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THE CURSE OF THE ELDERS? AID EFFECTIVENESS AND GERONTOCRACY IN DEVELOPING COUNTRIES¹

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Abstract

In this paper we use a simple standard overlapping-generation model to assess the impact of foreign aid. Because of deference to the elders, donors are not able to modify the sharing out of aid between the old and the young in the recipient economy. The model shows that, if aid is considered as a device intended to help attain the spontaneous steady state of the economy, it may lead to a rise or fall in savings, and hence in the growth rate of the economy, depending on a threshold share of aid accruing to elders. Alternately, if aid is intended to help the economy to reach its golden-rule steady state, the relevant level of aid increases with the share of aid accruing to elders, up to a certain threshold. If this share is higher than the threshold, the optimal level of aid is negative.

Key words : Developing Countries, Elders, Aid effectiveness, Overlapping Generations Models.

Résumé

Nous utilisons un modèle à générations imbriquées pour montre que la répartition de l'aide entre jeunes et vieux peut avoir un impact sur l'efficacité de l'aide en termes d'épargne, de croissance et de bien-être. Les sociétés en développement sont généralement marquées par une « déférence pour les anciens » profondément ancrée dans la culture traditionnelle. Nous supposons que les donateurs sont incapables de manipuler cette part, et nous montrons que la part de l'aide qui revient aux vieux a un impact sur la croissance et le bien-être positif en dessous d'un certain seuil et négatif au-delà.

Mots clés : Pays en développement, Anciens, Efficacité de l'aide, Modèles à générations imbriquées.

JEL Codes : E61, F35, F43, O11, O19.

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1 Introduction

Many African Presidents are rather old, and some of them make tremendous efforts to stay in power and die as Presidents. The idea that, in African countries, political power is often linked with age is widely accepted. Chabal and Daloz (1999, p.33) consider this as a good starting point for the analysis of African political systems: “Most African societies continue to subscribe to what might be called a system of deference vis-à-vis the elders, and age (or age group) matters socially and politically”. In fact, age interferes with power and money: “Inevitably, it is the earlier (largely prebendial) accumulation of wealth ... which gives the older generation the edge over younger political actors.” (*ibid*, p.34).

This pre-eminence of the elders is deeply rooted in the traditional structure of African communities. In those rural communities, the “hierarchy relies on positions of anteriority” The “first ones, the elders, are those to whom the seed and subsistence goods are owed” (Meillassoux 1981, p.42). This specific position in the circulation of subsistence goods means that the elder is “responsible for the management of the community” (*ibid*, p.43). Even in an urban context, this pre-eminence of the elder is still to be seen in the rigid patriarchal structure of households. In traditional African societies, it is often assumed that the reality of power is in fact in the hands of a “council of elders”. In this context, the chief is no more than the spokesperson for the group of elders, taking into account the interests of the community as such. In this context, the centralization of income in the hands of the elders is sometimes presented as a way of enhancing the well-being of the community.

This pre-eminence of elders is to some extent compatible with democracy, as gerontocracy may characterize each competing political party. The deference to the elders is not specific to Africa. It has also been described as an important feature of the traditional culture in Asia (Confucianism) and in the Middle East.

Nevertheless, to our knowledge, this stylized fact of Governance in most developing countries has been ignored in the abundant literature on aid effectiveness. A substantial part of the recent literature is devoted to the debatable findings of Burnside and Dollar (2000), who argued that aid works only if the recipient country has good policies and sound institutions. Recent attempts at providing new insights into the relationship between aid and its economic impacts emphasise the need to take the quality of institutions into account, and the impact of aid on capacity building (Moss et al. (2006)), or at least the role of corruption (Akhand and Gupta (2002)). As the literature is inconclusive, Bourguignon and Sundberg (2007, p.316) conclude

that “The causality chain has been largely ignored and as a consequence the relationship between aid and development has been handled mostly as a kind of “black box”. Making further progress on aid effectiveness requires opening that box”.

This paper aims to doing so by modelling the impact of foreign aid on investment and growth using an overlapping-generations model. Such a model is likely to capture some aspects of the power of elders in African aid-recipient countries. Nevertheless, we take into account only a part of the story in order to keep things relatively simple. We investigate the different impact of foreign aid if provided mainly to elders or, conversely, young people.

Our setting is quite different from that in Bhagwati & Grinols (1979), who made the assumption of two different and constant savings rates, one for domestic income and the other for aid disbursements (which may be negative), showing that capital inflows may have positive or negative effects on domestic savings, but a positive effect on investment. Here, aid is supposed to provide an income to the representative agent of the economy. This income is then added to the agent’s other income and split according to the agent’s rational choice between consumption and investment. In this very simple setting aid institutions have no say over the distribution of aid between the young and the old. One rationale for this would be to acknowledge, as is now widely accepted, that conditionality does not work. Another rationale is that donors are fragmented, which makes coordination difficult and allows significant room for manoeuvre by leaders. However, this setting does not take into account all aspects of aid capture, in particular capital flight.

