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Should Easier Access to International Credit Replace Foreign Aid?*

By

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Abstract

We examine the interaction between foreign aid and binding borrowing constraint for a recipient country. We also analyze how these two instruments affect economic growth via non-linear relationships. First of all, we develop a two-country, two-period trade-theoretic model to develop testable hypotheses and then we use dynamic panel analysis to test those hypotheses empirically. Our main findings are that: (i) better access to international credit for a recipient country reduces the amount of foreign aid it receives, and (ii) there is a critical level of international financial transfer, and the marginal effect of foreign aid is larger than that of loans if and only if the transfer (loans or foreign aid) is below this critical level.

Keywords: Foreign aid, foreign loans, borrowing constraint, economic growth, fungibility, public input.
JEL Classification: F34, F35, O11, O16.

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1 Introduction

Much has been written about the effectiveness or otherwise of foreign aid. Empirical studies on the subject can broadly be classified into three types: foreign aid works (see for example Dalgaard *et al.*, 2004; Hansen and Tarp, 2000); foreign aid does not work (see, for example, Easterly, 2003; Rajan and Subramanian, 2005); and foreign aid works under some conditions (Burnside and Dollar, 2000; Collier and Dollar, 2002).[1]

Convinced that foreign aid does not work, Bauer (1971) argued that it should be replaced by free or easier access to the international credit market. He argued that foreign aid is misused and the need to repay loans would make the recipients use them more effectively.[2]

Foreign aid and international credit can help foster the economic growth of a developing country through various channels: (i) they add to the investible resources for domestic investment, and, thus, augment capital stock; and (ii) they can bridge the foreign exchange gap of a developing country, which, in turn, may provide it with a necessary cushion to import capital goods.[3] Capital inflows may also generate two effects that can be detrimental to the recipient's economy: (i) aid, in particular, which is mainly transferred to the governments, may induce politicians to engage in its misappropriation; and (ii) capital inflows, particularly a large inflow of it, can result in overvaluation of exchange rate of a recipient country, which may render its exports less competitive in the world market. Since most of foreign aid constitutes direct transfers to governments, its impact on economic growth depends on how it is utilized. If aid is used to finance complementary goods in developing countries, such as infrastructure and human development, its effect will be positive. But if it crowds out private investment or is used to generate rent seeking activities by politicians, its effect will

[1]For a detailed review of the literature on foreign aid, see Lahiri, 2006; McGillivray *et al.*, 2006.

[2]Stern (1974) while reviewing Bauer (1971) made a robust defense of foreign aid as an instrument for development.

[3]These arguments are based on the so-called two-gap model of economic development. See, Chenery and Strout (1966).

be negative. As indicated by Harms and Lutz (2006), the net effect of aid on economic growth, therefore, will depend on which effect dominates.

Even when foreign aid is effective, it is not clear *a priori* that it is the best form of assistance from abroad.[4] In particular, better access to the international credit market could, for reasons outlined in Bauer (1971), be *more* effective than foreign aid. We shall examine if that is indeed the case, and revisit this issue both theoretically and empirically.

It should also be pointed out that both foreign aid and foreign lending are much lower than what many development practitioners would like. As far as foreign aid is concerned, although it was agreed by all parties at the United Nations (after the publication of the Pearson Commission Report in the 1960s) that developed countries should provide 1% of their national income as aid, the actual amount of aid has fallen far short of this figure, except for four or five countries. As for loans, there is extensive evidence to suggest that private firms in many developing countries face severe credit constraints. Galindo and Schiantarelli (2003) provide evidence for several Latin American countries. Harrison and McMillan (2003) find that many manufacturing firms in the Ivory Coast face severe credit constraints. Using firm-level data in the manufacturing sector from six African countries, Bigsten *et al.* (2003) estimate the extent of credit constraints among firms of various sizes. Héricourt and Poncet (2007) find binding credit constraints among private manufacturing firms in China. Finally, Rajan and Zingales (1998) provide extensive evidence of sector-level financial development (or the lack of it) for 41 developed and developing countries.

For our theoretical contribution, we construct a two-period, two-country (recipient and donor) trade-theoretic model where the recipient country is subject to a binding borrowing constraint. The donor gives foreign aid in period 1 for the provision of a public input. However, foreign aid is fully fungible and the recipient spends only a certain fraction of foreign aid for the public input and the rest is given back to the consumers as lump-sum

[4]See Addison *et al.* (2005) for a discussion on alternative ways of financing development assistance.

payments. This fraction is chosen optimally by the recipient government. In this framework, we compare the effect of a relaxation of the borrowing constraint with an equivalent amount of foreign aid, on the recipient welfare. We find that when the initial level of lending and foreign aid are low, the marginal effect on welfare of a change in foreign aid is larger than that of a relaxation of the borrowing constraint. When the initial levels of foreign aid and lending are large, we get the opposite effect.

We also consider a situation when the donor government choses the level of foreign aid optimally. We assume the donor to be altruistic.[5] To be more specific, we consider a simultaneous-move game where each government chooses respectively the instrument at its disposal. In this case we find that a relaxation of the borrowing constraint reduces the amount of foreign aid the donor gives.

From our theoretical analysis, we thus derive two testable hypotheses: (i) more loans reduces the level of foreign aid, and (ii) foreign aid is more (less) effective than loans if the initial level of the two variables is low (high). In our empirical analysis, we test these two hypothesis using a panel data on 114 aid-recipient countries for the period 1997-2008. Data on foreign aid is collected from the OECD, and to measure access to foreign borrowing, we take offshore bank loans data from the Bank of International Settlement (BIS) Locational Banking Statistics. We estimate two separate sets of regressions using the system Generalized Method of Moments (GMM) approach, mainly to address the endogeneity problem in multiple variables. In the first, we regress aid against loans and other control variables. Our results strongly support hypothesis (i) above. In the second, in order to test hypothesis (ii) we regress growth rate of GDP against aid, the square of aid, loans, the square of loans and other controls. We find a U-shaped relationship between growth and loans, and an inverted U-shaped relationship between growth and aid. These two together imply that the marginal

[5]It is well known that in reality donors have many motives for giving foreign aid, and self-interest also play a major role in aid allocation. See, for example, Maizels and Nissanke (1984).

effect of aid on growth is bigger (smaller) than that of loans at lower (higher) levels of the two variables, supporting our theoretical findings.

The layout of the paper is as follows. In the following section, we shall develop the theoretical framework. This section is divided into two subsections. In subsection 2.1, we consider the case where foreign aid is exogenous and examine the effects of foreign aid and loans on growth. In section 2.2, foreign aid is optimally chosen by the donor and there we examine the effect of a relaxation of the borrowing constraint on the optimal level of foreign aid. Section 3 carries out the empirical analysis. It is also divided into two subsection. In subsection 3.1, we estimate the effect of loans on foreign aid, and in section 3.2 the effects of aid and loans on growth. Some concluding remarks are made in section 4.

2 The Basic Theoretical Model

There are two countries, and two periods. The countries are a recipient country of foreign aid (labeled α) and a donor country (labeled β). In period 1, the recipient country receives T amount of foreign aid from the donor. Foreign aid is given for the purpose of providing a public input, the level of which is denoted by g. However, we assume that foreign aid is fully fungible and the recipient can allocate a proportion of it as lump-sum payments to consumers.[6] The recipient government uses a proportion λ of foreign aid and an amount $\bar{L}$ obtained by lump-sum taxation of its nationals, to pay for a public input g which increases production in period 2. Given the difficulties in most countries with lump-sum taxation, we shall take $\bar{L}$ to be exogenous.[7] In each period and in each country, there are n private goods produced and consumed. The consumption side of the two economies is represented by the inter-temporal expenditure function of a representative consumer: $E^{\alpha}(p, p/(1+r), u^{\alpha})$ and $E^{\beta}(p, p/(1+r^{*}), u^{\beta}-\theta u^{\alpha})$ respectively, where u^{α} and u^{β} are utility levels, and r and r^{*} interest

[6]Many studies have found that, for all intents and purposes, aid is indeed fungible, See, for example, Boone, 1996; Feyzioglu *et al.*, 1998; and Swaroop *et al.*, 2000.

[7]See Wilson (1991) on limitations on lump-sum taxation.

rates, in the two countries, and the nx1 vector p is the vector of prices.[8] In specifying the expenditure function in the donor country, we have assumed that its representative consumer is altruistic toward its counterpart in the recipient country and θ is the altruism parameter. We shall assume both countries to be small in goods market so that p is exogenously given. The revenue functions — which represent the total value added — in the two countries in period 1 are given by $R^{\alpha 1}(p, \bar{K})$ and $R^{\beta 1}(p)$ where $\bar{K}$ is the level of initial capital stock in the recipient country.[9] In period 2, the revenue functions are $R^{\alpha 2}(p, \bar{K} + I, g)$ and $R^{\beta 2}(p)$ where I is the level of investment made in period 1, $R^{\alpha 2}_{33} \leq 0$, and $R^{\alpha 2}_{22} < 0$. We also assume that private capital and public input are complements ($R^{\alpha 2}_{23} \geq 0$).

