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## Poverty reduction and aid policy

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## **Abstract**

This paper deals with the effectiveness of several alternative models of aid allocation in terms of poverty reduction. We use a model that admits the presence of diminishing returns to aid in the output and poverty functions. We shall discuss the impact of aid on poverty in a single country, showing that conditional aid to improve policies has a deeper impact than the other alternatives of aid allocation. But if the donor's aim is to maximise poverty reduction in a group of countries in presence of conflicts of interest between donor and recipient, a general rule to distribute aid cannot be stated a priori. Decreasing returns can offset the positive impact on incentives to improve policies. There is not something like a universal solution and aid policy should be tailored according to the recipient characteristics.

## **Outline**

1. Introduction
2. The model
3. Reducing poverty in a single country
4. Reducing poverty in a group of countries
5. Some examples
6. Concluding remarks



## 1. INTRODUCTION

The impact of foreign aid on recipient countries has received much attention in recent years. In our opinion, this is due to three main reasons. First, there is a widespread belief that the effectiveness of aid in terms of poverty reduction or growth promotion has been worse than expected. Nevertheless, empirical research is far from conclusive. Some studies, such as Mosley *et al.* (1987) and Boone (1994 and 1996) found that the impact of aid on growth or poverty is not statistically significant, Burnside and Dollar (2000) showed that the impact maybe positive but only in those countries showing a good policy framework, and Lensink and White (1998), Durberry *et al.* (1999) or Hansen and Tarp (2000) found that the impact is positive even in absence of good environments. Secondly, since aid flows decreased during the 1990's, their efficient allocation must be an issue of major concern, both for donors and for recipients. As pointed out by Alesina and Dollar (2000), this implies that efficient allocation must not be constrained by other priorities in the donors' agenda (as geostrategic or commercial concerns). Thirdly, as a consequence of the shortcomings of traditional management of aid, the World Bank (1998) has recently proposed a new approach on aid allocation based on the quality of policies implemented by the recipient countries. This new approach has stimulated a debate concerning the effectiveness of different rules to aid allocation.

Although this debate is recent, it is deeply linked to two issues that have a long tradition in the literature about foreign aid. On the one hand, *aid fungibility* (see, for example, Pack and Pack, 1993, Feyzioglu et al, 1998, or Devarajan and Swaroop, 1998). On the other hand, *conditionality*, which is the donor's reaction to fungibility by linking aid to the recipient's commitment to improve policies. During the 80's conditionality was mainly related to IMF and World Bank structural adjustment programs. Yet this sort of conditionality was severely criticised on the various grounds. First, because it may be extremely difficult to impose the adequate conditions (Killick, 1997). Second, because it may generate important problems of incentives in the recipient country (Collier, 1997, and Collier et al, 1997). Finally, because asymmetric information between the donor and the recipient may give rise to important costs (Svensson, 2000 and Cordella and Dell'Ariccia, 2002).



As a consequence of these problems with the traditional approach to conditionality, new approaches to implement aid policies were developed. Thus the seminal studies of Burnside and Dollar (2000) and Collier and Dollar (1999) set the foundations of an aid policy where *conditionality* was replaced by *selectivity*. Such approach is based on two assessments: Aid is unable to change domestic policies of the recipient country (ex-ante conditionality is ineffective) and aid is only effective in countries with sound economic policies. If the former explain ineffectiveness of ex-ante conditionality, the latter support selectivity of aid allocation. Following this approach Collier and Collar (1999) carried out estimates on the effectiveness of the new approach to aid allocation in terms of poverty reduction and the results found were outstanding: If all aid money were allocated on the basis of high poverty rates and reasonably effective policies and institutions, even today's small aid flows could lift 19 million people out of poverty each year – almost twice the estimated 10 million now being helped.

In contrast to this approach, some authors like Mosley and Hudson (2001) have defended a more flexible interpretation of conditionality, whereby the interaction between recipients and donors play a crucial role. From this proposal the presence of fungibility is admitted, but its extent is made dependent on the aims and performance of the recipient government. In addition, it is argued that under some circumstances a certain degree of conditionality may stimulate better policies in the recipient country.

Therefore, if one accepts certain incidence from aid to recipient policies, the problem consists in defining adequate contracts. In other words, the matter is to design conditionalities in the presence of asymmetric information and strategic behaviour. For example, Pedersen (1996) investigates the strategic interaction between donor and recipient assuming perfect information. If it is assumed that the goal of the former is to promote growth in the recipient country, while the latter may have other objectives, the donor should behave as an active "Stackelberg leader" by imposing conditionality. Similarly, Azam and Laffont (2001) assume perfect information and tried to define the optimal aid contract given the presence of strategic behaviour. Svensson (2000) on the other hand, drops the assumption of perfect information by considering that the conditions imposed on the recipient country cannot be perfectly monitored. In that context, optimal contract conditionalities are not necessarily complied with. Similarly, Cordella and Dell'Ariccia (2002, a and b) consider asymmetric information, so the donor

can only partially monitor the compliance of conditionalities. The use of conditionality as a screening device may thus result in aid contracts excluding those poverty-oriented policies that cannot be monitored. In sum, according to these authors, selectivity provides an excessively rigid interpretation of conditionality and aid policies must be implemented with more flexibility.

