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Abstract

The empirical effect of aid on growth is ambiguous. We build a growth model in which the government receives aid in order to finance a productive public good and agents devote time to appropriate public resources. We show that the relationship between aid and growth is hump-shaped since aid promotes rent-seeking.

Keywords: Foreign aid, economic growth
JEL code: O40, O11, O19

1. Introduction

"Have international aid positive effects on growth?" The literature on growth and aid does not offer any conclusive answer, being empirical evidence ambiguous and mixed (see Minoiu and Reddy, 2010, for an excellent revision of the literature). The subsequent question is "Is there any explanation for this ambiguity?" There is a group of papers that document that foreign aid stimulates the emergence of rent-seeking activities by powerful social groups in order to appropriate resources of the government (see Reinnika and Svensson, 2004, and Maren, 1997, among others). Another set of papers finds evidence that aid may erode the quality

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of institutions (see Rajan and Subramanian, 2007, and Djankov et al., 2008), which would have negative consequences on growth (see Djankov et al., 2008, for a detailed discussion of the literature).

We analyze the relationship between aid and growth in a model in which agents devote time to work and to rent-seeking activities in order to appropriate public resources from the government. The source of public revenues are non distortionary taxes and foreign aid. The revenues of the government that are not grabbed by rent-seeking activities, are used to finance a public good which is productive *à la* Barro.

We show that there exists a hump-shaped relationship between aid and growth due to three offsetting mechanisms: *(i)* the increase in aid rises the government's resources and so the provision of the public good, expanding the productivity of the private sector and the growth rate, *(ii)* the increase in the government's resources rises the profitability of the rent-seeking activities, which reduces the resources devoted to the public good, *(iii)* since agents devote more time to rent-seeking activities, the labor supply drops reducing growth. We show that for low levels of aid the first effect prevails, while for high levels the opposite is true. Incorporating the assumption that the international aid is proportional to the income of the donor, we show that a drop in aid may even promote the convergence of the per capita income of the receptor country to the one of the donor.

Many papers have studied the effect of rent-seeking activities in the economy (see Bethencourt and Perera-Tallo, 2014, for a review), however, only a few group of them have analyzed the impact of these activities in an aid setting. Svensson (2000) poses a repeated game model in which different groups interact strategically to capture the aid received by the government. Nevertheless, he does not analyze the consequences of this activity on growth.

2. The Model

Time is continuous with an infinite horizon. Population, $N(t)$, is constant. There is a single good in the economy that can be used for consumption, investment and as a public good provided by the government:

$$y(t) = c(t) + g(t) + \dot{k}(t) + \delta k(t) \tag{2.1}$$

where y denotes per capita production, c denotes per capita consumption, g denotes per capita public good provided by the government, k denotes per capita capital, and $\delta \in (0, 1)$ denotes the depreciation rate.

2.1. Preferences:

There is a continuum of identical households indexed in $[0,1]$ with preferences given by a time separable utility function:

$$\int_0^{\infty} u(c(t))e^{-\rho t}dt \tag{2.2}$$

where $\rho > 0$ is the discount rate of the utility function, c denotes the consumption, and $u(.)$ is the isoelastic felicity function:

$$u(c) = \begin{cases} \frac{c^{1-\sigma}}{1-\sigma} & if \quad \sigma \in (0,1) \cup (1,+\infty) \\ \\ ln(c) & if \quad \sigma = 1 \end{cases} \tag{2.3}$$

2.2. Production Technology:

The technology is given by the following production function:

$$Ag(t)^{1-\alpha}K(t)^{\alpha}L(t)^{1-\alpha} \tag{2.4}$$

where K denotes capital, L denotes labor, g denotes the per capita amount of a public good provided by the government and $A > 0$.