The inter-temporal budget constraint for the representative consumers are:

$$E^{\alpha}(p, p/(1+r), u^{\alpha}) + I = R^{\alpha 1}(p, \bar{K}) + \frac{R^{\alpha 2}(p, \bar{K} + I, g)}{1+r} - \bar{L} + f((1-\lambda)T), \quad (1)$$

$$E^{\beta}(p, p/(1+r^*), u^{\beta} - \theta u^{\alpha}) = R^{\beta 1}(p) + \frac{R^{\beta 2}(p)}{1+r^*} - T, \quad (2)$$

where $(1-\lambda)T$ is the part of foreign aid that is returned to the representative consumer in recipient country as a lump-sum transfer. Following Lahiri and Raimondos-Møller (1997), we assume that there is a diminishing return to the part of foreign aid that is returned to the consumers in a lump-sum fashion, and this is represented by the function $f(\cdot)$ with $f' > 0$ and $f'' < 0$. This assumption is also consistent with findings in the recent literature that show that, due to a whole host of reasons, the marginal effect of a large flow of foreign aid can be negligible or negative (see Mavrotas (2006) for a discussion of the issues).

The budget constraint for the government in the recipient country is:

$$g = \bar{L} + \lambda T, \quad (3)$$

[8]The partial derivative of an expenditure function with respect to the price of a good is the compensated demand function of that good. For this and other properties of the the expenditure function see, for example, Dixit and Norman (1980).

[9]Endowment other than capital are omitted as they do not vary in our analysis. The partial derivative of a revenue function with respect to the price of a good is the output supply function of that good.

i.e., public input is financed by a fixed lump-sum taxation and a proportion of foreign aid.

The level of investment in the recipient country is determined optimally by the representative consumer. It is done by setting $\partial u^{\alpha}/\partial I = 0$, taking r as given. This gives:

$$1 = R_2^{\alpha 2}/(1+r). \tag{4}$$

The left-hand side is the marginal cost of investment in the sense of consumption foregone, and the right-hand side is the present value of the marginal return to investment.

We assume that the representative consumer in the donor country can borrow as much as he/she wants from the international capital market at an exogenous interest rate r^*. However, the representative consumer in the recipient country is subject to a binding borrowing constraint. He/she can borrow only the amount $\bar{B}$ in period 1 and repay this amount with interest in period 2. This constraint is given formally by:

$$B^{\alpha}(r,T,\lambda) \equiv p' E_1^{\alpha} + I - \left[R^{\alpha 1} - \bar{L} + f((1-\lambda)T)\right] = \bar{B} = \frac{R^{\alpha 2} - p' E_2^{\alpha}}{1+r}, \tag{5}$$

where $B^{\alpha}(\cdot)$ is the demand for loans in period 1 in the recipient country.[10]

This completes the description of the basic model. It has five equations in (1)-(5) and five endogenous variables u^{α}, u^{β}, g, I and r.

2.1 The case of exogenous aid

In this section we shall first consider the optimal determination of the proportion λ allocated for the provision of public input g. Having done so, we shall then compare the effect of a change in the level of foreign aid with that of a relaxation of the borrowing constraint.

[10] E_i^{α} is the partial derivative with respect to the ith argument of the expenditure function. For example, E_1 is the nx1 vector of period-1 consumptions. All vectors are column vectors and for a vector x, its transpose is denoted by x'.

Differentiating (1)-(3) and using (4) and (5), we get:

$$E_3^{\alpha}\ du^{\alpha} = -\frac{\bar{B}}{1+r}\cdot dr + \left[\frac{\lambda R_3^{\alpha 2}}{1+r} + (1-\lambda)f'\right] dT + T\left[\frac{R_3^{\alpha 2}}{1+r} - f'\right] d\lambda, \quad (6)$$

$$E_3^{\beta}\ d(u^{\beta} - \theta u^{\alpha}) = -dT, \quad (7)$$

where E_3^i is the reciprocal of the marginal utility of income in country i ($i = \alpha,\ \beta$). It is also well-known that $E_{33}^i > 0$ ($i = \alpha,\ \beta$) implying diminishing marginal utility of income.

The first term on the right-hand side of (6) is the intertemporal term-of-trade effect: an increase in the rate of interest lowers the welfare of the borrower. For a given level of the interest rate, an increase in foreign aid raises the welfare of the recipient in two ways: (i) it increases the provision of the public input and thus welfare and this effect is proportional to λ (the proportion of aid allocated for public input provision), and (ii) it increases the lump-sum income of the recipient and this is proportion to the proportion of aid not allocated for public input provision. An increase in λ has a positive effect on recipient welfare (via increase in the provision of public input) and a negative effect (a decrease in the lump-sum income out of foreign aid). An increase in foreign aid reduces the income of the donor and, thus, its welfare, for a given level of recipient welfare (see (7)).

Differentiating (4), we get:

$$R_{22}^{\alpha 2} dI = -R_{23}^{\alpha 2} dg + dr. \quad (8)$$

That is, an increase in public input g increases the level of investment because of the complementarity between the public input and private capital, and an increase in the rate of interest r reduces investment by reducing the present value of the rate of return on investment.

Differentiating (5), and using (6), (3) and (8), we find:

$$-\frac{\bar{B}\epsilon^{\alpha}}{1+r}\cdot\ dr = d\bar{B} + \left[-c_y^{\alpha 1}\left\{\frac{\lambda R_3^{\alpha 2}}{1+r} + (1-\lambda)f'\right\} + \frac{\lambda R_{23}^{\alpha 2}}{R_{22}^{\alpha 2}} + (1-\lambda)f'\right] dT$$
$$-T\left[\frac{c_y^{\alpha 1} R_3^{\alpha 2}}{1+r} - \frac{R_{23}^{\alpha 2}}{R_{22}^{\alpha 2}} + f'(1-c_y^{\alpha 1})\right] d\lambda, \quad (9)$$

where $c_y^{\alpha 1}$ is the marginal propensity to spend on period 1 consumption, *i.e.*,

$$c_y^{\alpha 1} = \frac{\partial (p' E_1^\alpha)}{\partial u^\alpha} \cdot \frac{1}{E_3^\alpha} = \frac{p' E_{13}^\alpha}{E_3^\alpha} > 0,$$

and ϵ^α is the absolute value of the loans demand elasticity with respect to the interest rate:

$$\epsilon^\alpha = -\frac{\partial B^\alpha}{\partial (1+r)} \cdot \frac{1+r}{\bar{B}} > 0.$$

A relaxation of the borrowing constraint $\bar{B}$ increases the supply of loans and thus reduces the rate of interest. An increase in T increases utility of the recipient and thus the level of private consumption in period 1. This increases the demand for loans and thus the equilibrium interest rate. This effect is given by the first term in the coefficient of dT in (9). An increase in T increases the provision of public input making investments more profitable. This increases the demand for investment expenditure and, thus, the demand for loans, increasing the equilibrium interest rate. This is the second term. An increase in T increases the lump-sum income of the recipient in period 1, reducing the demand for loans and, thus, the equilibrium interest rate. This effect is given by the third term in the coefficient of dT. An increase in λ, like an increase in T, has three effects on the rate of interest. The only difference is that an increase in λ reduces the lump-sum income of the recipient in period 1 and this increases the demand for loans and the equilibrium interest rate.

Finally, substituting (9) in (6), we get:

$$\begin{aligned} E_3^\alpha \, du^\alpha &= \frac{1}{\epsilon^\alpha} \cdot d\bar{B} + T \left[\left\{ \frac{R_3^{\alpha 2}}{1+r} - f' \right\} \left\{ \frac{\epsilon^\alpha - c_y^{\alpha 1}}{\epsilon^\alpha} \right\} + \frac{R_{23}^{\alpha 2}}{\epsilon^\alpha R_{22}^{\alpha 2}} - \frac{f'}{\epsilon^\alpha} \right] d\lambda \qquad (10) \\ &+ \left[\left\{ \frac{\lambda R_3^{\alpha 2}}{1+r} + (1-\lambda) f' \right\} \left\{ \frac{\epsilon^\alpha - c_y^{\alpha 1}}{\epsilon^\alpha} \right\} + \frac{\lambda R_{23}^{\alpha 2}}{\epsilon^\alpha R_{22}^{\alpha 2}} + \frac{(1-\lambda) f'}{\epsilon^\alpha} \right] dT \end{aligned}$$

A relaxation of the borrowing constraint (*i.e.*, an increase in $\bar{B}$) increases welfare by reducing the interest rate. The effects of T and λ on u^α now have, in addition to the ones discussed after (6), the effects via induced changes in the interest rate.

After setting $\partial u^{\alpha}/\partial\lambda = 0$ and some simplifications, we get the first order condition for the recipient government's optimization problem:

$$u^{\alpha}_{\lambda}(\lambda, T, \bar{B}) = \left[\epsilon^{\alpha} - c_y^{\alpha 1} - \frac{\epsilon^{\alpha}_{23}}{\epsilon^{\alpha}_{22}}\right] R_3^{\alpha 2} - (1+r) f' \left(1 + \epsilon^{\alpha} - c_y^{\alpha 1}\right) = 0, \tag{11}$$

$$\begin{aligned} \text{where} \quad \epsilon^{\alpha}_{23} &= \frac{\partial R_3^{\alpha 2}}{\partial(\bar{K}+I)} \cdot \frac{\bar{K}+I}{R_3^{\alpha 2}} = R_{23}^{\alpha 2} \cdot \frac{\bar{K}+I}{R_3^{\alpha 2}} > 0, \\ \epsilon^{\alpha}_{22} &= -\frac{\partial R_2^{\alpha 2}}{\partial(\bar{K}+I)} \cdot \frac{\bar{K}+I}{R_2^{\alpha 2}} = -R_{22}^{\alpha 2} \cdot \frac{\bar{K}+I}{R_2^{\alpha 2}} = -R_{22}^{\alpha 2} \cdot \frac{\bar{K}+I}{1+r} > 0. \end{aligned}$$

There are two groups of effects from a rise in λ on the welfare of the recipient. The first is via an increase in the public input provision and these effects are given by the first term in (11). The second group of effects comes via a reduction in the lump-sump income out of foreign aid (induced by an increase in λ), and these effects are given by the second term in (11).