Our paper deals with this debate about conditionality and although we also defend a more flexible implementation of aid policies, our approach differ from those stated above. Our aim is not to analyse the strategic interaction between donors and recipients, but to discuss the effectiveness of several alternative models of aid allocation in terms of poverty reduction. In the first part of this study we present a model of growth and poverty where aid plays a crucial role. This model admits the presence of diminishing returns to aid in the output and poverty functions. In part two, we shall discuss the impact of aid on poverty in a single country, showing that conditional aid has a deeper impact than the other alternatives. Yet, for this conclusion to hold, some conditions concerning information and the volume of aid must be met. Finally, part three of the paper is devoted to expound our main criticism to conditional aid: if the donor's aim is to maximise poverty reduction in a group of countries in presence of conflicts of interest between donor and recipients, there is not something like a universal solution (as proposed by Collier and Dollar, 1999) and aid policy should be tailored according to the recipient characteristics.

## 2. THE MODEL

To study the effectiveness of different types of foreign aid policies, let us start by developing a model where the production and poverty functions of the recipient countries are defined, respectively, as:

$$y = g(a, z, t) \quad g_a > 0, g_{aa} < 0 \quad (1)$$

$$h = f_1(y, x) + f_2(a) \quad h_y < 0, h_{yy} > 0, h_a < 0, h_{aa} > 0. \quad (2)$$

The meaning of these variables is as follows:  $y$  stands for income,  $a$  is foreign aid,  $z$  is a variable capturing the quality of economic policy,  $h$  refers to poverty and  $t$  and  $x$  are two exogenous variables affecting  $y$  and  $h$ , respectively (for example, resource endowment

or income distribution)<sup>1</sup>. The main assumption of these expressions is that both income and poverty exhibit decreasing returns to aid and income, as indicated by the sign of the partial derivatives of both functions.

In the case of the income function the hypothesis of decreasing returns to aid has been justified in the literature by the negative effect of aid dependence on the institutional framework of the recipient countries, as in Lensink and White (1999); by the limits on the absorption capacity of aid, as in Hadjimichael et. al (1999); or by the so-called Dutch disease, as in Durberry et al. (1999). Nevertheless, although the theoretical arguments supporting the hypothesis of decreasing returns to aid differ in these studies, they all found the corresponding parameter estimate statistically significant.

With respect to the poverty function and as a first approximation, we have regressed poverty, using the log of infant mortality rate as a proxy, on the log of GDP per head. As can be seen in Table 1, the results of this regression support our hypothesis of decreasing returns to income<sup>2</sup>.

<b>Table 1. Infant Mortality Rate on GDP per head (t-ratio in brackets)</b>			
Parameter	intercept	GDP elasticity	R <sup>2</sup>
Value	7.65 (53.9)	-0.53 (24.7)	0.64

In addition, we must stress that in our model the impact of aid on poverty is twofold. On the one hand, and following the usual approach (see, for example, Collier and Dollar, 2000, or Burnside and Dollar, 2000) we assume that aid affects poverty through its impact on economic growth. On the other hand and departing from previous studies, we also assume that there is a direct impact of aid, as stated in the poverty function. The reason to include this effect is that we consider that aid may induce changes in the structure of government spending which may reduce poverty although they do not necessarily imply a higher growth rate.

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<sup>1</sup> Throughout this paper, a single subscript stands for the first derivative of the variable, while a double subscript refers to its second derivative.

Regarding the donor, we will consider it as fully altruistic and therefore, its only goal when implementing an aid program is to maximise its effectiveness in terms of poverty reduction. Obviously, it is a stylized and unrealistic assumption. However, this maximisation problem may be addressed to 1) reducing poverty in a single country, and 2) reducing poverty in a group of countries. To reach these goals, we will assume that aid can be allocated according to one of the following four criteria:

- 1) According to current poverty of the countries:  $a=c(h)$ .
- 2) According to donor discretionary decision :  $a=c(s)$ .
- 3) According to initial or historical poverty of the countries:  $a=c(h^*)$ .
- 4) According to the quality of policies of the recipient country:  $a=c(z)$ ,

where  $s$  is an exogenous variable and  $h^*$  refers to the historical poverty level of the recipient country (ies). Third criteria assume a pluriannual commitment according to poverty level in the decision point.

Therefore, the problem that the donor has to deal with consists of selecting the aid allocation criteria that maximises poverty reduction. Since this selection depends on the recipient government behaviour, we will consider three possibilities in this respect — instead of defining a particular welfare function<sup>3</sup>— The first possibility assumes that the recipient government tries to devote the highest possible amount of foreign aid to nonsocially-oriented expenses; this will be called the *nonsocially-oriented government* case. The second possibility assumes that the recipient government determines policies independently from foreign aid —which is compatible with any type of social commitment— this will be named the *independent government* case. The last possibility assumes that the recipient government seeks to reduce poverty but not at any cost; that is, poverty reduction is only one among a set of government priorities; this is labelled the

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2 The sample includes 340 observations corresponding to 68 countries. Thus, each country contributes to the regression with five observations, which are the averages of the following five periods: 1973-77, 1978-82, 1983-87, 1988-92, 1993-97. Source: World Bank

3 The reason to consider these three possibilities instead of defining a particular welfare function of the recipient government is that our aim is to investigate the incentives to improve policies according to different aid distribution rules, instead of analyse the results of maximisation programs in a strategic behaviour framework. Then, for the sake of simplicity, we decided to define a policy function instead of a welfare function that would complicate unnecessarily our argumentation.

*socially-oriented government* case, which, in our opinion, represents the most realistic situation, and therefore, our analysis will be focused on it.

### 3. REDUCING POVERTY IN A SINGLE COUNTRY

Now that the model has been defined, this section is devoted to study the impact on poverty of each of the four aid rules stated above depending on the recipient government behaviour.

