworthiness is affected by the following variables: current income (Y_1), the initial stock of debt (D_1), variables that influence future productivity (ϕ), and variables that reflect countries' vulnerability to creditor sanctions (γ). To account for the influence of Y_1 and D_1, we include the logarithm of countries' gross national income (*GNI*) and total external debt ($DEBT$), both in per-capita terms. Again, the original data are transformed into constant international dollars by using PPP-conversion factors and the US GDP-deflator. Based on our theoretical analysis, we expect *GNI* to raise $IICT$, while $DEBT$ should have a negative effect.

The positive influence of growth prospects on creditworthiness that is suggested by our model is captured by the following three variables: the growth rate of real per-capita income ($GROWTH$), the inflation rate (*INFLATION*) as a

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sample, we decided to stick to the original ODA series. However, since the evolution of EDA closely follows the time path of official development assistance, we do not expect this to be crucial for our results.

[12]The loss of data due to negative ODA values is negligible (10 observations). We also estimated an equation with the log of aid and the log of population as separate regressors. An F-test supported the restriction associated with using the log of per-capita aid.

proxy for macroeconomic stability, and a measure of "governance" (*GOV*), which reflects the absence of corruption, the quality of the bureaucracy, and the rule of law.[13] Our decision to control for the quality of governance is motivated by the recent literature on aid, growth, and capital flows, which emphasizes the role of countries' economic and institutional environment. It is also suggested by Ciocchini et al. (2003) who find that higher corruption raises countries' interest rate spreads. Note, however, that the fact that *Political Risk Services* started to publish its index in 1982 and introduced a new scaling for their governance variables in 1998 limits our sample to this time interval.

To control for countries' vulnerability to creditor sanctions (γ) and the resulting incentive to refrain from default, we use a measure of countries' trade openness (*TRADE*), which is the sum of exports and imports divided by GDP. Finally, we include the ratio of reserves over imports (*RESERVES*) to account for the fact that a lot of default episodes were triggered by balance-of-payments crises (Kaminsky and Reinhart, 1999) and that countries' ability to defend their pegs depends on their stock of foreign reserves. While this regressor is not derived from our model, it figures prominently in related studies (Haque et al., 1996), and omitting it would raise the risk of producing biased estimates.

3.1.4 Lagged dependent variable

In addition to the variables mentioned above, we use the lagged value of IICT as a regressor. Such a dynamic specification is suggested by Haque et al. (1996:718) who find that "there is considerable persistence in the ratings, so that a country tends to retain its rating over time unless significant adverse or positive develop-

[13] Each of these features is captured by an index that is published in the *International Country Risk Guide* and assembled in *Political Risk Services'* IRIS3 database. The measures range from 0 to 6, with a higher value reflecting a better business climate, and the composite measure we use is an unweighted average of the three indexes. Both the inflation rate and the governance index are transformed into natural logarithms.

ments occur".

3.2 Estimation

3.2.1 Specification

The equation we estimate is

$$IICT_{it} = \delta IICT_{i(t-1)} + \beta a_{i(t-1)} + \sum_{k=1}^{K} \gamma_k x_{k,i(t-1)} + \alpha_i + \xi_t + \varepsilon_{it}, \qquad (12)$$

In (12), α_i is an unobserved ("fixed" or "individual") effect that may be arbitrarily correlated with the other regressors. ξ_t is a time dummy which is meant to capture variations in industrialized countries' interest rates, but also general changes in investor sentiment. The variable $a_{i(t-1)}$ is the logarithm of per-capita aid received by country i in period $t-1$, while $x_{k,i(t-1)}$ is the control variable k for country i in period $t-1$. Finally, ε_{it} is the usual error term. The t-statistics presented below are based on a robust covariance matrix that allows for heteroskedastic disturbances. The fixed effects capture all country-specific, but time-invariant features. Given the considerable heterogeneity of our sample with respect to countries' political institutions, cultural background, and geographical conditions, their inclusion is particularly important to reduce the extent of omitted variable bias.[14] By using lagged values of the regressors we are trying to catch two birds with one stone: first, it is likely that the IICCR value for a given country in period t is formed on the basis of economic circumstances in period $t-1$, especially since 50 percent of the assessment is published in the month of March. Second, using lagged values is a simple strategy to reduce endogeneity bias.[15]

[14]An F-test that compares a pooled regression with the fixed-effects specification strongly supports our inclusion of country-specific dummies.