The remainder of the paper is organized as follows. Section 2 describes the basic features of the model. In section 3, it is shown that the distribution of foreign aid among elders and youngsters affects capital accumulation. Section 4 presents numeric simulations of the main conclusions of the model, and section 5 concludes.

2 The model

The general structure of our model is based on the two-period OLG model (Diamond (1965)). Time is discrete, $t = 1, 2, 3, \dots$ and the economy (but not its inhabitants) lives forever. In each time period a new generation is born. People live for two periods and then die. Then at any period t , two generations cohabit: the young (indexed by y) and the old (indexed by o). There are $N_{y,t}$ young and $N_{o,t}$ old at each period. We assume

that the population is growing at rate n . Then, $N_{y,t+1} = (1 + n) \cdot N_{y,t}$ and $N_{y,t} / N_{o,t} = (1 + n)$.

Each agent born at period t is endowed with one single unit of labour when young, and supplies it to firms inelastically. She receives a wage (w_t) which is used to finance consumption in the first period ($c_{j,t}$) and savings as physical capital ($e_{j,t}$). When the agent becomes old, i.e. in period $t + 1$, she lives on her previous savings. Preferences of individuals are assumed to be represented by an additively-separable utility function:

$$U_t(c_{y,t}, c_{o,t+1}) = u(c_{y,t}) + \beta u(c_{o,t+1}) \quad (1)$$

We shall assume that U is strictly increasing, strictly concave and twice continuously differentiable. For simplicity, we shall use a log-linear function of the form:

$$U_t(c_{y,t}, c_{o,t+1}) = \ln(c_{y,t}) + \beta \ln(c_{o,t+1}) \quad (2)$$

where β stands for the psychological discount rate.

For simplicity, we assume that the economy produces a single good which can be invested or consumed. Our economy has also one nonproduced input (labor). The production function for the one produced good is:

$$Y_t = K_t^\alpha N_{y,t}^{1-\alpha} \quad (3)$$

with $\alpha \in]0, 1[$.

The per capita production function is then:

$$y_t = k_t^\alpha$$

with $y_t \equiv Y_t / N_{y,t}$ and $k_t \equiv K_t / N_{y,t}$.

Capital depreciates at the rate of δ during the production process.

Markets are competitive so that production factors are paid their marginal product:

$$\begin{aligned} \frac{\partial Y_t}{\partial N_{y,t}} &= w_t = (1 - \alpha) k_t^\alpha \\ \frac{\partial Y_t}{\partial K_t} &= \alpha k_t^{\alpha-1} = r_t + \delta \end{aligned}$$

In the economy, capital market equilibrium requires that gross saving $E_{j,t}$ equals gross investment I_t with $E_{y,t} = N_{y,t} \cdot e_{y,t}$.

The per capita capital accumulation is then given by:

$$k_{t+1} = \frac{e_{y,t}}{1 + n} \quad (4)$$

which implies that the existing capital stock at the beginning of period $t + 1$ is an increasing function of previous young people's savings.

Last, we assume that the economy receives an amount of foreign aid per capita (in this setting, this refers to the number of young people) at each period t (denoted aid_t). Aid per capita is very different from one country to another (it is generally very low in large population countries like India), but is fairly stable in each country in the medium run.

According to some exogenous considerations (perhaps political), foreign aid is divided between young and old people according to a parameter θ :

$$aid_t = \theta aid_t + (1 - \theta) aid_t \quad (5)$$

where θ stands for the share of foreign aid received by the old and $(1 - \theta)$ the share of foreign aid received by the young. Because of population growth, in each period, the number of the old is lower than the number of the young. As a result, the amount of aid received by each old in period t is $\theta aid_t(1+n)$.

As most of the poor, in an African context, are likely to be young, θ is very similar to parameters used in other models to represent the aversion of the recipient government to poverty (See Boone (1996), Azam & Laffont (2003))

3 The distribution of foreign aid between generations and the rate of economic growth

The program of the representative agent is

$$\begin{aligned} Max U(c_{y,t}, c_{o,t+1}) &= \ln(c_{y,t}) + \beta \ln(c_{o,t+1}) \quad u' > 0; u'' < 0; 0 < \beta \leq 1 \\ \text{under } \left\{ \begin{array}{l} w_t + (1 - \theta) aid_t = c_{y,t} + e_{y,t} \\ c_{o,t+1} = (1 + r_{t+1}) e_{y,t} + \theta aid_{t+1}(1 + n) \end{array} \right. \end{aligned} \quad (6)$$

with $w_t = (1 - \alpha) k_t^\alpha$ and $r_{t+1} = \alpha k_{t+1}^{\alpha-1} - \delta$. This specification relies on the assumption that young people enjoy perfect foresight over the date of their death (which is the usual assumption, to keep things as simple as possible) and both the amount of aid they will receive when old.