- *Case 1) nonsocially-oriented government*

As already mentioned, this is a government that tries to maximise the amount of foreign aid that can be diverted from social expenses to its own welfare. To simplify, and without any loss of generality, we have assumed that domestic revenue, collected by the government through taxes, is efficiently employed, while foreign aid is only partially addressed to improve the economic and poverty situation of the country. This assumption implies that, if possible, the quality of economic policy (variable  $z$ ) will be treated by the recipient government as a mean to achieve its goal with respect to foreign aid, increasing fungibility. Taking this into account, the whole model can be defined by the following equations

$$y = g(a_1, z, t), \quad g_{a1} > 0, g_{a1a1} < 0, \quad (3)$$

$$h = f_1(y, x) + f_2(a_1), \quad h_y < 0, h_{yy} > 0, h_{a1} < 0, h_{a1a1} > 0, \quad (4)$$

$$z = f_3(G, V), \quad (5)$$

$$G = TY + a_1, \quad (6)$$

$$a = a_1 + a_2, \quad (7)$$

where  $V$  is a constant,  $G$  stands for government spending,  $T$  represents the tax rate,  $a_1$  refers to the amount of foreign aid devoted to promote growth and to reduce poverty and  $a_2$  is the amount of mishandled aid. Therefore, equation 3 indicates that the quality of economic policy is determined by the financial resources of the recipient government, while eq. 4 shows that these resources depend on the amount of taxes collected and the volume of foreign aid received.

Given the expressions above, the government searches to maximise  $a_2$  with respect to  $a_1$ . Then, according to the four criteria stated in the previous section, the effect of this maximisation program on  $z$  are:

1)  $a = c(h)$ .

Max.  $a_2 = \text{Max. } (a - a_1) = \text{Max. } a = \text{Max. } (h) = \text{Min. } (z)$  with respect to  $a_1$ .

2 and 3) exogenous aid.

Max.  $a_2 \Rightarrow a_1 = 0$ .

4)  $a = c(z)$ .

$$\text{Max. } a_2 \Rightarrow \frac{\partial a}{\partial a_1} = 0 \Rightarrow c_z \frac{\partial z}{\partial a_1} = 0 \Rightarrow c_z f_3 = 0,$$

which implies  $z > 0$ .

Therefore, as a consequence of the analysis, we can conclude by assessing that in this case conditional aid maximises poverty reductions, since it not only implies a more efficient use of foreign aid but also paves the way to a policy improvement in the recipient country. From another perspective, conditionality in aid programs addressed to a nonsocially-oriented government can be interpreted as a payment in terms of implementing a good environment for economic growth and poverty reduction that the recipient makes to the donor. On the contrary, non-conditionality would imply that the donor does not receive any payment in exchange of the aid given. Yet it must be stressed that conditionality may also entail an inefficient allocation of resources if there were relative prices distortions in the recipient countries or if donor excluding those policies that cannot be monitored (see Cordella and Dell'Ariccia, 2002).

- *Case 2) Independent government*

In this framework, conditionality does not affect the quality of economic policy in the recipient country, since the impact of aid on poverty depends only on its amount and not on the characteristics of the program used to allocate it. Therefore, it seems that, in principle, the type of program used to allocate aid is irrelevant. Yet, since it may affect the amount of foreign aid given, conditionality may be a bad aid policy if it induces an

aid reduction. On the other hand, and given the recipient government behaviour, it seems better to target aid to particular projects rather than to distribute it following a wider approach, as is the case of aid programs, budget support programs or the so-called sector-wide approach (SWAP). In addition, it may be convenient to increase the participation of NGO's and the private sector in the aid management, since it may reduce aid fungibility by decreasing the recipient government control over aid funds.

- *Case 3) Socially-oriented government*

In our opinion, this is the most realistic case, since it means that improving the impact of economic policy in terms of poverty reduction is only one among a set of priorities in the recipient government agenda. In other words, the government seeks to improve economic policy but not at any price. To give a mathematical expression to this behaviour, we will assume that the government will improve policies as long as they have a deep impact on poverty reduction, which can be represented by a function of the type<sup>4</sup>

$$\dot{z} = f_3\left(\frac{dh}{dz}\right) \quad (8)$$

Bearing this equation in mind, the analysis of the impact of aid on the incentives to improve  $z$  is as follows:

1)  $a = c(h)$

$$\frac{dh}{dz} = \frac{f_{1y} g_z}{1 - f_{1y} g_a c_h - f_{2a} c_h} \quad (9)$$

2) and 3) exogenous aid.

$$\frac{dh}{dz} = f_{1y} g_z \quad (10)$$

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<sup>4</sup> Throughout this paper, a dot on top of the variables stands for their derivative with respect to time

4)  $a=c(z)$

$$\frac{dh}{dz} = f1_y(g_z + g_a c_z) + f2_a c_z \quad (11)$$

According to these results and given the signs of the derivatives, conditionality becomes the best aid policy, since it generates the largest incentives to improve  $z$ , while giving aid according to current level of poverty generates the lowest incentives. Two remarks stemming from these results. First, to give aid according to poverty reduces the effectiveness of aid because it implies an aid reduction as poverty diminishes, giving rise to a moral hazard problem<sup>5</sup>. Yet this model of allocation aid can be redefined as the lower the poverty (or the higher its reduction) the higher the volume of aid received. In that case,  $c_h$  would be negative and, therefore, it would not be possible to assess *a priori* if this model is more or less efficient than conditional aid. The main argument supporting (the effort to reduce) poverty as the rule to qualify for aid is the presence of asymmetric information about the impact of policies on growth and poverty. If the recipient has better information than the donor, giving aid according to poverty would be more efficient than conditionality<sup>6</sup>. Yet, the principal argument against this type of program is the case of a country where poverty is not due to bad policies, so there is little room to foster growth through changes in domestic conditions. In this case, the country with “bad” environment would be poorly qualified for foreign aid that is necessary tool to promote growth and reduce poverty.