Substituting (11) into (10) we get

$$E_3^{\alpha}\, du^{\alpha} = \frac{1}{\epsilon^{\alpha}} \cdot d\bar{B} + f' \left[1 + \frac{1 - c_y^{\alpha 1}}{\epsilon^{\alpha}}\right] dT. \tag{12}$$

We are now in a position to compare the effect of foreign aid with that of a relaxation of the borrowing constraint. We assume that at low level of borrowing, price elasticity of demand for loans (ϵ^{α}) is very high. This would be the case, for example, when there is some indivisibility in the use of loans. We have already assumed that f' (marginal effect of aid) is large and positive at low levels of foreign aid. From these two assumptions and (12) it follows that at lower levels of borrowing and foreign aid, a relaxation of the borrowing constraint will have a smaller effect on recipient welfare than an equivalent increase in foreign aid, but at higher levels of borrowing and foreign aid, the effects will be just the opposite. This result is stated formally in the following proposition.

Proposition 1 *At low (high) levels of borrowing and foreign aid, an increase in foreign aid has a bigger (smaller) effect on recipient welfare than an equivalent relaxation in the borrowing constraint.*

The above proposition will be tested in section 3.2.

2.2 Borrowing Constraints and Aid

In this section we shall examine how the optimal values of aid T change when the borrowing constraint facing the recipient is relaxed a little. For doing so, we shall consider the optimal determination of the amount of aid T and the proportion λ allocated for the provision of public input g. In particular, we shall consider a simultaneous game between two governments: the donor decides the level of T and the recipient λ. The first-order condition for the recipient government is the same as (11). To obtain the first-order condition for the donor government, we first substitute (10) in (7) to get:

$$E_3^\beta du^\beta = \frac{\theta E_3^\beta}{E_3^\alpha \epsilon^\alpha} \cdot d\bar{B} + \frac{T\theta E_3^\beta}{E_3^\alpha} \left[\left\{ \frac{R_3^{\alpha 2}}{1+r} - f' \right\} \left\{ \frac{\epsilon^\alpha - c_y^{\alpha 1}}{\epsilon^\alpha} \right\} + \frac{R_{23}^{\alpha 2}}{\epsilon^\alpha R_{22}^{\alpha 2}} + \frac{f'}{\epsilon^\alpha} \right] d\lambda \quad (13)$$

$$+ \quad \left[-1 + \frac{\theta E_3^\beta}{E_3^\alpha} \left(\left\{ \frac{\lambda R_3^{\alpha 2}}{1+r} + (1-\lambda) f' \right\} \left\{ \frac{\epsilon^\alpha - c_y^{\alpha 1}}{\epsilon^\alpha} \right\} + \frac{\lambda R_{23}^{\alpha 2}}{\epsilon^\alpha R_{22}^{\alpha 2}} + \frac{(1-\lambda) f'}{\epsilon^\alpha} \right) \right] dT.$$

Most of the effects in (13) appear via changes in the utility of the recipient and those have been explained before. The only extra effect is the direct negative effect of T on donor welfare (see (7)). This extra effect is the first term in the coefficient of dT above.

From (13), setting $\partial u^\beta / \partial T$, we obtain the first-order condition for the donor country's optimization problem as:

$$\begin{aligned} u_T^\beta(\alpha, T, \bar{B}) &= -1 + \frac{\theta E_3^\beta}{E_3^\alpha} \left(\left\{ \frac{\lambda R_3^{\alpha 2}}{1+r} + (1-\lambda) f' \right\} \left\{ \frac{\epsilon^\alpha - c_y^{\alpha 1}}{\epsilon^\alpha} \right\} + \frac{\lambda R_{23}^{\alpha 2}}{\epsilon^\alpha R_{22}^{\alpha 2}} + \frac{(1-\lambda) f'}{\epsilon^\alpha} \right) \\ &= 0. \end{aligned} \quad (14)$$

Equations (11) and (14) simultaneously determine the equilibrium levels of T and λ in terms of $\bar{B}$ and other exogenous variables. We now want to examine the sign of $dT/d\bar{B}$. For this, we differentiate the two first-order conditions and simultaneously solve for $dT/d\bar{B}$ as:

$$\Delta \cdot \frac{dT}{d\bar{B}} = u^{\alpha}_{\lambda\bar{B}} u^{\beta}_{T\lambda} - u^{\alpha}_{\lambda\lambda} u^{\beta}_{T\bar{B}}, \tag{15}$$

where $\Delta = u^{\alpha}_{\lambda\lambda} u^{\beta}_{TT} - u^{\alpha}_{\lambda T} u^{\beta}_{T\lambda} > 0$ for the stability of the Nash equilibrium.

From the second-order condition for the recipient country's optimization problem, we have $u^{\alpha}_{\lambda\lambda} < 0$. It can be easily verified that $u^{\alpha}_{\lambda\bar{B}} > 0$ and that $u^{\beta}_{T\bar{B}} < 0$ if the marginal utility of income in the recipient country is sufficiently large (*i.e.*, E^{α}_{3} sufficiently small), and this is a reasonable assumption for a sufficiently poor country. From (15), it then follows that when $u^{\beta}_{T\lambda} < 0$, we have $dT/d\bar{B} < 0$, *i.e.*, borrowing and foreign aid are substitutes. The sufficient condition $u^{\beta}_{T\lambda} < 0$ is equivalent to saying that for the donor the two instruments are strategic substitutes. Formally,

Proposition 2 *A relaxation of the borrowing constraint reduces the amount of foreign aid if the donor's reaction function is downward sloping and if the marginal utility of income for the recipient is sufficiently large.*

A relaxation of the borrowing constraint benefits the recipient country for a given level of foreign aid. This effect on the welfare of the recipient also affect the welfare of the donor as it is altruistic. However, the marginal benefit of giving aid is weighted by the ratios of the marginal utility of income levels of the two countries in the welfare calculations. If the marginal utility of income of the recipient is higher than that of the donor, a relaxation of the borrowing constraint reduces the marginal benefit of giving aid without altering the marginal cost (which is unity), and thus reduces the optimal level of foreign aid. This is the direct effect. There is an indirect effect via an induced change in the value of λ. A relaxation of the borrowing constraint reduces the interest rate and thus increases the present value of the

marginal benefit of increasing λ (via an increase in the level of the public input provision). This increases the equilibrium level of λ. This increase in λ will reduce the equilibrium level of foreign aid if aid and λ are strategic substitutes for the donor.

The proposition will also be tested in section 3.1

3 Empirical Analysis

3.1 Borrowing and foreign aid

3.1.1 Description of data

We begin the empirical analysis by testing the second proposition of our theoretical model that a relaxation of borrowing constraints reduces the amount foreign aid received. Our data set comprises 114 aid-recipient countries over the period 1997-2008.[11] This study offers a separate analysis on the allocation of total and bilateral foreign assistance, whose data are taken from the online database of Development Aid Committee (DAC-2011) of the OECD.[12] The aid data contain net disbursements for development objectives and, thus, exclude military aid. We convert these data into constant USD2005 using the consumer price index for low and middle income countries. The figures for foreign aid are typically corrected for the size of the recipient countries. In the literature, there are two alternative ways for doing so: (i) divide foreign aid received by population of the recipient, *i.e.*, compute aid per capita (see, for example, Maizels and Nissanke, 1984; Trumbull and Wall, 1994; Younas and Bandyopadhyay, 2009; Younas, 2008), or (ii) compute foreign aid as a percentage of the GDP of the recipient country (see, for example, Boone, 1996; Burnside and Dollar, 2000; Hansen and Tarp, 2001; Baliamoune-Lutz and Mavrotas, 2009). In this paper, we shall use

[11] The reason for starting our analysis from this time period is due to the availability of cross-border lending data by the reporting banks from the Bank of International Settlements.

[12] Total aid is the sum of bilateral and multilateral aid. Since multilateral assistance mostly contains soft loans, we limit our focus on the other two types of aid.

both of these alternatives.

To measure access to foreign borrowing, we take offshore bank loans data from the Bank of International Settlement (BIS) Locational Banking Statistics.[13] These data contain cross-border loans to all sectors in developing countries from banks located in the BIS reporting countries. Since these are cross-border loans, local lending by banks in a BIS member country is not included. For example, loans vis-à-vis India are those from BIS reporting banks located outside of India. India is a BIS reporting country but local lending in foreign currencies by banks located in India are not included in the cross-border borrowing. The cross-border lending data are based on the residence of the reporting institutions and, therefore, measure the activities of all banking offices residing in each reporting country. Such offices report exclusively on their own unconsolidated business, which, thus, includes international transactions with any of their own affiliates.[14]

BIS adjusts the quarterly loans data for exchange rate changes. It also converts the relevant flow of new loans (net of repayments) in each quarter of the year into its original currency using end-of-period exchange rates, and subsequently converts the changes in stocks into dollar amounts using period-average exchange rates. We convert quarterly observations into annual observations by summing data for the four quarters. As in the case of foreign aid, the figures for loans are also corrected for the size of the loans recipient country in two different ways: (i) in per capita term, and (ii) as percentage of the GDP of the loans recipient country. Appendix A gives the list of countries for which we have computed the loans figures.