2.3. Fiscal policy:

The government collects non distortionary lump-sum taxes that are calculated as a portion of the per capita income. Furthermore, the government receives also financial funds from international aid, denoted by $aid(t)$ (in per capita terms):

$$T(t) = \tau y(t) + aid(t)$$

where T denotes the per capita revenues and $\tau \in (0,1)$ is the fixed tax rate. We denote the ratio international aid-(national) income by $a(t) \equiv aid(t)/y(t)$. Thus, the ratio government revenues-income is as follows:

$$\frac{T(t)}{y(t)} = \tau + a(t)$$

There exist rent-seeking activities associated to the government revenues. This means that not all the government revenues are devoted to the public good, a

part of them are "transferred" to agents. The amount of "transfers" that each agent "obtains" depends on the rent-seeking effort that she does in order to get such transfer. Each individual is endowed with one unit of time each period and decides the portion of time devoted to rent-seeking additivities, $l_p^i(t)$, and the portion devoted to work, $1 - l_p^i(t)$. The transfer that agent i receives, $tr^i(t)$, is as follows:

$$tr^i(t) = \frac{\left(l_p^i(t)\right)^\theta}{\int_0^1 \left(l_p^j(t)\right)^\theta dj} B l_p(t)^\beta T(t)$$

where $l_p(t) = \int_0^1 l_p^j(t)dj$ denotes the per capita time devoted to rent-seeking activities in the economy, $B \in [0,1]$, $\beta \in (0,1)$ and $\theta \in (0,1)$. Thus, the portion of government revenues appropriated by rent-seeking activities, Bl_p^β, is an increasing function of the per capita rent-seeking effort. Parameter B is a measure of the productivity of the rent-seeking technology and may be interpreted as a inverse index of the quality of institutions: the higher the B, the lower the quality of institutions. Finally, the share of per capita rent-seeking income received by agent i increases with her relative rent-seeking effort, l_p^i, and decreases with other agents' effort, l_p^j.

The government expends the part of government revenues that are not grabbed by rent-seeking activities to the public good:

$$g(t) = T(t)\left[1 - Bl_p(t)^\beta\right]$$

2.4. Firms

Firms maximize profits:

$$\max_{K(t),L(t)} Ag(t)^{1-\alpha}K(t)^\alpha L(t)^{1-\alpha} - w(t)L(t) - (\delta + r(t))K(t)$$

where w and r denote the prices of labor and physical capital respectively. The first order conditions are standard ones:

$$(1-\alpha)\frac{Ag(t)^{1-\alpha}K(t)^\alpha L(t)^{1-\alpha}}{L(t)} = w(t) \quad (2.5)$$

$$\alpha\frac{Ag(t)^{1-\alpha}K(t)^\alpha L(t)^{1-\alpha}}{K(t)} = (\delta + r(t)) \quad (2.6)$$

Using the labor market clearing condition $L(t) = (1 - l_p(t))N(t)$ in the above equations it yields:

$$(1-\alpha)\frac{y(t)}{(1-l_p(t))} = w(t) \tag{2.7}$$

$$\alpha\frac{y(t)}{k(t)} = (\delta + r(t)) \tag{2.8}$$

2.5. Households

Households face the following optimization problem:

$$Max \int_{t=0}^{\infty} u(c(t))e^{-\rho t}dt \tag{2.9}$$

$$s.t: r(t)b_t + w(t)\left(1 - l_p^i(t)\right) + \frac{\left(l_p^i(t)\right)^{\theta}}{\int_0^1 \left(l_p^j(t)\right)^{\theta} dj} B l_p(t)^{\beta} T(t) - \tau y(t) = \dot{b}(t) + c(t)$$

where $b(t)$ denotes the household assets at time t, that is, the household wealth, and $1 - l_p^i(t)$ denotes the amount of time devoted to work in the labor market. The household's optimization problem (2.9) implies that:

$$w(t) = \frac{\theta B l_p(t)^{\beta} T(t)}{(l_p^i(t))^{1-\theta} \int_0^1 \left(l_p^j(t)\right)^{\theta} dj} \tag{2.10}$$

$$\frac{\dot{c}(t)}{c(t)} = \frac{1}{\sigma}(r(t) - \rho)^{\frac{1}{\sigma}} \tag{2.11}$$

$$\lim_{t\to\infty} e^{-\rho t} c(t)^{-\sigma} b(t) = 0 \tag{2.12}$$

Equation (2.10) means that the marginal income from working should be equal to the marginal income from rent seeking. Given that all the agents are alike in equilibrium, the time devoted to the rent-seeking activity, l_p^i, is the same for all agents, $l_p^i(t) = l_p^j(t) = l_p(t)\ \forall i, j$. This symmetry condition plus equation (2.7) and equation (2.10) imply:

$$\frac{l_p^{1-\beta}}{1 - l_p} = \frac{\theta B}{(1-\alpha)}\frac{T}{y} \tag{2.13}$$