Secondly, it must be stressed that the effect of conditional aid on incentives decreases as aid grows (especially if a high share of aid is unconditional) or if the recipient has already developed a good policy framework prior to being qualified for conditional aid. As shown in Appendix I, although an aid increase reduces the incentives to improve economic and poverty policies under any allocation criteria —as long as cross derivatives ( $g_{za}$ ) are null— the largest reduction of incentives takes place in the case of conditional aid<sup>7</sup>. In sum, we can conclude this section by saying that although conditionality fosters good policies, it also reduces more rapidly than any other type of aid allocation model the incentives to improve the quality of policies as aid and  $z$

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<sup>5</sup> Note that moral hazard does not exist if aid is given according to historical poverty

<sup>6</sup> See Cordella and Dell’Ariccia (2002)

<sup>7</sup> Under some circumstances, incentives may increase in the case of  $a=c(h)$  (see Appendix I)



increase. Therefore, while conditionality can be a good aid policy under some circumstances, its effectiveness can be seriously reduced in other cases<sup>8</sup>.

#### 4. REDUCING POVERTY IN A GROUP OF COUNTRIES

In this section, we will try to shed some light on one of—in our opinion—the main shortcomings of conditionality, the fact that while it can be a good policy to implement aid programs when there is only one recipient, efficient aid programs may be much more difficult to achieve in the case of several recipients. To see this, let us, for the sake of simplicity, consider only two recipient countries (labelled a and b). We will also assume that the aim of the donor consists of maximising the impact of an aid increase on global poverty, which implies that it must equate the marginal effectiveness of aid, that is,

$$\frac{dh}{da}(a) = \frac{dh}{da}(b). \quad (12)$$

If  $z$  is exogenous, equation (12) would become

$$(f1_y g_a + f2_a)(a) = (f1_y g_a + f2_a)(b), \quad (13)$$

irrespective to the aid policy followed. Then and given the presence of decreasing returns to income and aid, if the cross derivatives in the income function are zero, aid must always be targeted on the poorest country. Yet, if these derivatives are positive, aid distribution will depend on the form of the income function, the amount of aid and  $z$ .

If  $z$  depends on  $\frac{dh}{dz}$ , then, we can identify two different cases according to the aid policy followed by the donor.

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<sup>8</sup> However, this result changes if cross derivatives are positive. Among other things, let us note that in that case the moral hazard problem is amplified, since if aid is given according to poverty, the incentives to improve policies diminishes, for it would entail a greater aid reduction (see Appendix I). In this sense, empirical research about the interaction of aid and policy in the income function is far from being conclusive. For

- *Case 1) ex-post aid increase*

By an ex-post aid increase we mean that the aid increase is unconditioned or conditioned on the current situation of the recipient countries. In that case, the donor must reach the following equality

$$(f_{1y}g_a + f_{2a} + f_{1y}g_z \frac{dz}{da})(a) = (f_{1y}g_a + f_{2a} + f_{1y}g_z \frac{dz}{da})(b). \quad (14)$$

Yet it must be noted that if the aid increase is implemented ex post, then  $\frac{dz}{da} < 0$ , since

$\frac{d(\frac{dh}{dz})}{da} > 0$  (see Appendix I). To avoid this result, which means that an aid increase may result in worse policies in the recipient country, we will modify our model by assuming<sup>9</sup>:

$$\begin{aligned} \dot{z} &= f_3\left(\frac{dh}{dz}\right) \quad \text{if} \quad f_3\left(\frac{dh}{dz}\right) \geq 0 \\ \dot{z} &= 0 \quad \text{if} \quad f_3\left(\frac{dh}{dz}\right) < 0 \end{aligned} \quad (15)$$

Once we have carried out this modification to our model, the donor's goal becomes, as in the previous situation,

$$(f_{1y}g_a + f_{2a})(a) = (f_{1y}g_a + f_{2a})(b). \quad (16)$$

Therefore, and given the presence of diminishing returns, aid must be targeted to the poorest country rather than to the country with the best policies —as long as cross derivatives are null.

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example, while Dollar and Burnside (2000) found statistically significant the pertinent parameter, Hansen y Tarp (2000) found the opposite result.

- *Case 2) ex ante aid increase*

Within this framework the donor increases the volume of aid and the increase is either unconditioned or conditioned to future policies. Thus, in both countries we get

$$\frac{dh}{da} = (f_{1y}g_a + f_{2a}) + f_{1y}g_z \frac{dz}{da}, \quad (17)$$

and, therefore, it cannot be stated a priori which country should receive a larger amount of aid. The term in parentheses is higher in the poorest country, given the presence of decreasing returns, but the second term of the right hand side of (17) may be higher in the less poor country if the country's social commitment is strong enough. Furthermore, if resource endowments and production and poverty functions differ across countries, defining a general rule of aid allocation is even more difficult. Finally, it should be remembered that if cross derivatives are positive, the moral hazard component is amplified, since if aid is given according to poverty, the poorer country has less incentives to improve policies, for it would entail a greater aid reduction (see Appendix I).