[15]Our results did not change by much when we experimented with other specifications, e.g. the September value of the IICCR and contemporaneous values of the regressors.

3.2.2 GMM estimation

It is well-known that estimating equation (12) by OLS leads to biased coefficients.[16] We therefore follow the procedure suggested by Arellano and Bond (1991): the first step is to eliminate the country-specific effects by taking differences on both sides of equation (12). This yields

$$\Delta IICT_{it} = \delta \Delta IICT_{i(t-1)} + \beta \Delta a_{i(t-1)} + \sum_{k=1}^{K} \gamma_k \Delta x_{k,i(t-1)} + \Delta \xi_t + \Delta \varepsilon_{it}, \qquad (13)$$

where $\Delta IICT_{it} \equiv IICT_{it} - IICT_{i(t-1)}$. The second step is to estimate (13) by GMM. Arrelano and Bond (1991) demonstrate that, by using lagged levels of both the endogenous variable and of the regressors as instruments, one arrives at a set of moment conditions which allow to efficiently estimate the model's parameters. These estimates are consistent if the error term ε_{it} is serially uncorrelated – an assumption that can be checked by testing the hypothesis of no second-order serial correlation in the first-differenced residuals (Arellano and Bond 1991).

While the validity of the overidentifying restrictions used in GMM estimation can be assessed by considering Hansen's J-statistic (Hansen 1982), past levels of the right-hand variables are weak instruments for current differences if the time series involved are highly persistent. The solution suggested by Arellano and Bover (1995) as well as Blundell and Bond (1998) is to add further moment conditions by simultaneously estimating equations (12) and (13). As stated above, the $IICT$ series are likely to be very persistent. We therefore decided to use the "Systems-GMM" estimator of Blundell and Bond (1998). Most of our results are based on an efficient two-step GMM estimator that applies an endogenous weighting matrix to the moment conditions, and standard errors are computed

[16] The bias disappears in panels with infinitely long time series (Nickell, 1981). Bond (2002) and Wooldridge (2002) offer excellent surveys of the problems associated with dynamic panel data estimation and of the available approaches to arrive at consistent estimates.

by using Windmeijer's (2005) finite sample correction. Since exploiting all available lags as instruments results in a proliferation of moment conditions, and since the finite-sample bias of the GMM estimator is exacerbated if the number of instruments exceeds the number of countries (Judson and Owen, 1999), our main results are derived by using a restricted set of instruments – usually the first to fourth lags of the regressors. Moreover, we follow the strategy of Roodman (2004) who further reduces the size of instrument matrix by summing up individual moment conditions.[17]. While we will stick to this specification for most of the paper, we will also report the consequences of using alternative approaches.

3.2.3 Results

Column 1 of **Table 1** presents the results of estimating (13). Most importantly, aid has a positive effect, and the coefficient is significant at the one-percent level.[18] Moreover, most control variables have the expected sign, although not all of them are significant. The p-value for the J-statistic supports the hypothesis that the instruments used are exogenous. The p-value for the Arellano-Bond (m2) test statistic indicates that we can confidently reject the hypothesis that the disturbances are serially correlated. Finally, the results confirm the observation of Haque et al. (1996) that credit ratings are very persistent. For countries that are stigmatized by a bad rating this implies that investors are slow at changing their assessment even when the country is hit by a positive aid shock. Combining the coefficients of aid and of the lagged dependent variable, one finds that, in the long run, a permanent one-percent increase of aid per capita raises creditworthiness

[17] This implies that, e.g., the two moment conditions $E(x_{i,t-2}\Delta\varepsilon_{i,t}) = 0$ and $E(x_{i,t-3}\Delta\varepsilon_{i,t}) = 0$, merge into $E(x_{i,t-2}\Delta\varepsilon_{i,t} + x_{i,t-3}\Delta\varepsilon_{i,t}) = 0$. Reducing the number of instruments obviously comes at the cost of lower efficiency, but in small samples it reduces the risk of overfitting the model. The "collapse" option is part of the *xtabond2* Stata routine written by David Roodman.