[13] In the literature there are a few alternative data sources for credits. The country-level measures of credit constraints come from the Financial Structure Database, compiled by Beck *et al.*, (2000) and updated by Beck and Demirgüç-Kunt (2009). The sector level variables such as external finance dependence and asset tangibility come from Rajan and Zingales (1998), and these have been updated in Chor and Manova (2011). The third is the BIS data (see, for example, Papaioannou (2009) and Hermann and Mihaljek (2011)). The first two sources give us information on the extent of credit constraints and the third source gives us data on the flow of foreign loans. Since the purpose of this paper is to compare the flow of net foreign aid with that of net foreign loans received by a country, we use the third source.

[14] Detailed information on the locational banking statistics is available on the BIS website under http://www.bis.org/statistics/.

While drawing control variables, we take guidelines from the empirical literature on aid. GDP per capita (in constant USD2000) captures the altruistic motivation for aid allocation. An obvious drawback of using GDP per capita as a proxy for economic need results from its skewed distribution due to high income inequalities in developing countries. Thus, as an alternative measure of economic needs, we also employ infant mortality rates in some of our models' specifications.[15] Population is included to examine the size related biases in aid allocation as past studies consistently find that countries with smaller population receive more aid.[16] Trade openness (percentage of exports plus imports to GDP) captures the influence of trade and macroeconomic policies of a developing country on aid allocation. This also resonates well with the commercial motives of donor nations in giving more aid to economically open regimes (*e.g.*, Younas, 2008). While inflation measures macroeconomic instability, its squared term is included to examine its diminishing effect on aid. Data for all these control variables are taken from the online resource of World Development Indicators (2010) of the World Bank.

An overwhelming empirical literature on aid finds that democratic countries receive more aid (*e.g.*, Alesina and Dollar, 2000; Trumbull and Wall, 1994). Thus, we employ data on "political rights and civil liberties" from Freedom House (2010). "Political rights" refers to freedom of the people to participate in the political process through voting, organizing their own political party, and forming effective opposition, while "civil liberties" entail the freedoms of expression, religious belief, movement, and right to form unions. Each of these two indices is measured on a scale from 1 (best) to 7 (worst). Following Trumbull and Wall (1994) and Younas and Bandyopadhyay (2009) among others, we first add and then revert these two indices so that the resulting index ranges from 2 (worst) to 14 (best). As a

[15]The World Bank (2010) defines infant mortality rate as the number of infants dying before reaching one year of age, per 1000 live births in a given year. Some data observations for infant mortality rate are missing for some countries. Since these values change slowly over time, we interpolated missing observations by calculating averages from available values (Younas and Bandyopadhyay, 2009; Younas, 2008).

[16]See seminal study of Dudley and Montmarquette (1976) for a detailed discussion about the small country effect and foreign aid allocation.

robustness check, we also employ data on "voice and accountability" compiled by Kaufmann *et al.* (2009). This index scores between -2.5 and 2.5, where a higher value indicates that citizens are able to participate in selecting their government, and enjoy freedom of expression, freedom of association and free media.

In addition, all of our econometric specifications include time-invariant country-specific fixed effects to account for the usual politico-strategic considerations for aid allocation.[17] We also include time dummy variables in all specifications to account for unexpected events such as flood, drought or other calamities, which may lead to aid spikes for any given year.

3.1.2 The empirical methodology

The following econometric concerns guide our choice of empirical methodology; ignoring these may cause the estimates to be biased and inconsistent: (i) the joint effect of multiple endogenous variables in aid regressions such as foreign loans, GDP per capita, trade openness, among others. (ii) unobserved country-specific factors that may correlate with other explanatory variables; and, (iii) persistence in aid allocation over time. In their influential paper on aid, Hansen and Tarp (2001) recommend using a dynamic panel generalized method of moment (GMM) estimator for deriving estimation results. This method is particularly useful when endogeneity is suspected in multiple variables, as in our application.[18]

In an empirical cross-country analysis, one can employ two kinds of GMM panel estimators: the difference-GMM estimators as proposed by Arellano and Bond (1991) and the system-GMM estimator as proposed by Blundell and Bond (1998). As for endogeneity, Arellano and Bover (1995) point out that the lagged levels as used in the difference-GMM are often poor instruments for the first differences. The system-GMM uses additional moment

[17] See Dreher *et al.* (2009) and Kuziemko and Werker (2006) for a detailed discussion on these considerations for aid allocation.

[18] Lack of finding appropriate instruments for many endogenous variables and non-availability of their data for developing countries renders the alternative method of two-stage least square (2SLS) infeasible, and the use of invalid instruments could contaminate the estimation results rather than improve them.

conditions and combines the regressions, one in first differences and one in levels, using both lagged differences and lagged levels as instruments. This estimator reduces potential biases and is considered to increase efficiency (*e.g.*, Asiedu and Lien, 2011; Bandyopadhyay *et al.*, 2011).

The system-GMM is also particularly well suited for large cross sections and a small number of time periods, which is the case in our sample. One potential concern, however, is that this estimator may increase the bias in the estimates if it utilizes more instruments. In each regression we tested, the numbers of instruments utilized are less than numbers of cross sections.[19] We employ the two-step GMM estimator in all regressions, which is considered asymptotically efficient and robust to all kinds of heteroskedasticity (Asiedu and Lien, 2011; Bandyopadhyay *et al.*, 2011). We also test for the validity of instruments and the presence of autocorrelation in each regression. For all the regressions, our results confirm the validity of instruments and the absence of autocorrelation.[20]

We estimate the following equation for aid:

$$ln(aid)_{it} = \beta_0 + \beta_1\ ln(loans)_{it} + \beta_2\ ln(aid)_{i,t-1} + X'_{it}\lambda + \eta_i + \sigma_t + \epsilon_{it}, \tag{16}$$

where subscripts i refers to countries, t to time, η_i to the country-specific effects, σ_t to the time-effect, X to the vector of control variables discussed above, and ϵ_{it} to the error term. For reasons mentioned before, we shall use two different measures of aid and loans: in per capita terms and as percentage of GDP. By its construction, the dynamic GMM estimator takes first difference of Equation (16), which eliminates the country-specific fixed-effects.

We prefer estimating a log-log model for the following reasons: (i) Most variables in our study vary across wide range (such as aid per capita, loans per capita, GDP per capita, population size and trade openness, among others), and also exhibit skewed distribution.

[19]Roodman (2007) states that in a study involving panel GMM estimator the number of instruments should ideally be less than the number of cross-sections, which is the case in all of our regressions.

[20]See the numbers of instruments utilized, Hansen J test, and second-order autocorrelation test reported in Tables 2-4.

Therefore, log transformation smooths the data; (ii) This reduces the effect of outliers on estimates; and (iii) The estimated coefficients can be interpreted as elasticities. The descriptive statistics are reported in Table 1.[21]

3.1.3 Estimation results

Tables 2-4 present results for aid equation. In Table 2, Column (1) reports the results of our baseline model, where we include log loans per capita, log GDP per capita and the lagged value of log total aid per capita. Consistent with the prediction of our theoretical model, the coefficient of log loans per capita is negative and statistically different from zero at the 1% level. As expected, the coefficient of log GDP per capita is also negative, but it is not statistically significant. The effect of lagged log aid per capita is positive and significant, implying persistence in aid allocation over time.

Column (2) reports results for the fully specified model by including other control variables. The coefficient of log loans per capita remains negative and significant at the 1% level, suggesting that a higher inflow of foreign loans is associated with a lower aid allocation. That is, developing countries having better access to foreign credits receive less foreign aid.

The negative coefficient of log GDP per capita also becomes statistically significant at the 1% level, which is consistent with the previous finding that poor countries receive more aid. A negative and significant coefficient of log population confirms the bias in aid allocation to the small countries. Both trade openness and inflation positively impact aid, while the negative coefficient of the squared term of log inflation underscores its diminishing effect. As expected, better conditions of political rights and civil liberties positively influence aid, but their effects are not statistically significant.

[21]Data on some observations for some variables also exhibit negative values. Following others in the literature, we linearly transform all variables by adding a constant in their values so that their lowest value equals zero.

As a robustness check, in column (3), we drop the political rights and civil liberties variable and instead include an alternative measure of democracy "log voice and accountability", which has positive and significant impact on aid at the 1% level. Likewise, in columns (4) and (5), we replace log GDP per capita with log infant mortality rate. The positive and significant impact of infant mortality rate confirms that, all else equal, poverty remains a key criterion for aid allocation. The significance of political rights and civil liberties in column (4) and voice and accountability in column (5) further confirms that more democratic regimes are rewarded with aid. In each regression in Table 2, both the Hansen J and 2nd order autocorrelation tests confirm the validity of the instruments and the absence of serial correlation, respectively.