Using the Implicit Function Theorem, we define $l_p(.)$ as the increasing function that relates the time devoted to rent-seeking activities with the ratio government

revenues-income:

$$l_p\left(\frac{T}{y}\right) \overset{Def}{\Longleftrightarrow} \frac{\left(l_p\left(\frac{T}{y}\right)\right)^{1-\beta}}{1-l_p\left(\frac{T}{y}\right)} = \frac{\theta B}{(1-\alpha)}\frac{T}{y}, \quad \frac{\partial l_p\left(\frac{T}{y}\right)}{\partial\left(\frac{T}{y}\right)} = \frac{\theta B}{(1-\alpha)}\frac{\left[1-l_p\right]^2 l_p^{\beta}}{(1-\beta)\left[1-l_p\right]+l_p} > 0$$

3. Balanced growth path

Using equations (2.4), (2.8), (2.11) and (2.13) we get the growth rate of the economy, denoted by v, which is constant when the ratio international aid-income, a, is constant:

$$v = \frac{\dot{c}}{c} = \frac{1}{\sigma}\left(\alpha A^{\frac{1}{\alpha}}\left[\frac{(1-\alpha)}{\theta B}\left(l_p\left(\frac{T}{y}\right)\right)^{1-\beta}\left[1-B\left(l_p\left(\frac{T}{y}\right)\right)^{\beta}\right]\right]^{\frac{1-\alpha}{\alpha}} - \delta - \rho\right)$$

Thus, the relationship between the growth rate and the ratio government's revenues-income shows a hump-shaped form (it is strictly increasing first and then, strictly decreasing) reaching its maximum level at the following value:

$$\left(\frac{T}{y}\right)^{*} = \tau + a = \frac{(1-\alpha)}{\theta}\frac{(1-\beta)^{\frac{1-\beta}{\beta}}}{(B)^{\frac{1}{\beta}} - (1-\beta)^{\frac{1}{\beta}}} \tag{3.1}$$

Assuming that $\tau < \left(\frac{T}{y}\right)^{*}$, this implies that the level of international aid over income that maximizes the growth rate, a^{*}, is as follows:

$$a^{*} = \frac{(1-\alpha)}{\theta}\frac{(1-\beta)^{\frac{1-\beta}{\beta}}}{(B)^{\frac{1}{\beta}} - (1-\beta)^{\frac{1}{\beta}}} - \tau$$

Notice that the reason for this hump-shaped relation is different from the Barro's model (Barro, 1990). In the Barro's model, the hump-shaped relationship between growth and tax rate is due to the distortionary effect that the capital income tax has over the present-future consumption decision. Moreover, the effect of international aid on growth would be always positive, since the increase of aid would imply an increase of government's expenditure for the same tax rate. The distortionary tax effect of Barro's model have been erased from our model to make clear that this distortion does not play any role. In our model, the effect of an increase in the government's revenue produces three different effect: first, it increases, at

less before rent-seeking, the government expenditure in the public good, which increases the productivity of the private sector and the growth rate (this is the standard effect as in the Barro's model); second, the increase in the government revenues encourages rent-seeking and thus, reduces the portion of the government revenues that are devoted to the productive government expenditure, reducing growth; and third, since agents devote more effort to rent-seeking activities, the labor supply goes down, reducing growth. When the amount of international aid is below the level a^*, the first effect prevails and the international aid has a positive effect on growth. When the international aid exceeds level a^*, negative effects prevails and the international aid hampers growth.

3.1. Convergence

In this section we study the convergence of the country that receives the international aid, which we call *South,* to the country that gives it, which we call *North.* We will analyze how international aid affects the convergence in per capita income.

We assume that, in absence of international aid, the North grows faster than the South, but its growth rate is smaller than the maximum growth rate of the South:

$$\begin{aligned} v^N &> \frac{1}{\sigma}\left(\alpha A^{\frac{1}{\alpha}}\left[\frac{(1-\alpha)}{\theta B}\left(l_p\left(\tau\right)\right)^{1-\beta}\left[1-B\left(l_p\left(\tau\right)\right)^{\beta}\right]\right]^{\frac{1-\alpha}{\alpha}}-\delta-\rho\right)=v^S_{\text{no aid}} \\ v^N &< \frac{1}{\sigma}\left(\alpha A^{\frac{1}{\alpha}}\left[\frac{(1-\alpha)}{\theta B^{\frac{1}{\beta}}}\left(1-\beta\right)^{\frac{1-\beta}{\beta}}\beta\right]^{\frac{1-\alpha}{\alpha}}-\delta-\rho\right)=\max_{T/y} v^S \end{aligned}$$