[18] Evaluated at the mean, the estimated coefficient of 5.94 implies a short-run elasticity of 0.04.

by approximately 0.25 percent.

While the two-step estimator used in column (1) is superior to the one-step estimator in terms of efficiency, those efficiency gains may be rather modest, and the one-step alternative which uses an exogenous weighting matrix may be more reliable in small samples. In column (2) of Table 1 we therefore present results which demonstrate that using the one-step estimator delivers the same qualitative results as the two-step alternative.

To make sure that our result is not due to a few influential observations, we proceeded by applying Hadi's (1994) procedure to identify multivariate outliers and excluded those observations from the sample. The results in column (3) of Table 1 suggest that the effect of aid and of most other regressors becomes stronger if we omit outliers.

It is an open issue whether GMM estimation really improves upon the fixed-effects estimator in dynamic panel-data models with small samples.[19] An alternative approach is to estimate (12) by OLS and to apply the bias-correction suggested by Kiviet (1995) and Bruno (2005). As indicated by column (4) of Table 1, using this "corrected LSDV (LSDVC)" estimator does not change our main finding that aid raises creditworthiness.[20]

3.3 Robustness checks

In this subsection, we will report the results of replacing total aid per capita in equation (13) by different types of aid, of running this regression for various country groups and time periods, and of experimenting with non-linear specifications. Apart from testing the robustness of our previous findings, these variations provide important insights on the channels through which aid affects country

[19]Judson and Owen (1999) demonstrate that the bias of the fixed-effects estimator depends on the length of the time series relative to the cross-sectional dimension.

[20]To compute these results, we used the *xtlsdvc* routine developed for Stata by Giovanni Bruno.

creditworthiness.

Table 2 differentiates between various types of aid: column 1 considers only pure grants, while columns 2 and 3 consider technical assistance and loans, respectively. While grants and technical assistance have a stronger impact on creditworthiness than total aid, the coefficient for loans is much smaller and not significantly different from zero. This seems intuitive: both grants and technical assistance correspond to the type of transfer modelled in Section 2, with technical assistance being more likely to be used productively and to raise future income.[21] Conversely, loans which raise the future debt burden seem to be less suited to improve a country's standing vis-a-vis international capital markets, even in the short run.[22] Columns 4 and 5 of Table 2 show that bilateral aid has a much stronger impact on creditworthiness than multilateral aid. We conjecture that this difference reflects the fact that a large part of multilateral aid consists of loans while the dominant share of bilateral aid comes in the form of pure grants (OECD 2005). Hence, the findings in columns (4) and (5) of Table 2 seem to replicate the result that grants have a strong impact on creditworthiness while loans have none.

In some countries, net aid flows – i.e. new disbursements minus repayments of

[21]Our result is also in line with Asiedu and Villamil (2002) whose model implies that the threat of withholding productivity-enhancing aid is especially powerful in preventing default. A more skeptical view is expressed by Roodman (2004:6) who notes that technical assistance "...funds not so much recipient governments as consultants." Note, however, that Roodman's statement does not exclude the possibility that the advise offered by those consultants raises productivity.

[22]For those countries where loan repayments exceed new disbursements, net loans per capita are negative and the logarithm is not defined. We checked whether the resulting reduction of the sample was driving our results by omitting those observations from the benchmark regression in Table 1. It turned out that, in this smaller sample, total aid still had a significantly positive effect on creditworthiness, which suggests that the result in column (3) of Table 2 is not driven by the modified sample.

loans – are substantially reduced by interest payments on existing debt. To check the possibility that the impact of aid changes if interest payments are netted out, we subtracted those payments from both total aid and from the grant component of aid. The results are reported in columns (1) and (2) of **Table 3**. Apparently, our main finding is not affected by this modification: neither the coefficient of total aid nor its significance changes dramatically. The impact of grants shrinks, but it is still significantly positive and slightly bigger than the effect of total aid. Note, however, that the number of observations is reduced by almost 10 percent if we subtract interest payments. Since we want to preserve the biggest possible sample and since netting out interest payments does not affect our main findings, we decided to move on using net aid without the adjustment for interest payments. Columns (3) and (4) of Table 3 investigate the possibility that the effect of aid on creditworthiness merely reflects the consequences of one-time debt-writeoffs, e.g. in the wake of the Brady deals of the late eighties and early nineties. We therefore subtracted "debt forgiveness grants" as reported by the OECD (2005) from total aid and grants, respectively. The results demonstrate that this variation has almost no influence on the size of the estimated coefficients. This suggests that the impact of aid on creditworthiness goes beyond the effect of debt forgiveness.[23]