The inclusion of the new control variables in our fully specified models in columns (2-5) leaves the coefficient of the loans per capita negative, robust at around 0.037 and statistically significant at the 1% level. This suggests that a one percent increase in loans per capita is associated with a 0.037 percent decline in aid per capita. In monetary terms, this amounts to a reduction of total aid per capita of 2.091 USD for the average, and 1.270 USD for the median country in our sample. Note that in both columns (3) and (4), the estimated coefficient of lagged log aid per capita is 0.289, while the estimated coefficient of log loans per capita is 0.037. Thus, the long run effect on aid per capita is 0.052 (= 0.037/(1 - 0.289)), which implies that the aid reduction effect of loans increases over time.

Let us consider an example to get a better sense of this aid reduction effect of loans. Take two countries in our study Mexico, who received the lowest (1.12 USD), and Cape Verde, who received the highest (328.43 USD) amount of average aid per capita over the sample period. Then a one percent increase in loans per capita will induce a reduction of aid per capita of 0.042 USD in the short run and 0.056 in the long run for Mexico; and this amounts stands at 12.152 USD in the short run and 16.422 in the long run for Cape Verde. In total dollar value, this reduces aid by 4.217 million USD in the short run and

5.622 million USD in the long run for Mexico, while for Cape Verde this reduction in aid amounts to 5.564 million USD in the short run and 7.519 million USD in the long run. To offer yet another perspective, this reduces total aid by 76.830 million USD in the short run and 103.824 million USD in the long run for China, which is the most populous country in our sample. For Dominica, which is the least populous country in our sample, this reduction stands at 0.806 million USD in the short run and 1.089 million USD in the long run.

Next we examine whether the influence of loans on aid changes when we replace our dependent variable log total aid per capita with log bilateral aid per capita in Equation (16). The results in Table 3 show that log loans per capita has both quantitatively and qualitatively approximately the same effect on log bilateral aid per capita as for log total aid per capita in Table 2. This is true both for our baseline model as well as for our fully specified models. In fact, the magnitude of the coefficient of log loans per capita shows a marginal decrease from 0.037 to 0.043 in our fully specified model in column (3). In monetary terms, this amounts to a reduction of bilateral aid per capita of 1.525 USD for the average, and 1.476 USD for the median country in our sample. This long run effect is 0.056 (= 0.043/(1 - 0.229)), which, further strengthens our findings that the aid reduction effect of loans increases over time. The sign, significance, and interpretation of all other control variables remain the same as above.[22]

Finally, we run regressions by redefining our dependent variables as log total aid/GDP, log bilateral aid/GDP, and our key independent variable as log loans/GDP. We use log transformations of these variables for the same reasons as mentioned above. Table 4 reports the estimation results of the fully specified models for both log total aid/GDP and for log bilateral aid/GDP. In 5 out of 6 regressions, the coefficients of log loans/GDP remain negative and significant at the 1% level. These results further strengthen our findings in Tables 2 and 3 and, hence, our theoretical prediction that better access to foreign credits

[22]The variable of political rights and civil liberties which was statistically insignificant in column (2) of Table 1 remains statistically significant for all regressions of log bilateral aid per capita.

reduces flow of aid to the developing countries. In fact, these findings suggest that the aid reduction influence of loans is substantially larger. For example, the size of the coefficient of log loans/GDP is 0.042 in log total aid/GDP regression in column (2), and its size is 0.071 for log bilateral aid/GDP regression in column (5). This suggests that the long run aid reduction effect of loans is 0.138 (= 0.042/(1 - 0.696)) for total aid/GDP, while it is 0.169 (= 0.071/(1 - 0.581)) for bilateral aid/GDP. The findings of all other control variables are as expected.

3.2 Borrowing, foreign aid and growth

3.2.1 Description of data and the empirical model

In this section, we test the first proposition of our theoretical model that at low (high) levels of borrowing and foreign aid, an increase in foreign aid has a bigger (smaller) effect on recipient welfare than an equivalent relaxation in the borrowing constraint. Following the empirical literature on aid-growth, we use growth rate of real GDP per capita to measure welfare (*e.g.*, Arndt *et al.*, 2010; Burnside and Dollar, 2000; Hansen and Tarp, 2001). The main variables of interests for testing this proposition are foreign aid and foreign loans.

Our empirical methodology still rests on the application of dynamic panel model based on the system-GMM estimator as employed for aid regressions in Table 2-4. This method has also been favored by several other recent contributions in aid-growth literature (*e.g.*, Arndt *et al.*, 2010; Asiedu and Nandwa, 2007; Hansen and Tarp, 2001). Our empirical strategy of using log-log model and, thus, necessary transformations of variables exhibiting negative values remains the same as discussed above in section 3.1.

Our empirical growth model takes the following form:

$$\begin{aligned} ln(growth)_{it} &= \beta_0 + \beta_1 ln(aid)_{it} + \beta_2 (ln(aid))^2_{it} + \beta_3 ln(loans)_{it} + \beta_4 (ln(loans))^2_{it} \\ &+ \beta_5 ln(growth)_{i,t-1} + Z'_{it}\gamma + \kappa_i + \tau_t + \mu_{it}, \end{aligned} \tag{17}$$

where subscripts i refers to countries, t to time, κ_i to the country-specific effects, τ_t to the time-effect, Z to the vector of control variables, and μ_{it} to the disturbance term. Once again we use two alternative measures for aid and loans: in per capita terms and as percentage of GDP. Our main variables of interests in equation (17) are: log aid, log loans, (log aid)^2 and (log loans)^2. Based on the first proposition of our theoretical model, we hypothesize that $\beta_1 > 0,\ \beta_2 < 0,\ \beta_3 < 0$, and $\beta_4 > 0$. That is, if these four coefficients turn out to be as hypothesized, then the marginal effect of aid is higher (lower) than that of loans when the magnitude of these two variables is small (large).

With regards to the selection of control variable, we take guidelines from the recent aid-growth literature (*e.g.*, Arndt *et al.*, 2010; Asiedu and Nandwa, 2007; Burnside and Dollar, 2000; Hansen and Tarp, 2001). Specifically, we include: log fixed capital formation as proxied by investment/GDP, log initial real GDP per capita, log inflation and its squared term, log government consumption/GDP, log secondary school enrollments, log rule of law and the lagged value of log growth rate of real GDP per capita. Rule of law reflects the strength and impartiality of the legal system, as well as the enforcement of property rights. For robustness analysis, we also replace log initial real GDP per capita with log infant mortality rates.

Many influential past studies conclude that countries' institutions are important for their economic growth and poverty alleviation (*e.g.*, Acemoglu *et al.*, 2001; Rodrik *et al.*, 2004). Thus, we also employ alternative measures of institutional quality to examine whether the results of our main variables of interest remain robust with their inclusion. Data for the rule of law and other institutional measures such as regulatory quality and government effectiveness are taken from Kaufmann *et al.* (2009). A higher score of these institutional indices indicates better quality.[23] Data for all the other control variables come from WDI (2010). The descriptive statistics of all these variables are presented in Table 1.

[23]While regulatory quality captures the ability of the government to formulate and implement sound policies and regulations promoting private sector development, government effectiveness mainly measures the quality of public services and the degree of its independence from political pressures.

3.2.2 Estimation results

Tables 5-8 report the results. In table 5, column (1) presents the estimation results of the model that includes log total aid per capita and log loans per capita but not their squared terms; it, however, includes all other standard control variables. We find that while the coefficient of log loans per capita is positive and significant at the 1% level, the effect of log aid per capita is not statistically significant. This finding of aid is consistent with Boone (1996), who concludes that aid has no significant impact on macroeconomic variables. Boone's empirical results, however, have been questioned by subsequent studies, which, unlike Boone, model aid-growth relation in the non-linear form (*e.g.*, Burnside and Dollar, 2000; Durbarry *et al.*, 1998; Hadjimichael *et al.*, 1995; Hansen and Tarp, 2001).

Column (2) presents estimation results of our fully specified model which also includes squared terms of both log total aid per capita and log loans per capita. The positively significant coefficient of log total aid per capita and negatively significant coefficient of its squared term confirm diminishing marginal returns to aid. This suggests that while some countries may utilize aid effectively, others lack the absorptive capacity or institutional quality with which to complement aid. This also indicates that after reaching a threshold level, the negative rent seeking effect of aid dominates its positive infrastructure building effect, as pointed out in Harms and Lutz (2006).[24] On the other hand, the negative significant coefficient of log loans per capita and positive significant coefficient of its squared term suggests an increasing marginal return to loans. The signs of the coefficients of these main variables of our interests agree with our prior.

We evaluate the marginal effect of aid on growth ($\beta_1 + 2\beta_2\ Aid$) at the mean value of aid per capita, 5.23.[25] We also evaluate this effect at its median value, 5.17, to deal with the

[24] See Hansen and Tarp (2001) for a detailed discussion on the theoretical arguments about non-linear effect of aid on economic growth, which relate to absorptive capacity constraints, Dutch disease and institutional destruction problems in developing countries.

[25] For every regressions, the marginal effect of aid at its mean value (along with the significance of the marginal effect) is also reported in Table 5.

problem of skewed distribution of aid across countries and time. These calculations show that a one percent increase in the aid per capita induces an increase of roughly 0.05 percent in growth when this effect is evaluated at its mean value, and it spurs about 0.06 percent of growth when evaluated at its median level. Interestingly, this marginal impact of aid does not turn negative even when it is evaluated at a very high value of aid in our sample. For example, this effect is 0.04% when evaluated at 90th percentile of aid. This suggests that although aid is most effective at low level and its marginal effect decreases quite fast, it never has a growth demoting effect in our sample countries and time periods. This finding appears to appeal to the morals of giving aid as underscored by Stern (1974), who argues for the transfer from the better-off to the worse-off countries if the benefit to the latter justifies the cost to the former.