## 5. SOME EXAMPLES

Let us present some examples showing that aid cannot be distributed across countries following a general rule. Assume that the production and poverty functions are<sup>10</sup>

$$y = ka^{1/2}z^{1/2}, \quad (18)$$

$$h = y^{-1/2}a^{-1/2}, \quad (19)$$

where  $k$  is a constant. Then, the following cases can be identified:

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<sup>9</sup> Yet, as stated by the World Bank, in some cases aid, by allowing governments to delay reforms, can be detrimental to growth (World Bank, 1998)

- *Case 1) where  $z$  is exogenous*

In this case, eq. (19) becomes

$$h = k^{-1/2} a^{-3/4} z^{-1/4}, \quad (20)$$

and therefore,

$$\frac{dh}{da} = -\frac{3}{4} a^{-1} h. \quad (21)$$

Since the impact of aid on poverty grows as poverty increases, aid must be distributed according to poverty.

- *Case 2)  $z$  depending on  $\frac{dh}{dz}$ . Ex post aid increase.*

In this case, let us assume that  $z$  is a function of the type,

$$\dot{z} = -\left(\frac{dh}{dz} + R\right) \quad (22)$$

where  $R$  is a constant that indicates the commitment of the recipient country with good policies, so the higher  $R$  the sounder the commitment. Assuming that the initial aid was exogenous, we have

$$\frac{dh}{dz} = f_y g_z = -\frac{1}{4} k^{-1/2} a^{-3/4} z^{-5/4}, \quad (23)$$

so in equilibrium ( $\dot{z} = 0$ ) we get,

$$z = 4^{-4/5} R^{-4/5} k^{-2/5} a^{-3/5}, \quad (24)$$

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10 To simplify calculations we have considered a multiplicative form of the poverty function.

$$y = 4^{-2/5} R^{-2/5} k^{4/5} a^{1/5}, \quad (25)$$

$$h = 4^{1/5} R^{1/5} k^{-2/5} a^{-3/5}, \quad (26)$$

and then,

$$\frac{dh}{da} = -\frac{3}{5} a^{-1} h. \quad (27)$$

The result obtained is, as in the previous case, that more aid should flow to the poorest country. The reason, as before, is that given the presence of diminishing returns, aid is more efficient in this country. In this sense, recall that, since the aid increase is ex post, it eliminates the possible effect of aid on  $z$ .

- *Case 3)  $z$  depending on  $\frac{dh}{dz}$ . Ex ante aid increase.*

In this context, if the original aid was unconditional, poverty reaches, as before, the following level

$$h = 4^{1/5} R^{1/5} k^{-2/5} a^{-3/5}. \quad (26)$$

On the other hand, an ex ante conditional aid increase implies

$$\frac{dh}{dz} = f_y g_z + f_y g_a c_z + f_a c_z. \quad (28)$$

If we assume that aid policy is implemented by means of

$$a = sz, \quad (29)$$

where  $s$  is a constant, we get in equilibrium,

$$z = k^{-1/4} R^{-1/2} s^{-3/8}, \quad (30)$$

$$y = k^{3/4} R^{-1/2} s^{1/8}, \quad (31)$$

$$h = k^{-1/4} R^{1/2} s^{-3/8}. \quad (32)$$

Therefore, to change from unconditional to conditional aid implies that the determinants of poverty also change, from  $h = 4^{1/5} R^{1/5} k^{-2/5} a^{-3/5}$  to  $h = k^{-1/4} R^{1/2} s^{-3/8}$ . Thus, it is not possible to define a general rule to identify which country will experience the strongest reduction of poverty as aid increases. This reduction will depend on  $k$  and  $R$ , standing, respectively, for other inputs apart from economic policy and foreign aid affecting income and for the degree of commitment with economic and poverty policies. To see this, let us present some calibrations of this model showing different results.

Calibration 1) The initial situation with unconditional aid is characterised by the figures shown in Table 2. Note that countries only differ with respect to their commitment with economic and poverty policies.

<b>Table 2. Initial situation</b>			
Country	k	A	R
A	1	1	2
B	1	1	1

In this context and using the expressions above, we would get the equilibrium values shown in Table 3, while if the donor starts a conditional aid program with  $a = 5z$ , the new situation becomes as shown in Table 4.

<b>Table 3. Initial situation II</b>			
	z	Y	h
Countr			
y			
A	0.189	0.435	1.516
B	0.330	0.574	1.320

<b>Table 4. Conditional aid</b>				
	z	y	h	a
Countr				
y				
A	0.387	0.865	0.773	1.933
B	0.547	1.223	0.547	2.734

Therefore, poverty reduction is higher in the country with better economic policies than in the poorest country (0.773 versus 0.743). In this sense, it must be remarked that the deeper impact of aid on poverty in the country with the highest  $z$  is not only due to the fact that it receives a larger amount of aid than the poorer country, since if the latter would get the same volume of (unconditional) aid than the former (2.734), poverty reduction would be 0.69 (0.60 in country B if aid were unconditional).

Yet, if we make  $k=2$  in country B, we would get the values shown in Tables 5 and 6. In this case, aid should be given according to poverty, since poverty reduction in A reaches 0.74, while in B is only 0.54 —despite the fact that with conditional aid A receives less aid than B.

<b>Table 5. Initial situation III</b>			
Country	$z$	$Y$	$h$
A	0.189	0.435	1.516
B	0.250	1	1

<b>Table 6. Conditional aid II</b>				
	$Z$	$y$	$h$	$a$
Countr $y$				
A	0.387	0.865	0.773	1.933
B	0.460	2.057	0.460	2.299

Similarly, if we hold the original values of  $k$  but we make  $R=6$  in country A, we get the results shown in Tables 7 and 8. According to these values, poverty reduction would be larger in B than in A (0.77 versus 0.55). Nevertheless, in this case this result is due to the fact that the poorest country receives a lower amount of aid, since if it would get the same amount of (unconditional) aid, that is 2.734, we would obtain the values shown in Table 9. According to these values, poverty reduction would be larger in the poorest country than in the country with the best economic policies (0.86 versus 0.77).