Table 4 considers various subsets of our original sample. We started by removing individual regions from our sample (columns 1 to 3):[24] If we remove the Latin American countries, the coefficient of aid drops somewhat, but it is still significantly different from zero. Omitting Sub-Saharan African or Asian countries (columns (4) and (5)) leads to similar results: while the coefficient of aid and of some control variables may change, our general finding that aid raises

[23]When we tested the importance of debt forgiveness for our results by removing countries involved in Brady deals, we found that this did not alter our findings.

[24]Removing regions instead of considering them in isolation helps to keep the subsample at a reasonable size.

creditworthiness does not seem to be driven by any particular region.

A strict reading of our theoretical model suggests that it should only apply to those countries who have access to international capital markets. Data on market access are provided by Gelos et al. (2003), and column (4) of Table 4 shows the consequences of omitting countries who never issued international bonds. Apparently, this does not alter our main findings.

Finally, we checked whether our results were driven by the rather volatile assessment of transition countries' creditworthiness in the early 1990s, and removed those countries from the sample. Column (5) of Table 4 shows that our key result is not affected by this sample modification. It is notable, however, that the coefficient of the lagged dependent variable rises substantially, which indicates that transition countries were more likely to see their creditworthiness reassessed than other countries.

Columns (1) and (2) of **Table 5** report the results from running the regression for observations before and after 1990. While this break point is somewhat arbitrary, it is likely that aid disbursement criteria and thus the impact of aid changed after the end of the cold war. The numbers indicate that there are, indeed, substantial differences between the two decades: while the coefficients and t-statistics suggest a significantly positive effect in both periods, aid had a much stronger impact on credit ratings during the 1980s than during the 1990s. This may be due to the fact that transition countries' credit ratings were particularly volatile in the early 1990s, and that most of the outliers identified above fall into this period. In fact, if we omit transition countries and outliers the significance of aid during the 1990s improves substantially (see column (3) of Table 5). We also investigated the proposition brought forward by Hansen and Tarp (2000) (among others) that there are diminishing returns to aid, and used the squared value of aid as an additional regressor. The numbers in column (4) of Table 5 do not support this notion: the coefficient of aid squared is positive, but not significantly different from zero. Finally, we checked whether the effect of aid on creditworthiness depends on the institutional environment and therefore included an interactive term – the logarithm of aid per capita times our governance variable *GOV* – as an additional regressor. As column (5) of Table 5 demonstrates, the notion that "money matters – in a good policy environment" (World Bank, 1998:28) is not supported in our context: the coefficient of the interactive term is negative, but insignificant.

4 Summary and conclusions

When we started this investigation, we were curious whether aid could possibly raise developing countries' creditworthiness and thus act as a "catalyst" for private capital flows. In this respect, our results are both encouraging and disheartening: aid has a significantly positive effect on the *Institutional Investor*'s index of country credit risk, but the size of this effect is rather modest. Moreover, credit ratings are extremely persistent, such that a temporary increase in aid flows is unlikely to improve the ratings of countries whose economic and institutional weaknesses taint their standing vis-a-vis international capital markets.

Our results also shed light on the channels through which aid may improve creditworthiness: technical cooperation and grants seem to be more effective than loans, suggesting that aid improves a country's reputation when it lowers future repayment obligations relative to future income and thus reduces the potential benefits from default. This conjecture is also supported by the observation that bilateral aid has a stronger impact on the *Institutional Investor*'s ratings than multilateral aid. On a more general level, our results thus emphasize the importance to disentangle the different components of aid when assessing the effect of aid on macroeconomic variables. While this paper has limited its attention to the relationship between aid flows and creditworthiness, we are quite sure that this insight generalizes to other parts of the aid-effectiveness debate.

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5 Data appendix

5.1 Definitions and sources

Institutional Investor Country Credit Rating (IICCR): Country Credit Ratings published in the Institutional Investor magazine every March and September since 1979. Source: Institutional Investor magazine, various issues.