Next we evaluate the marginal effect of loans on growth ($\beta_3 + 2\beta_4\ Loans$). Notice that both mean, 9.28, and median, 9.27, values of loans per capita are approximately the same; therefore, we report its marginal effect evaluated at its mean value.[26] This marginal effect of loans per capita on growth is 0.32, which is 84.38 percent higher than the marginal effect of aid per capita at its mean. This implies that starting at the mean level, an increase in aid will result in a decline in its positive effect on growth, while an increase in loans will augment its positive effect on growth. This, however, also implies that starting at a low level, aid has a larger positive effect on growth than loans. In fact, the negative effect of loans does not turn positive until it attains a fairly large value. These findings agree with the first proposition of our theoretical model.

The marginal effects of aid and loans computed above have been at their respective mean and median values. However, it is of interest to compute the critical level of financial transfer (either aid or loans) below (above) which the marginal effect of aid (loans) is larger. To do so we need to compute the value of X such that $\beta_1 + 2\beta_2 * X = \beta_3 + 2\beta_4 * X$. For column 2

[26]Like aid, the marginal effect of loans (along with the significance of the marginal effect) is also reported in Table 5.

of table 5, the value of X is computed as 6.479 which is higher than the mean value of total aid per capita and lower than the mean value of loans per capita.[27]

Many past studies state that a change in control variables can change the results in growth regression (see, for example, Dollar and Levin, 2004). Thus, we check whether the results of our variables of interest are robust to the introduction of alternative controls that explain growth. In column (3), we replace log initial GDP per capita with log infant mortality rates. Next, we replace log rule of law with log regulatory quality and log government effectiveness, one at a time (see columns 4 and 5). These results show that sign, significance and even the magnitude of the coefficients of the variables of our interest remain the same with the inclusion of other control variables.

We now briefly discuss the results of control variables. Our results strongly support the findings of Hansen and Tarp (2001) that the lagged growth rate has a robust and positive effect on its current rate as its estimated coefficients are significant at the 1% level in all the regressions. Although domestic investment as proxied by fixed capita formation positively affect growth, but its statistical significance is not robust across all the specifications. As expected, initial GDP per capita, infant mortality rates and government consumption negatively influence growth, while school enrollment positively affects growth. Our findings also support the assertion of Rodrik *et al.* (2004) that institutions are important for growth as the coefficients of rule of law, regulatory quality and government effectiveness are positive and significant at the 1% level. Lastly, the sign and significance of the coefficients of inflation and its squared term reflect its diminishing effect.

Next we replace log total aid per capita with log bilateral aid per capita as the former also includes part of multilateral assistance. The results in Table 6 show that the nonlinear effect of bilateral aid per capita is both quantitatively and qualitatively the same as that of total

[27]We also compute these values for all our regressions in which the squared values of *Aid* and *Loans* appear, and these are reported in Tables 5-8.

aid per capita, which further confirms decreasing marginal returns to aid. Like aid per capita, this positive effect on growth decreases, but it never becomes negative even at the maximum value of bilateral aid per capita in our sample. For example, in the regression results in column (2), the partial effect of log bilateral aid per capita evaluated at its maximum value in our sample (6.37) stands at 0.02.

The negative significant coefficient of log loans per capita and positive significant coefficient of its squared term in all the regressions further confirm increasing returns to loans. Table 6 also shows that, for all the regressions, the partial effect of loans per capita evaluated at its mean value is between 40 and 58 percent larger than the partial effects calculated in Table 5. These results further strengthen our key assertion that the effectiveness of aid in fostering economic growth is higher at lower levels, while the effectiveness of loans is higher at higher levels. Similar examples given for the results in Table 5 above to elucidate the first proposition of our theoretical model can be replicated in the case for results in Table 6. The estimated results of all other control variables are as expected and agree with our prior.

Finally, we take our main variables of interest as percentage of GDP: log total aid/GDP, log bilateral aid/GDP, log offshore bank loans/GDP and their respective squared terms. These results are presented in Table 7 and 8. In all the regressions, the sign and significance of the coefficients of aid and loans variables strongly confirm their non-monotonic relationship with growth, as found in the case of these variables in per capita form.

4 Conclusion

Should foreign aid be replaced by an easier access to international credit? Many in the past have argued an affirmative answer to this question. The argument lies partly on the belief that foreign aid is ineffective and partly on the argument that loans give more incentives to the recipients to utilize them wisely. Whether aid is ineffective is a moot point in the first

place. Second, whether loans have been effective in the past is also a moot point, as we have witnessed several financial crises involving developing countries.

In this paper we revisit these issues in a unified way. First of all we develop a theoretical model to examine the effect of both foreign aid and loans on the welfare of the recipient country. We also examine the interaction between foreign aid and loans. Our theoretical model has two periods and two countries: a recipient and a donor. The recipient country is subject to a binding borrowing constraint and the donor is altruistic toward the recipient. Foreign aid is given for the purpose of providing a public input; however, the recipient is able to optimally divert a proportion of it as lump-sum payments to the consumers. We find that both foreign aid and a relaxation of the borrowing constraint increase the welfare of the recipient. However, the marginal effect of a loan is larger than that of foreign aid if and only if the initial level of that transfer is sufficiently large. We also consider the case where the amount of foreign aid is optimally chosen by the donor, and find that a relaxation of the borrowing constraint reduces the equilibrium level of foreign aid.

Having established the above-mentioned propositions, we then test them using data. We use annual data for the period 1997-2008 for 114 aid-recipient countries. The sources are the OECD, the World Bank, Freedom House, Kaufmann *et al.* (2009), and the Bank of International Settlement. We employ a dynamic panel generalized method of moments (GMM) analysis to our data set, mainly to address the endogeneity problem in multiple variables. We use various controls apart from the main variables of interest and use different definitions of the main variables: aid per capita, loans per capita, aid as a proportion of GDP, and loans as a proportion of GDP. All of our regressions point to a robust non-linear relationship between growth and aid and between growth and loans. In particular, we find strong support for our theoretical prediction that there is a critical value of money transfer, and if the initial levels of loans or aid are lower than this critical level, then the marginal effect of foreign aid is larger than that of loans. We also find strong support of our other theoretical prediction that more loans do reduce the level of foreign aid.

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Table 1: Summary statistics for variables used in aid (Equation 16) as well as in growth regressions (Equation 17).

Variables	Obs.	Mean	Std. Dev.	Min	Max
Ln (Real net total aid per capita)	1347	5.234	0.316	0.000	6.530
Ln (Real net bilateral aid per capita)	1347	5.241	0.247	0.000	6.368
Ln (Net total aid/GDP)	1347	2.092	0.682	0.000	4.597
Ln (Net bilateral aid/GDP)	1347	1.939	0.512	0.000	4.525
Ln (Net offshore bank loans per capita)	1368	9.279	0.260	0.000	10.288
Ln (Net offshore bank loans/GDP)	1362	4.471	0.145	0.000	5.158
Ln (GDP per capita constant 2000USD)	1359	6.940	1.206	4.390	9.739
Ln (Infant mortality)	1368	3.651	0.795	1.065	5.056
Ln (Population)	1368	15.828	1.873	11.172	21.004
Ln (Trade/GDP)	1334	4.312	0.487	2.763	5.647
Ln (Inflation)	1358	3.502	0.363	0.000	6.365
Ln (Political rights and civil liberties)	1368	1.975	0.486	0.788	2.639
Ln (Voice and accountability)	1368	0.961	0.302	0.000	1.502
Ln (Growth rate of real GDP per capita)	1362	3.496	0.167	0.000	4.154
Ln (Fixed capital formation/GDP)	1266	3.003	0.394	0.742	4.121
Ln (Initial GDP per capita)	1366	6.827	1.188	4.642	9.342
Ln (Government consumption/GDP)	1279	2.592	0.406	0.975	4.242
Ln (School enrollment)	1037	3.906	0.655	1.609	4.737
Ln (Rule of law)	1360	1.014	0.251	0.000	1.590
Ln (Regulatory quality)	1357	1.161	0.238	0.000	1.656
Ln (Government effectiveness)	1344	1.065	0.251	0.000	1.563

Note: Data for all variables range from 1997-2008. All of the ratios are defined as percentage of GDP. Total aid is the sum of bilateral and multilateral aid. Loans data from Bank for International Settlement (BIS) is adjusted for exchange rate movements (done by BIS).