<b>Table 7. Initial situation IV</b>			
Country	$z$	$Y$	$h$

A	0.079	0.280	1.888
B	0.330	0.574	1.320

<b>Table 8. Conditional aid III</b>				
	z	y	h	a
Countr				
y				
A	0.223	0.499	1.340	1.116
B	0.547	1.223	0.547	2.734

<b>Table 9. Unconditional aid III</b>				
	z	y	h	a
Countr				
y				
A	0.043	0.343	1.033	2.734

In sum, in a world of diminishing returns to aid and differences across countries there is not a general rule to allocate foreign aid in order to maximise global poverty.

## 6. CONCLUDING REMARKS

Throughout this paper, we have analysed several possibilities to allocate foreign aid. To this end, we have developed a model whose main feature is the presence of decreasing returns to aid and income in the poverty and output functions. By means of this model we have investigated the impact on poverty of four different aid allocation rules. If the donor's goal consists of reducing aid in a single country, we have shown that, by imposing conditionality, aid can be more effective. However, two caveats must be made. First, a conditional aid program will achieve its targets as long as information is symmetric; otherwise an aid program based on the efforts made by the recipient country to reduce poverty may be more efficient. Second, as the volume of aid increases, the incentives to improve the quality of policies in the recipient country decrease more rapidly in the case of conditional aid than in other type of aid programs, which implies



that while conditionality can be a good aid policy under some circumstances, its effectiveness can be seriously reduced in other cases.

Being the donor's aim to reduce poverty in a group of countries, and not only in a single country, we have tried to show that conditionality cannot be the general rule to maximise the effectiveness of foreign aid. Given the presence of diminishing returns to aid and income in the output and poverty functions, a general rule to distribute aid cannot be stated a priori: decreasing returns can offset the positive impact on incentives to improve policies. In other words, due to decreasing returns, the donor may find it more efficient to target aid to the poorest country rather than to the country with the best policies. Furthermore, if resource endowment and production and poverty functions differ across countries, defining a general rule of aid allocation is even more difficult.

Given the impossibility to define a general rule and since the case-by-case analysis seems to us very difficult to implement in practice, a third possibility consists of defining a mixed aid allocation model combining both elements, the poverty level of the country and its efforts to improve policies. This rule can be expressed as

$$\begin{aligned} a &= \beta c_1(z) + (1 - \beta) c_2(h^*) \\ 0 &\leq \beta \leq 1 \end{aligned} \quad (33)$$

where  $h^*$  stands for the poverty level (which is not necessarily current) and  $\beta$  will be defined according to the weight given by the donor to each element of the aid function.

A fourth possibility refers to a hybrid aid rule where the amount of aid is determined by poverty but it is simultaneously subject to revisions according to the quality of policies. Thus, long-term aid programs are governed by poverty, while its short-term implementation partially depends on the efforts made by the recipient country to improve its policies. The expression of this rule could be

$$a_0 = c(h^*), \quad (34)$$

$$a_{t+1} = a_t + \theta(z_{t+1} - z_t), \quad (35)$$

where subscript  $t$  refers to time and  $\theta$  measures the aid variation carried out in time  $t+1$  according to the efforts made to improve policies. It must be noted that the difference between this criteria and those of the World Bank is twofold. On the one hand, the donor takes a long-term commitment (as proposed by partnership principle) determined by the initial poverty level. On the other hand, although domestic policies play a role in both allocation models, in the former it is the effort to improve them what counts, while in the latter it is their current quality what matters. In the World Bank criteria policy environment determines the option between giving or not giving aid, in our proposal only grades the donor commitment.

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## Appendix I

In this appendix we will briefly study the impact of an increase in aid on the incentives to improve economic policy through the expression  $\frac{d(\frac{dh}{dz})}{da}$ . In this sense, we will divide the analysis into two cases, one where cross derivatives in the production function are zero and the one where they are positive.

- *Case 1) Null cross derivatives*

1. *Criteria 2 and 3, where  $a$  is exogenous.*

Since in this context  $\frac{dh}{dz} = f_{ly} g_z$ , we get

$$\frac{d(\frac{dh}{dz})}{da} = \frac{f_{lyy} g_z g_a}{1 - g_z^2 f_{yy} f'(\frac{dh}{dz}) - f_y g_{zz} f'(\frac{dh}{dz})}. \quad (I.1)$$

Since this expression is positive, as aid increases it reduces the incentives to improve the economic policy of the recipient country.