Aid: Logarithm of official development assistance and net official aid per capita in constant international dollars. (To transform the flow of aid denoted in current US dollars into constant international dollars, we used the World Bank's PPP-conversion factors and the US GDP deflator.)Source: OECD (2005).

Grants: Logarithm of grants per capita. Grants are transfers in cash or in kind for which no legal debt is incurred by the recipient in constant international dollars. OECD (2005).

Technical cooperation: Logarithm of technical cooperation per capita. Technical co-operation is the provision of know-how in the form of personnel, training, research and associated costs in constant international dollars. Source: OECD (2005).

Loans: Logarithm of loans per capita. Loans are transfers in cash or in kind for which the recipient incurs a legal debt in constant international dollars. OECD (2005).

Bilateral Aid: Logarithm of bilateral aid per capita. Bilateral transactions are those undertaken by a donor country directly with an aid recipient (in constant international dollars. Source: OECD (2005).

Multilateral Aid: Logarithm of multilateral aid per capita. Total net aid flows minus bilateral aid in constant international dollars. Source: OECD (2005).

GNI: Logarithm of gross national income per capita in constant international dollars. Source: World Bank (2005).

Debt: Logarithm of total external debt per capita in constant international dollars. Source: World Bank (2005).

Growth: Annual percentage growth rate of gross domestic product per capita based on constant local currency. World Bank (2005).

Inflation: Logarithm of the annual percentage inflation rate, as measured by the consumer price index. Source: World Bank (2005).

Governance: Logarithm of a governance indicator which is an unweighted average of three International Country Risk Guide (ICRG) indices, ranging from 0 to 6: *Corruption in Government*: Lower scores indicate "high government officials are likely to demand special payments" and that "illegal payments are generally expected throughout lower levels of government" in the form of "bribes connected with import and export licenses, exchange controls, tax assessment, police protection, or loans." *Rule of Law*: This variable "reflects the degree to which the citizens of a country are willing to accept the established institutions to make and implement laws and adjudicate disputes." Higher scores indicate: "sound political institutions, a strong court system, and provisions for an orderly succession of power." Lower scores indicate: "a tradition of depending on physical force or illegal means to settle claims." Upon changes in government new leaders "may be less likely to accept the obligations of the previous regime." *Quality of the Bureaucracy*: High scores indicate "an established mechanism for recruitment and training," "autonomy from political pressure," and "strength and expertise to govern without drastic changes in policy or interruptions in government services" when governments change. Source: Political Risk Services

Trade: Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product. Source: World Bank (2005).

Reserves: Net international reserves (excludes gold) divided by imports of goods and services. Source: World Bank (2005).

5.2 Countries

5.2.1 Total sample

Algeria , Angola, Argentina, Bangladesh, Bolivia, Botswana, Brazil, Bulgaria, Burkina Faso, Cameroon, Chile, China, Colombia, Congo Rep., Costa Rica, Cote d'Ivoire, Democratic Republic of Congo, Dominican Republic, Ecuador, Egypt Arab Rep., El Salvador, Ethiopia, Gabon, Ghana, Guatemala, Haiti, Honduras, Hungary, India, Indonesia, Iran, Jamaica, Jordan, Kenya, Malawi, Malaysia, Mali, Mexico, Morocco, Mozambique, Nicaragua, Nigeria, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Romania, Russian Federation, Senegal, Sierra Leone, South Africa, Sri Lanka, Sudan, Syrian Arab Republic, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Uganda, Uruguay, Venezuela RB, Vietnam, Zambia, Zimbabwe

5.2.2 Countries without access to international capital markets

Burkina Faso, Bolivia, Botswana, Georgia, Haiti, Mali, Malawi, Nicaragua, Nepal, Sierra Leone, Togo, Uganda.

Note: Countries that never accessed international capital markets are identified by Gelos et al. (2003).