Table 2: Dependent variable: Ln (Total aid per capita); Estimation technique: the system-GMM

Independent Variables	(1)	(2)	(3)	(4)	(5)
Ln (Offshore bank loans per capita)	-0.055*** (0.000)	-0.039*** (0.000)	-0.037*** (0.000)	-0.036*** (0.000)	-0.037*** (0.000)
Ln (GDP per capita)	-0.026 (0.128)	-0.040*** (0.000)	-0.050*** (0.000)		
Ln (Total aid per capita) lagged	0.591*** (0.000)	0.319*** (0.000)	0.289*** (0.000)	0.310*** (0.000)	0.289*** (0.000)
Ln (Population)		-0.050*** (0.000)	-0.049*** (0.000)	-0.044*** (0.000)	-0.045*** (0.000)
Ln (Political rights and civil liberties)		0.007 (0.402)		0.051*** (0.000)	
Ln (Trade openness)		0.073*** (0.000)	0.095*** (0.000)	0.009 (0.342)	0.01 (0.168)
Ln (Inflation)		0.550*** (0.000)	0.465*** (0.000)	0.532*** (0.000)	0.512*** (0.000)
Ln (Inflation) squared		-0.068*** (0.000)	-0.056*** (0.000)	-0.061*** (0.000)	-0.056*** (0.000)
Ln (Voice and accountability)			0.107*** (0.000)		0.152*** (0.000)
Ln (Infant mortality)				0.023*** (0.000)	0.038*** (0.000)
Hansen J test[1]	0.202	0.279	0.258	0.245	0.245
2nd order autocorrelation test[2]	0.286	0.388	0.519	0.406	0.536
# of observations	1225	1198	1198	1198	1198
# of countries, n	114	114	114	114	114
# of instruments, i	33	113	113	113	113
Instrument ratio, $r = n/i$	3.45	1.01	1.01	1.01	1.01
Time effect included	Yes	Yes	Yes	Yes	Yes

Notes for this and all subsequent tables: We employ two-step estimation for the system-GMM, which is considered asymptotically efficient and robust to all kinds of heteroskedasticity. Superscripts ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively. P values are in parentheses.

[1] The null hypothesis is that the instruments are not correlated with the residuals. (P values)

[2] The null hypothesis is that the error term exhibits no second-order serial correlation. (P values)

Table 3: Dependent variable: Ln (Bilateral aid per capita); Estimation technique: the system-GMM

Independent variables	(1)	(2)	(3)	(4)	(5)
Ln (Offshore bank loans per capita)	-0.036*** (0.000)	-0.042*** (0.000)	-0.043*** (0.000)	-0.036*** (0.000)	-0.039*** (0.000)
Ln (GDP per capita)	0.007 (0.626)	-0.022*** (0.000)	-0.028*** (0.000)		
Ln (Bilateral aid per capita) lagged	0.359*** (0.000)	0.242*** (0.000)	0.229*** (0.000)	0.201*** (0.000)	0.176*** (0.000)
Ln (Population)		-0.026*** (0.000)	-0.026*** (0.000)	-0.035*** (0.000)	-0.035*** (0.000)
Ln (Political rights and civil liberties)		0.040*** (0.000)		0.015** (0.033)	
Ln (Trade openness)		0.048*** (0.000)	0.057*** (0.000)	0.004 (0.660)	-0.004 (0.566)
Ln (Inflation)		0.487*** (0.000)	0.416*** (0.000)	0.518*** (0.000)	0.503*** (0.000)
Ln (Inflation) squared		-0.061*** (0.000)	-0.051*** (0.000)	-0.061*** (0.000)	-0.058*** (0.000)
Ln (Voice and accountability)			0.025*** (0.000)		0.066*** (0.000)
Ln (Infant mortality)				0.016*** (0.000)	0.021*** (0.000)
Hansen J test	0.064	0.241	0.365	0.266	0.240
2nd order autocorrelation test	0.322	0.375	0.385	0.428	0.541
# of observations	1225	1198	1198	1198	1198
# of countries, n	114	114	114	114	114
# of instruments, i	33	113	113	113	113
Instrument ratio, $r = n/i$	3.45	1.01	1.01	1.01	1.01
Time effect included	Yes	Yes	Yes	Yes	Yes

Table 4: Dependent Variable: Aid/GDP; Estimation technique: the system-GMM

Dependent Variables →	Ln (Total aid/GDP)			Ln (Bilateral aid/GDP)		
Independent Variables ↓	(1)	(2)	(3)	(4)	(5)	(6)
Ln (Offshore bank loans/GDP	-0.027***	-0.042***	-0.008	-0.074***	-0.071***	-0.036***
	(0.008)	(0.000)	(0.529)	(0.000)	(0.000)	(0.001)
Ln (GDP per capita)	-0.167***	-0.174***		-0.166***	-0.168***	
	(0.000)	(0.000)		(0.000)	(0.000)	
Ln (Total aid/GDP) lagged	0.683***	0.696***	0.785***			
	(0.000)	(0.000)	(0.000)			
Ln (Bilateral aid/GDP) lagged				0.568***	0.581***	0.679***
				(0.000)	(0.000)	(0.000)
Ln (Population)	-0.043***	-0.029***	-0.023***	-0.022***	-0.018***	-0.018***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln (Political rights and civil liberties)	0.026*		0.043***	0.035***		0.057***
	(0.100)		(0.000)	(0.005)		(0.000)
Ln (Trade openness)	0.033***	0.089***	0.013	0.048***	0.052***	0.024**
	(0.004)	(0.000)	(0.386)	(0.000)	(0.000)	(0.051)
Ln (Inflation)	0.236***	0.058	0.300***	0.614***	0.388***	0.726***
	(0.000)	(0.144)	(0.000)	(0.000)	(0.000)	(0.000)
Ln (Inflation) squared	-0.016***	0.007	-0.020***	-0.064***	-0.036***	-0.072***
	(0.005)	(0.174)	(0.006)	(0.000)	(0.000)	(0.006)
Ln (Voice and accountability)		0.192***			0.134***	
		(0.000)			(0.000)	
Ln (Infant mortality)			0.126***			0.32***
			(0.001)			(0.000)
Hansen J test	0.214	0.413	0.275	0.329	0.388	0.357
2nd order autocorrelation test	0.951	0.882	0.945	0.179	0.17	0.298
# of observations	1198	1198	1198	1198	1198	1198
# of countries, n	114	114	114	114	114	114
# of instruments, i	113	113	113	113	113	113
Instrument ratio, $r = n/i$	1.01	1.01	1.01	1.01	1.01	1.01
Time effect included	Yes	Yes	Yes	Yes	Yes	Yes

Table 5: Dependent variable: Ln (Growth rate of GDP per capita); Estimation technique: the system-GMM

Independent Variables	(1)	(2)	(3)	(4)	(5)
Ln (Total aid per capita)	0.012	0.222***	0.217***	0.153***	0.159***
	(0.494)	(0.000)	(0.000)	(0.002)	(0.000)
Ln (Total aid per capita) squared		-0.016***	-0.016***	-0.010**	-0.013***
		(0.001)	(0.001)	(0.024)	(0.003)
Ln (Offshore bank loans per capita)	0.969***	-0.685***	-0.735***	-0.449***	-0.702***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Ln (Offshore bank loans per capita) squared		0.054***	0.055***	0.044***	0.051***
		(0.000)	(0.000)	(0.000)	(0.000)
Ln (Growth rate of GDP per capita) lagged	0.190***	0.216***	0.214***	0.172***	0.278***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Ln (Fixed capital formation)	0.030*	0.007	0.01	0.027**	0.051***
	(0.068)	(0.556)	(0.221)	(0.026)	(0.000)
Ln (Initial GDP per capita)	-0.014	-0.007		-0.025***	-0.009
	(0.124)	(0.197)		(0.000)	(0.136)
Ln (Infant mortality)			-0.023***		
			(0.002)		
Ln (Inflation)	2.180***	1.906***	2.229***	1.305***	2.050***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln (Inflation) squared	-0.286***	-0.248***	-0.290***	-0.157***	-0.266***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln (Govt. consumption)	-0.031*	-0.033**	-0.032**	-0.065***	-0.028***
	(0.064)	(0.014)	(0.019)	(0.000)	(0.011)
Ln (School enrollment)	0.007	0.036***	0.006	0.052***	0.039***
	(0.777)	(0.002)	(0.551)	(0.000)	(0.001)
Ln (Rule of law)	0.058**	0.069***	0.081***		
	(0.019)	(0.002)	(0.002)		
Ln (Regulatory quality)				0.151***	
				(0.000)	
Ln (Government effectiveness)					0.077***
					(0.002)
Hansen J test	0.411	0.404	0.096	0.599	0.371
2nd order autocorrelation test	0.324	0.666	0.846	0.954	0.398
# of observations	917	917	917	917	917
# of countries, n	110	110	110	110	110
# of instruments, i	68	84	88	84	84
Instrument ratio, $r = n/i$	1.62	1.31	1.25	1.31	1.31
Time effect included	Yes	Yes	Yes	Yes	Yes
Marginal effect of aid		0.055***	0.050***	0.048***	0.023***
Marginal effect of loans		0.317***	0.286***	0.368***	0.244***
Critical Value of Aid/Loans (X)		6.479	6.704	5.574	6.727

Table 6: Dependent variable: Ln (Growth rate of GDP per capita); Estimation technique: the system-GMM