2. *Criteria:  $a=c(h)$*

In this case,  $\frac{dh}{dz} = \frac{f_{ly} g_z}{1 - f_{ly} g_a c_h - f_{2a} c_h}$ , so we get

$$\begin{aligned}
\frac{d(\frac{dh}{dz})}{da} = & \frac{1}{D} \frac{f_{1yy} g_z g_a}{1 - \frac{g_z^2 f_{yy} f'(\frac{dh}{dz})}{D} - \frac{f_y g_{zz} f'(\frac{dh}{dz})}{D} - \frac{f_y g_z^2 c_h g_a f_{yy} f'(\frac{dh}{dz})}{D^2}} + \\
& + \frac{1}{D^2} \frac{f_{1y} g_z c_h f_{2aa} + f_{1y}^2 g_z c_h g_{aa} + f_{1y} g_z c_h f_{aa}}{1 - \frac{g_z^2 f_{yy} f'(\frac{dh}{dz})}{D} - \frac{f_y g_{zz} f'(\frac{dh}{dz})}{D} - \frac{f_y g_z^2 c_h g_a f_{yy} f'(\frac{dh}{dz})}{D^2}} \quad .(I.2)
\end{aligned}$$

where  $D = 1 - f_{1y} g_a c_h - f_{2a} c_h > 0$ . A simple manipulation of the common part of the denominators of this expression yields

$$1 - \frac{f_y g_{zz} f'(\frac{dh}{dz})}{D} - \frac{g_z^2 f_{yy} f'(\frac{dh}{dz})(1 - c_h f_{2a})}{D^2},$$

which is positive and therefore both denominators are positive. Given the signs of the numerators, the first term of this expression is positive, while the others are negative, and therefore, the sign of the whole expression is undetermined. In this sense, note that the first term of (I.2) is positive because of diminishing returns to income in the poverty function, while the second term is negative because the cost of better policies in terms of a reduction of the aid received is lower. In other words, the greater the amount of aid received, the less important the moral hazard problem. On the other hand, recall that the first term of this expression is smaller than (I.1) and therefore, the loss of incentives is greater when aid is exogenously given than when is distributed according to poverty.

### 3. Criteria $a=c(z)$

In this case  $\frac{dh}{dz} = f_{1y}(g_z + g_a c_z) + f_{2a} c_z$ , so

$$\frac{d(\frac{dh}{dz})}{da} = \frac{f_{1yy} g_z g_a + c_z g_z^2 f_{1yy} + c_z g_{aa} f_{1y} + c_z f_{aa}}{1 - g_z^2 f_{yy} f'(\frac{dh}{dz}) - f_{1y} g_{zz} f'(\frac{dh}{dz}) - c_z f_{1yy} g_z g_a f'(\frac{dh}{dz})}, \quad (I.3)$$

and rearranging terms we get

$$\frac{d(\frac{dh}{dz})}{da} = \frac{f_{ly} g_z g_a (1 + \frac{c_z g_a}{g_z})}{1 - g_z^2 f_{yy} f'(\frac{dh}{dz})(1 + \frac{c_z g_a}{g_z}) - f_{ly} g_{zz} f'(\frac{dh}{dz})} + \frac{c_z g_a^2 f_{ly} + c_z f_{aa}}{1 - g_z^2 f_{yy} f'(\frac{dh}{dz})(1 + \frac{c_z g_a}{g_z}) - f_{ly} g_{zz} f'(\frac{dh}{dz})}, \quad (I.4)$$

and

$$\frac{d(\frac{dh}{dz})}{da} = \frac{f_{ly} g_z g_a}{\frac{1}{(1 + \frac{c_z g_a}{g_z})} - g_z^2 f_{yy} f'(\frac{dh}{dz}) - \frac{f_{ly} g_{zz} f'(\frac{dh}{dz})}{(1 + \frac{c_z g_a}{g_z})}} + \frac{c_z g_a^2 f_{ly} + c_z f_{aa}}{1 - g_z^2 f_{yy} f'(\frac{dh}{dz})(1 + \frac{c_z g_a}{g_z}) - f_{ly} g_{zz} f'(\frac{dh}{dz})} \quad (I.5)$$

The numerator of the first term of this expression equals that of the case where  $a$  was exogenous and, since the denominator is lower in (I.5), this common component is larger. With respect to the second term of the summation, it is also positive, so the incentive reduction as aid increases is greater under this aid policy.

- **Case 2) Positive cross derivatives ( $g_{az} > 0$ )**

1. Criteria 2 and 3, where  $a$  is exogenous.

Since  $\frac{dh}{dz} = f_{ly} g_z$ , we get

$$\frac{d(\frac{dh}{dz})}{da} = \frac{f_{ly} g_z g_a + f_{ly} g_{za}}{1 - g_z^2 f_{yy} f'(\frac{dh}{dz}) - f_{ly} g_{zz} f'(\frac{dh}{dz})}. \quad (I.6)$$

The difference with the case where cross derivatives were zero is the second component of the numerator, standing for the cross-effect of an aid increase on the impact of a  $z$  improvement on income. If this effect is large enough, an aid increase may result in higher incentives to improve economic policy.

## 2. Criteria $z=c(h)$

Since  $\frac{dh}{dz} = \frac{f_1 y g_z}{1 - f_1 y g_a c_h - f_2 a c_h}$ , we get

$$\begin{aligned} \frac{d\left(\frac{dh}{dz}\right)}{da} &= \frac{1}{D} \frac{f_{1yy} g_z g_a + f_{1y} g_{za}}{1 - \frac{g_z^2 f_{yy} f'(\frac{dh}{dz})}{D} - \frac{f_y g_{zz} f'(\frac{dh}{dz})}{D} - \frac{f_y g_z^2 c_h g_a f_{yy} f'(\frac{dh}{dz})}{D^2} - \frac{f^2 y c_h g_z g_{az} f'(\frac{dh}{dz})}{D^2}} + \\ &+ \frac{1}{D^2} \frac{f_{1y} g_z c_h f_{2aa} + f_{1y} g_z c_h g_{aa} + f_{1y} g_z c_h f_{aa}}{1 - \frac{g_z^2 f_{yy} f'(\frac{dh}{dz})}{D} - \frac{f_y g_{zz} f'(\frac{dh}{dz})}{D} - \frac{f_y g_z^2 c_h g_a f_{yy} f'(\frac{dh}{dz})}{D^2} - \frac{f^2 y c_h g_z g_{az} f'(\frac{dh}{dz})}{D^2}} \end{aligned} \quad (I.7)$$

Compared to the case where cross derivatives were null, this expression shows that the incentives to improve policies increase via numerator but decrease via denominator.