5.2.3 Summary statistics and correlations

Table A.1: Summary statistics

	Mean	Std. Dev.	Min.	Max.
IICR	27.84	14.33	4.05	72.3
Total aid p.c.	106.16	150.89	-54.57	1785.99
Grants p.c.	79.57	129.77	0.38	1946.98
Techn. Ass. p.c.	24.96	28.96	-13.74	308.24
Loans p.c.	26.60	48.94	-266.30	505.99
Bilat. aid p.c.	78.51	122.43	-37.69	1494.75
Multilat. aid p.c.	27.65	40.94	-75.71	386.04
GNI p.c.	3623.12	2484.42	213.38	19146.11
Debt p.c.	2429.45	2637.29	125.31	37116.06
GROWTH	0.86	4.89	-20.90	16.54
Inflation	153.24	1102.781	0.06	23773.13
Governance	2.77	0.92	0.67	5.33
TRADE	57.83	27.54	12.35	192.11
RESERVES	26.41	28.06	0.42	276.91

Notes: Summary statistics refer to the 847 observations used in the regression underlying column (1) of Table 2. While the aid-per-capita variables, Gross National Income (GNI), debt per capita, inflation and governance entered our regressions in logs, the summary statistics refer to the original data.

Table A.2: Correlations

	AID	GNI	DEBT	GROWTH	INFL.	GOV	TRADE	RES.
AID	1.00							
GNI	-0.24	1.00						
DEBT	0.11	0.63	1.00					
GROWTH	-0.09	0.09	-0.09	1.00				
INFLATION	-0.07	0.01	0.15	-0.25	1.00			
GOV	-0.17	0.32	0.27	0.18	-0.05	1.00		
TRADE	0.33	0.12	0.39	0.03	-0.22	0.26	1.00	
RESERVES	-0.23	0.25	-0.02	0.16	0.00	0.22	-0.05	1.00

Notes: Summary statistics refer to the 847 observations used in the regression underlying column (1) of Table 2. All correlations refer to the variables as used in the regressions,i.e. the logarithm of aid per capita, the logarithm of GNI per capita etc.

6 Tables

Table 1: Benchmark specification: Alternative estimation methods
(Dependent variable: Transformed index of country credit risk)

	(1) SYS-GMM two-step lags 1 to 4	(2) SYS-GMM one-step lags 1 to 4	(3) SYS-GMM two-step no outliers	(4) LSDVC
AID	5.939***	6.269***	7.278***	4.066***
	(3.77)	(2.89)	(3.20)	(4.26)
GNI	21.746**	11.564	20.552**	-0.250
	(2.29)	(1.33)	(2.01)	(-0.09)
DEBT	-23.084***	-27.306***	-25.594***	-11.315***
	(-2.75)	(-3.36)	(-4.03)	(-6.66)
GROWTH	0.664***	0.695***	0.622***	0.706***
	(3.59)	(4.51)	(3.60)	(7.15)
INFLATION	-1.560	-2.358*	-1.527	-1.039*
	(-1.52)	(-1.96)	(-1.55)	(-1.86)
GOV	14.173**	9.335*	14.997**	3.560*
	(2.04)	(1.67)	(2.47)	(1.84)
TRADE	0.389**	0.393**	0.340*	0.219***
	(2.10)	(2.29)	(1.98)	(4.35)
RESERVES	0.281**	0.360***	0.323***	0.217***
	(2.41)	(2.76)	(2.65)	(6.74)
Lagged IICT	0.832***	0.918***	0.865***	0.914***
	(13.89)	(12.48)	(12.18)	(45.94)
Observations	837	837	814	837
Countries	70	70	68	70
Instruments	61	61	61	
J-statistic (p value)	0.30	0.43	0.25	
Arellano-Bond stat. (p value)	0.38	0.43	0.58	

Notes: In parentheses: Absolute values of t-statistics, based on a robust covariance-matrix. ***, **, *: significance levels of 1, 5, 10 percent. All regressions include time dummies. Column (1): Two-step Systems-GMM estimator applying Windmeijer's (2005) finite-sample correction to compute standard errors. Lags 1 to 4 of regressors used as instruments. Reduction of moment conditions by using the "collapse" option suggested by Roodman (2004). Column (2): One-step Systems-GMM estimator. Lags 1 to 4 of regressors used as instruments. Column (4): The corrected fixed effects (LSDVC) estimator suggested by Kiviet (1995) and Bruno (2005).