where the superscript N and S means respectively North and South. We consider that the North spends the fraction ψ of her income on international aid to the South:

$$a=\frac{aid}{y}=\psi\frac{y^N}{y^S}=\frac{\psi}{z}$$

where $z=y^S/y^N$ denotes the convergence index. Thus, along the balanced growth path the following equation should hold:

$$v^N=\frac{1}{\sigma}\left(\alpha A^{\frac{1}{\alpha}}\left[\frac{(1\text{-}\alpha)}{\theta B}\left(l_p\left(\tau+\frac{\psi}{z}\right)\right)^{1-\beta}\left[1-B\left(l_p\left(\tau+\frac{\psi}{z}\right)\right)^{\beta}\right]\right]^{\frac{1-\alpha}{\alpha}}-\delta-\rho\right)$$

Given the hump-shaped relationship between growth and international aid in the South, there are two balanced growth path, in one of them (with superscript

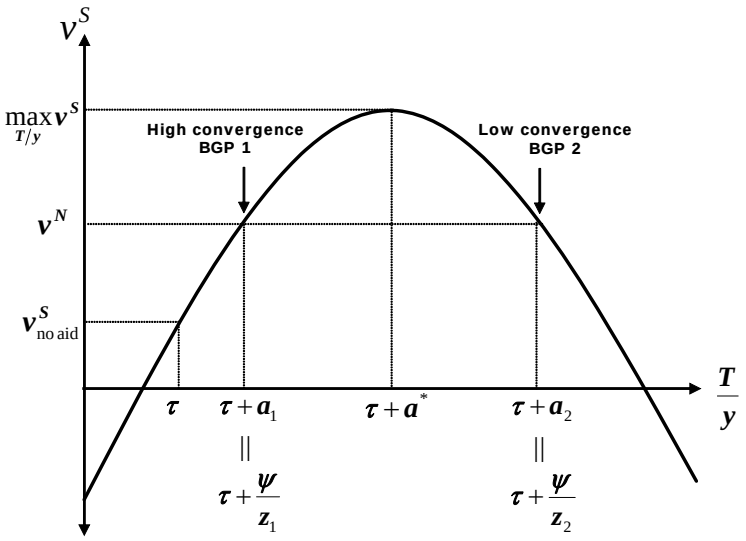

Figure 3.1: Relationship between growth rate and aid

1) the ratio international aid-income is lower than the optimal level, and in the other (with superscript 2) it happens just the opposite (see figure 3.1).

Note that the convergence index is higher in the balanced growth path number 1 (with a lower amount of international aid) than in the other:

$$\frac{\psi}{z^1} = a^1 < a^* < a^2 = \frac{\psi}{z^2} \Rightarrow z^1 > z^2$$

There exists a simple way to make the South economy to converge to the balanced growth path with the higher convergence index: reducing the international aid. More precisely, if the international aid behaves according with following rule:

$$a(t) = \min\left\{\frac{\psi}{z(t)}, a^*\right\}$$

then, the economy in the South will converge to the "good" balanced growth path (the number 1) where the convergence index is the largest.

4. Conclusions

Empirical evidence on the effect of foreign aid on economic growth is ambiguous and mixed. This paper analyzes the relationship between aid and growth in a context in which rent-seeking activities erode the effort of government to provide public goods which generate growth. To do that, we build a model in which agents devote time to work and to rent-seeking activities to appropriate public revenues coming from non distortionary taxes and foreign aid. The government uses the revenues after rent-seeking to finance a public good which generates growth.

We show that there exists a hump-shaped relationship between aid and growth. When aid increases, three effects on growth appear: *(i)* it rises the government's resources and so the provision of the public good, increasing the productivity of the private sector and the growth rate, *(ii)* the increase in the government's resources rises the profitability of the rent-seeking activities, reducing the amount of public revenues after rent-seeking and so the growth, *(iii)* since agents devote more time to rent-seeking activities, the labor supply drops, reducing growth. We show that for low levels of aid the first effect prevails, while for high levels the opposite is true. Incorporating the assumption that the international aid is a fraction of the income of the donor, we show that a drop in aid may increase the income convergence of the receptor country to the donor.

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