Independent Variables	(1)	(2)	(3)	(4)	(5)
Ln (Bilateral aid per capita)	0.014	0.233***	0.252***	0.185***	0.175***
	(0.648)	(0.000)	(0.000)	(0.002)	(0.000)
Ln (Bilateral aid per capita) squared		-0.017***	-0.018***	-0.014**	-0.014***
		(0.006)	(0.001)	(0.017)	(0.006)
Ln (Offshore bank loans per capita)	0.851***	-0.936***	-0.894***	-0.645***	-0.902***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Ln (Offshore bank loans per capita) squared		0.080***	0.074***	0.070***	0.080***
		(0.000)	(0.000)	(0.000)	(0.000)
Ln (Growth rate of GDP per capita) lagged	0.286***	0.234***	0.212***	0.162***	0.218***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln (Fixed capital formation)	0.016	0.01	0.015**	0.006	0.039***
	(0.348)	(0.307)	(0.041)	(0.543)	(0.000)
Ln (Initial GDP per capita)	-0.022**	-0.009		-0.030***	-0.014**
	(0.014)	(0.129)		(0.000)	(0.042)
Ln (Infant mortality)			-0.030***		
			(0.000)		
Ln (Inflation)	1.821***	1.891***	2.105***	1.095***	1.839***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Ln (Inflation) squared	-0.236***	-0.247***	-0.274***	-0.131***	-0.239***
	-0.001	(0.000)	(0.000)	(0.003)	(0.000)
Ln (Govt. consumption)	-0.029*	-0.033**	-0.040***	-0.049***	-0.042***
	(0.057)	(0.014)	(0.000)	(0.000)	(0.000)
Ln (School enrollment)	0.032	0.034***	-0.020*	0.055***	0.041***
	(0.162)	(0.002)	(0.064)	(0.000)	(0.001)
Ln (Rule of law)	0.057***	0.077***	0.059***		
	(0.010)	(0.000)	(0.000)		
Ln (Regulatory quality)				0.176***	
				(0.000)	
Ln (Government effectiveness)					0.092***
					(0.000)
Hansen J test	0.428	0.328	0.963	0.612	0.443
2nd order autocorrelation test	0.35	0.603	0.493	0.265	0.551
# of observations	917	917	917	917	917
# of countries, n	110	110	110	110	110
# of instruments, i	68	84	88	84	84
Instrument ratio, $r = n/i$	1.62	1.31	1.25	1.31	1.31
Time effect included	Yes	Yes	Yes	Yes	Yes
Marginal effect of aid		0.054***	0.063***	0.038***	0.028***
Marginal effect of loans		0.549***	0.479***	0.654***	0.583***
Critical Value of Aid/Loans (X)		6.026	6.229	4.940	5.729

Table 7: Dependent variable: Ln (Growth rate of GDP per capita); Estimation technique: the system-GMM

Independent Variables	(1)	(2)	(3)	(4)	(5)
Ln (Total aid/GDP)	0.024	0.145***	0.195***	0.107**	0.100***
	(0.149)	(0.000)	(0.000)	(0.022)	(0.002)
Ln (Total aid/GDP) squared		-0.029***	-0.037***	-0.023**	-0.023***
		(0.001)	(0.001)	(0.023)	(0.001)
Ln (Offshore bank loans/GDP)	0.490***	-3.135***	-4.222***	-4.820***	-6.511***
	(0.000)	(0.002)	(0.001)	(0.001)	(0.000)
Ln (Offshore bank loans/GDP) squared		0.368***	0.467***	0.557***	0.732***
		(0.001)	(0.000)	(0.000)	(0.000)
Ln (Growth rate of GDP per capita) lagged	0.108**	0.155***	0.196***	0.142***	0.203***
	(0.015)	(0.000)	(0.000)	(0.000)	(0.000)
Ln (Fixed capital formation)	0.004	-0.004	0.007	-0.031**	0.005
	(0.812)	(0.625)	(0.361)	(0.024)	(0.621)
Ln (Initial GDP per capita)	-0.024**	-0.030***		-0.041***	-0.034***
	(0.046)	(0.000)		(0.000)	(0.000)
Ln (Infant mortality)			-0.018**		
			(0.015)		
Ln (Inflation)	1.499***	1.939***	1.714***	1.349***	1.872***
	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)
Ln (Inflation) squared	-0.204***	-0.262***	-0.226***	-0.173***	-0.254***
	(0.005)	(0.000)	(0.000)	(0.000)	(0.000)
Ln (Govt. consumption)	-0.009	0.009	-0.022*	0.015	0.008
	(0.639)	(0.479)	(0.064)	(0.303)	(0.591)
Ln (School enrollment)	0.038*	0.057***	0.008	0.055***	0.051***
	(0.077)	(0.000)	(0.474)	(0.000)	(0.000)
Ln (Rule of law)	0.036	0.087***	0.065***		
	(0.212)	(0.000)	(0.000)		
Ln (Regulatory quality)				0.170***	
				(0.000)	
Ln (Government effectiveness)					0.098***
					(0.000)
Hansen J test	0.718	0.258	0.162	0.351	0.32
2nd order autocorrelation test	0.072	0.906	0.093	0.807	0.899
# of observations	917	917	917	917	917
# of countries, n	110	110	110	110	110
# of instruments, i	68	84	84	84	84
Instrument ratio, $r = n/i$	1.62	1.31	1.25	1.31	1.31
Time effect included	Yes	Yes	Yes	Yes	Yes
Marginal effect of aid		0.024***	0.040***	0.011***	0.004***
Marginal effect of loans		0.156***	-0.046***	0.161***	0.035***
Critical Value of Aid/Loans (X)		4.131	4.382	4.247	4.396

Table 8: Dependent variable: Ln (Growth rate of GDP per capita); Estimation technique: the system-GMM

Independent Variables	(1)	(2)	(3)	(4)	(5)
Ln (Bilateral aid/GDP)	0.014	0.219***	0.300***	0.178***	0.04
	(0.503)	(0.000)	(0.000)	(0.006)	(0.451)
Ln (Bilateral aid/GDP) squared		-0.051***	-0.061***	-0.041***	-0.010
		(0.001)	(0.000)	(0.005)	(0.338)
Ln (Offshore bank loans/GDP)	0.380***	-4.075***	-6.138***	-5.882***	-6.947***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln (Offshore bank loans/GDP) squared		0.472***	0.683***	0.669***	0.776***
		(0.001)	(0.000)	(0.000)	(0.000)
Ln (Growth rate of GDP per capita) lagged	0.180***	0.226***	0.241***	0.201***	0.248***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln (Fixed capital formation)	-0.026*	-0.010	-0.008	-0.020	0.025**
	(0.086)	(0.190)	(0.462)	(0.118)	(0.016)
Ln (Initial GDP per capita)	-0.032***	-0.024***		-0.034***	-0.028***
	(0.000)	(0.001)		(0.000)	(0.001)
Ln (Infant mortality)			-0.031***		
			(0.001)		
Ln (Inflation)	1.176***	1.295***	1.329***	1.120***	1.041***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Ln (Inflation) squared	-0.149***	-0.166***	-0.166***	-0.139***	-0.132***
	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)
Ln (Govt. consumption)	0.009	-0.001	-0.029***	-0.008	0.018*
	(0.587)	(0.909)	(0.000)	(0.525)	(0.066)
Ln (School enrollment)	0.055**	0.045***	-0.007	0.043***	0.049***
	(0.017)	(0.000)	(0.645)	(0.000)	(0.000)
Ln (Rule of law)	0.055**	0.081***	0.068***		
	(0.032)	(0.000)	(0.000)		
Ln (Regulatory quality)				0.184***	
				(0.000)	
Ln (Government effectiveness)					0.108***
					(0.000)
Hansen J test	0.589	0.232	0.193	0.428	0.486
2nd order autocorrelation test	0.104	0.792	0.705	0.99	0.955
# of observations	917	917	917	917	917
# of countries, n	110	110	110	110	110
# of instruments, i	68	84	88	84	84
Instrument ratio, $r = n/i$	1.62	1.31	1.25	1.31	1.31
Time effect included	Yes	Yes	Yes	Yes	Yes
Marginal effect of aid		0.021***	0.063***	0.019***	0.001
Marginal effect of loans		0.146***	-0.030***	0.100***	-0.008***
Critical Value of Aid/Loans (X)		4.105	4.327	4.268	3.988

Appendix 1: List of Countries in our sample

Country	Country	Country
Albania	Gambia	Nigeria
Algeria	Georgia	Oman
Angola	Ghana	Pakistan
Argentina	Grenada	Panama
Azerbaijan	Guatemala	Papua New Guinea
Bahrain	Guinea	Paraguay
Bangladesh	Guinea-Bissau	Peru
Benin	Guyana	Philippines
Bhutan	Haiti	Rwanda
Bolivia	Honduras	Samoa
Botswana	India	Senegal
Brazil	Indonesia	Seychelles
Burkina Faso	Iran	Sierra Leone
Burundi	Jordan	Slovenia
Cambodia	Kazakhstan	Solomon Islands
Cameroon	Kenya	South Africa
Cape Verde	Kyrgyz Rep.	Sri Lanka
Central African Rep.	Laos	St. Lucia
Chad	Lebanon	Sudan
Chile	Lesotho	Swaziland
China	Libya	Syria
Colombia	Madagascar	Tajikistan
Comoros	Malawi	Tanzania
Congo, DR	Malaysia	Thailand
Congo, Rep	Maldives	Togo
Costa Rica	Mali	Tonga
Cote d'Ivoire	Malta	Trinidad & Tobago
Croatia	Mauritania	Tunisia
Djibouti	Mauritius	Turkey
Dominica	Mexico	Turkmenistan
Dominican Rep.	Moldova	Uganda
Ecuador	Mongolia	Uruguay
Egypt	Morocco	Uzbekistan
El Salvador	Mozambique	Venezuela
Eritrea	Namibia	Vietnam
Ethiopia	Nepal	Yemen
Fiji	Nicaragua	Zambia
Gabon	Niger	Zimbabwe