Table 2: Different types of aid

(Dependent variable: Transformed index of country credit risk)

	(1)	(2)	(3)	(4)	(5)
	Grants	Technical A.	Loans	Bilateral	Multilateral
AID	8.657***	11.314***	0.575	6.136***	3.108**
	(4.44)	(3.53)	(0.53)	(2.99)	(2.45)
GNI	13.095	12.529	30.986***	21.546**	24.227**
	(1.15)	(1.04)	(3.05)	(2.16)	(2.11)
DEBT	-20.507**	-18.757**	-38.691***	-27.123***	-27.654***
	(-2.25)	(-2.13)	(-5.22)	(-3.88)	(-3.14)
GROWTH	0.735***	0.649***	0.530***	0.613***	0.638***
	(4.04)	(3.77)	(2.80)	(3.59)	(3.27)
INFLATION	-2.260**	-2.137**	-1.521	-1.589	-1.913
	(-1.90)	(-2.48)	(-0.95)	(-1.33)	(-1.34)
GOV	13.025*	14.858**	5.586	12.583*	15.036*
	(1.78)	(2.00)	(0.57)	(1.68)	(1.91)
TRADE	0.298	0.288	0.637***	0.411**	0.364**
	(1.64)	(1.57)	(4.41)	(2.59)	(2.03)
RESERVES	0.240*	0.233*	0.222	0.253**	0.345**
	(1.85)	(1.96)	(1.31)	(2.18)	(2.29)
Lagged IICT	0.883***	0.810***	0.777***	0.827***	0.843***
	(14.58)	(15.58)	(9.36)	(12.76)	(14.07)
Observations	847	846	702	829	812
Countries	70	70	69	70	70
Instruments	61	61	61	61	61
J-statistic (p value)	0.29	0.61	0.34	0.27	0.23
Arellano-Bond (p value)	0.29	0.29	0.57	0.31	0.67

Notes: In parentheses: Absolute values of t-statistics, based on a robust covariance-matrix. ***, **, *: significance levels of 1, 5, 10 percent. All regressions include time dummies. The estimator used is the Blundell an Bond (1998) two-step Systems-GMM estimator applying Windmeijer's (2005) finite-sample correction to compute standard errors. Lags 1 to 4 of regressors used as instruments. Reduction of moment conditions by using the "collapse" option suggested by Roodman (2004).

Table 3: Netting out interest payments and debt forgiveness grants
(Dependent variable: Transformed index of country credit risk)

	(1)	(2)	(3)	(4)
	Aid w/o int.paym.	Grants w/o int.paym.	Aid w/o debt forg.	Grants w/o debt forg.
AID	4.870**	4.911***	5.480***	8.445***
	(2.49)	(2.88)	(3.16)	(4.35)
GNI	16.320**	14.937**	23.847**	15.907
	(2.09)	(2.00)	(2.41)	(1.53)
DEBT	-19.399**	-19.679***	-26.417***	-21.841***
	(-2.44)	(-2.82)	(-3.11)	(-2.73)
GROWTH	0.583***	0.583***	0.641***	0.680***
	(3.26)	(3.80)	(3.30)	(3.93)
INFLATION	-2.165*	-2.226*	-1.707	-2.227*
	(-1.71)	(-1.83)	(-1.54)	(-1.94)
GOV	11.094	10.876	14.401*	13.539*
	(1.56)	(1.42)	(1.81)	(1.86)
TRADE	0.277	0.336**	0.448***	0.334*
	(1.68)	(2.14)	(2.39)	(1.89)
RESERVES	0.249	0.329**	0.312**	0.242*
	(1.42)	(2.33)	(2.56)	(1.94)
Lagged IICT	0.909***	0.892***	0.840***	0.864***
	(12.16)	(14.60)	(14.08)	(14.47)
Observations	782	797	832	847
Countries	64	65	70	70
Instruments	61	61	61	61
J-statistic (p value)	0.19	0.35	0.19	0.32
Arellano-Bond (p value)	0.31	0.42	0.43	0.20

Notes: See Table 2.