However,  $\lim_{g_{az} \rightarrow \infty} \frac{d\left(\frac{dh}{dz}\right)}{da} = \frac{1}{-\frac{f_y c_h g_z f'(\frac{dh}{dz})}{D}}$  so, the higher the cross derivatives the larger the

incentives. Besides, note that the last term of both denominators captures the effect of cross derivatives on the moral hazard problem. If incentives grow, the pertinent increase of  $z$  will be reduced because the cost of better policies in terms of less aid received is higher, since the impact on poverty is larger.

## 3. Criteria $a=c(z)$



Since  $\frac{dh}{dz} = f_{1y}(g_z + g_a c_z) + f_{2a} c_z$ , we get

$$\frac{d\left(\frac{dh}{dz}\right)}{da} = \frac{f_{1yy}g_zg_a + c_zg_a^2f_{1yy} + c_zg_{aa}f_{1y} + c_zf_{aa} + f_{1y}g_{za}}{1 - g_z^2f_{yy}f'\left(\frac{dh}{dz}\right) - f_{1y}g_{zz}f'\left(\frac{dh}{dz}\right) - c_zf_{1yy}g_zg_af'\left(\frac{dh}{dz}\right) - c_zf_{1y}g_{az}f'\left(\frac{dh}{dz}\right)} \quad (I.8)$$

Therefore, in comparison with the case where cross-derivatives were zero, incentives increase both via numerator and denominator. Yet, we could find the paradox that if  $g_{az}$  is large enough this fraction would be positive, thus reducing the incentives, since

$$\lim_{g_{az} \rightarrow \infty} \frac{d\left(\frac{dh}{dz}\right)}{da} = \frac{1}{-c_zf'\left(\frac{dh}{dz}\right)}. \text{ Intuitively, this loss of incentives to improve } z \text{ —or increase}$$

of incentives to diminish  $z$ — is due to the fact that if the country reduces  $z$ , it will result in an aid reduction. But the cost in terms of poverty of this reduction has been largely, given that  $z$  had previously diminished and that cross derivatives are large enough.

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- 02/11 **Simona Mateut, Spiros Bougheas and Paul Mizen**, “Trade Credit, Bank Lending and Monetary Policy Transmission”
- 02/12 **Bouwe R. Dijkstra**, “Time Consistency and Investment Incentives in Environmental Policy”
- 02/13 **Bouwe R. Dijkstra**, “Samaritan vs Rotten Kid: Another Look”
- 02/14 **Michael Bleaney and Mark A. Roberts**, “International Labour Mobility and Unemployment”
- 02/15 **Cihan Yalcin, Spiros Bougheas and Paul Mizen**, “Corporate Credit and Monetary Policy: The Impact of Firm-Specific Characteristics on Financial Structure”
- 02/16 **Christophe Muller**, “The Geometry of the Comparative Statics”
- 03/01 **Arijit Mukherjee**, “Licensing in a Vertically Separated Industry”
- 03/02 **Arijit Mukherjee and Enrico Pennings**, “Imitation, Patent Protection and Welfare”
- 03/03 **Arijit Mukherjee**, “Bernard vs. Cournot Competition in Asymmetric Duopoly: The Role of Licensing”
- 03/04 **Richard Cornes and Roger Hartley**, “Aggregative Public Good Games”
- 03/05 **Mark McGillivray and Bazoumana Ouattara**, “Aid, Debt Burden and Government Fiscal Behaviour in Côte d’Ivoire”
- 03/06 **José Antonio Alonso and Carlos Garcimartín**, “Poverty Reduction and Aid Policy”

## Members of the Centre

### Director

**Oliver Morrissey** - aid policy, trade and agriculture

### Research Fellows (Internal)

**Simon Appleton** – poverty, education, household economics

**Adam Blake** – CGE models of low-income countries

**Mike Bleaney** - growth, international macroeconomics

**Indraneel Dasgupta** – development theory, household bargaining

**Norman Gemmell** – growth and public sector issues

**Ken Ingersent** - agricultural trade

**Tim Lloyd** – agricultural commodity markets

**Andrew McKay** - poverty, peasant households, agriculture

**Chris Milner** - trade and development

**Wyn Morgan** - futures markets, commodity markets

**Christophe Muller** – poverty, household panel econometrics

**Tony Rayner** - agricultural policy and trade

### Research Fellows (External)

**David Fielding** (*University of Leicester*) – investment, monetary and fiscal policy

**Ravi Kanbur** (*Cornell*) – inequality, public goods – Visiting Research Fellow

**Henrik Hansen** (*University of Copenhagen*) – aid and growth

**Stephen Knowles** (*University of Otago*) – inequality and growth

**Sam Laird** (*UNCTAD*) – trade policy, WTO

**Robert Lensink** (*University of Groningen*) – aid, investment, macroeconomics

**Scott McDonald** (*University of Sheffield*) – CGE modelling, agriculture

**Mark McGillivray** (*WIDER, Helsinki*) – aid allocation, aid policy

**Doug Nelson** (*Tulane University*) - political economy of trade

**Shelton Nicholls** (*University of West Indies*) – trade, integration

**Eric Strobl** (*University of Louvain*) – labour markets

**Finn Tarp** (*University of Copenhagen*) – aid, CGE modelling