Table 4: Different country groups
(Dependent variable: Transformed index of country credit risk)

	(1)	(2)	(3)	(4)	(5)
	no Lat.Am.	no Subs. Afr.	no Asia	Cap.M. access	No transition c.
AID	3.688**	5.903***	4.681**	5.685***	6.491***
	(2.36)	(3.34)	(2.43)	(2.92)	(2.87)
GNI	14.026	5.169	16.766*	15.891*	14.53*
	(1.59)	(0.50)	(1.99)	(1.79)	(1.99)
DEBT	-12.908*	-22.395**	-25.676***	-32.821***	-27.995***
	(-1.89)	(-2.56)	(-3.31)	(-3.89)	(-3.49)
GROWTH	0.505***	0.999***	0.5448***	0.848***	0.6310***
	(2.91)	(5.36)	(3.63)	(5.41)	(4.23)
INFLATION	-2.298**	-2.666**	-2.28*	-0.47	-2.014*
	(-2.11)	(-2.39)	(-1.81)	(-0.42)	(-1.73)
GOV	18.604***	12.489**	1.100	10.328	7.415
	(2.66)	(2.09)	(0.16)	(1.61)	(1.23)
TRADE	0.076	0.232	0.389**	0.475***	0.397**
	(0.90)	(1.21)	(2.00)	(2.82)	(2.33)
RESERVES	0.244	0.388***	0.397***	0.338***	0.360**
	(2.12)	(3.45)	(2.64)	(3.12)	(2.43)
Lagged IICT	0.877***	0.908***	0.901***	0.844***	0.930***
	(14.16)	(13.29)	(11.61)	(11.52)	(12.00)
Observations	518	602	690	733	804
Countries	49	46	59	60	65
Instruments	61	61	61	61	61
J-statistic (p value)	0.65	0.65	0.45	0.44	0.58
Arellano-Bond (p value)	0.25	0.95	0.40	0.36	0.25

Notes: In parentheses: Absolute values of t-statistics, based on a robust covariance-matrix. ***, **, *: significance levels of 1, 5, 10 percent. All regressions include time dummies. The estimator used is the Blundell an Bond (1998) one-step Systems-GMM estimator. Lags 1 to 4 of regressors used as instruments. Reduction of moment conditions by using the "collapse" option suggested by Roodman (2004).

Table 5: Structural breaks and nonlinear effects
(Dependent variable: Transformed index of country credit risk)

	(1)	(2)	(3)	(4)	(5)
	Through 1990	After 1990 Full sample	After 1990 no outliers no trans. count.	AID sq.	Aid * GOV
AID	4.853**	1.760*	2.171***	6.194***	8.582**
	(2.25)	(1.97)	(2.87)	(5.53)	(2.48)
AID squared				0.068	
				(0.31)	
AID * GOV					-1.015
					(-0.84)
GNI	23.315*	11.765*	13.111***	16.734*	19.842*
	(1.89)	(1.85)	(3.17)	(1.80)	(1.92)
DEBT	-26.153**	-6.167	-8.743**	-19,779**	-19.732**
	(-2.48)	(-0.88)	(-2.11)	(-2.31)	(-2.46)
GROWTH	0.684**	0.673***	0.530***	0.751***	0.681***
	(2.34)	(3.22)	(3.95)	(4.07)	(3.49)
INFLATION	-0.834	-1.578	0.172	-1.868*	-1.545
	(-0.50)	(-1.45)	(0.21)	(-2.08)	(-1.58)
GOV	16.888	-0.766	0.201	14.825*	23.338**
	(1.26)	(-0.17)	(0.00)	(2.07)	(2.37)
TRADE	0.746***	0.073	0.125*	0.299*	0.304**
	(3.12)	(0.86)	(1.67)	(1.86)	(2.00)
RESERVES	0.233	0.197***	0.303***	0.201*	0.214
	(1.46)	(2.65)	(4.14)	(1.99)	(1.64)
Lagged IICT	0.717***	0.803***	0.818***	0.837***	0.815***
	(9.76)	(13.30)	(19.26)	(13.41)	(12.00)
Observations	365	472	424	837	837
Countries	54	68	62	70	70
Instruments	53	63	62	66	66
J-statistic (*p* value)	0.37	0.38	0.71	0.21	0.27
A.-B. (*p* value)	0.27	0.56	0.90	0.32	0.30

Notes: See Table 2.

Figure 1: The effect of raising A_1 on the equilibrium value of K_2 $\left(\tilde{A}_1 > A_1\right)$