The resolution leads to the standard first-order condition:

$$\frac{c_{y,t}}{c_{o,t+1}} = \frac{1}{\beta(1 + r_{t+1})} \quad (7)$$

and to the following values of $e_{y,t}$, $c_{y,t}$ and $c_{o,t+1}$:

$$e_{y,t} = \frac{\beta}{1 + \beta} \left[w_t + (1 - \theta) aid_t - \frac{\theta(1 + n)}{\beta(1 + r_{t+1})} aid_{t+1} \right] \quad (8)$$

$$c_{y,t} = \frac{1}{1+\beta} \left[w_t + (1-\theta) aid_t + \frac{\theta(1+n)}{(1+r_{t+1})} aid_{t+1} \right] \quad (9)$$

$$c_{o,t+1} = \frac{\beta(1+r_{t+1})}{1+\beta} \left[w_t + (1-\theta) aid_t + \frac{\theta(1+n)}{(1+r_{t+1})} aid_{t+1} \right] \quad (10)$$

Differentiating equation (8) allows us to highlight the relationship between the share of foreign aid received by old people and savings per capita, *ceteris paribus*:

$$\frac{\partial e_{y,t}}{\partial \theta} = \frac{\beta}{1+\beta} \left(-aid_t - \frac{1+n}{\beta(1+r_{t+1})} aid_{t+1} \right) < 0 \quad (11)$$

This implies that savings per capita fall with an increase in the share of foreign aid received by old people: when foreign aid goes mainly to elders, young people know that they will have an additional source of income when they become older. Consequently, they save less when they are young and saving is a *decreasing function of θ* . But this does not take into account the dynamics of the model. Namely, w_t , and r_{t+1} are related, as the former is a function of k_t , the second a function of k_{t+1} and both functions of aid_t and aid_{t+1} . We tackle this point in the next section of the paper.

We now need to specify how foreign aid changes over time. We will consider two alternative ways of tackling this question.

3.1 Speeding the convergence to the decentralized steady-state equilibrium

First, we consider that foreign aid is aimed at increasing the speed of convergence along the growth-path rather than a way of modifying it. Thus, foreign aid at period t is provided according to:

$$aid_t = \phi(y^* - y_t^a) \quad (12)$$

with y_t^a being expected GNI at time t and $\phi \in]0, 1[$. For simplicity, we assume that the donor enjoys perfect foresight, which implies that y_t^a equals y_t . We use y_t^a rather than y_{t-1} in equation (12) because in overlapping generations models (OGM), each period lasts a generation (20 to 30 years). So, using y_{t-1} amounts to making current foreign aid dependent on a "20-year old" level of income.

Equation (12) implies that foreign aid aims to speed up the convergence of the recipient economy to its steady state, without being able to modify the final result of the transition process.

Steady-state production per capita is given by:

$$y^* = (k^*)^\alpha \text{ with } k^* = \left[\frac{\beta}{(1+\beta)} \frac{(1-\alpha)}{(1+n)} \right]^{\frac{1}{1-\alpha}} \quad (13)$$

Using equations (12) and (13), the dynamic equation of the model is:

$$k_{t+1} = \frac{e_{y,t}}{1+n} = A \left[(1-\alpha) k_t^\alpha + (1-\theta) \phi (y^* - y_t) - \frac{\theta(1+n)}{\beta (\alpha k_{t+1}^{\alpha-1} - \delta)} \phi (y^* - y_{t+1}) \right] \quad (14)$$

$$= A \left[(1-\alpha) k_t^\alpha + (1-\theta) \phi (y^* - k_t^\alpha) - \frac{\theta(1+n)}{\beta (\alpha k_{t+1}^{\alpha-1} - \delta)} \phi (y^* - k_{t+1}^\alpha) \right] \quad (15)$$

with $A = \frac{\beta}{(1+\beta)(1+n)}$.

There is no analytical solution to the dynamic equation (14), relating k_{t+1} to k_t . The only way to show what the dynamics looks like is to simulate using numerical values. Following Barro and Sala-i-Martin (1995), we assume that each “period” represents in fact 25 years. So the relevant parameters for each “period” are the annual rates raised to the power of 25. For simulation purposes, we will pick up realistic values for the annual rates of population growth rate (2.5%), pure preference rate for the present (6%) and capital depreciation rate (5%), resulting in values for the entire period of 0.854, 0.233 and 0.723 respectively. Figure 1 shows the results for these specific values of the parameters, assuming that $\theta = 0.5$ and $\phi = 0.2$. The relationship between k_{t+1} and k_t is monotonous, resulting in only one stable equilibrium for $k^* = 0.00949$ (remember that due to equation (13) this value is the same with and without aid). As we will show later (point 3.2), this economy is in a situation of under-capitalisation, meaning that the decentralized steady-state capital per capita level is lower than the Golden Rule one. This situation is likely to be relevant for developing countries.

3.2 Golden Rule

We have so far assumed that aid is aimed to speed up the process of convergence to the decentralized steady state. This setting provides a useful benchmark case, assuming that donors are not able to modify the steady-state level. This seems consistent with the idea that aid is used in the last

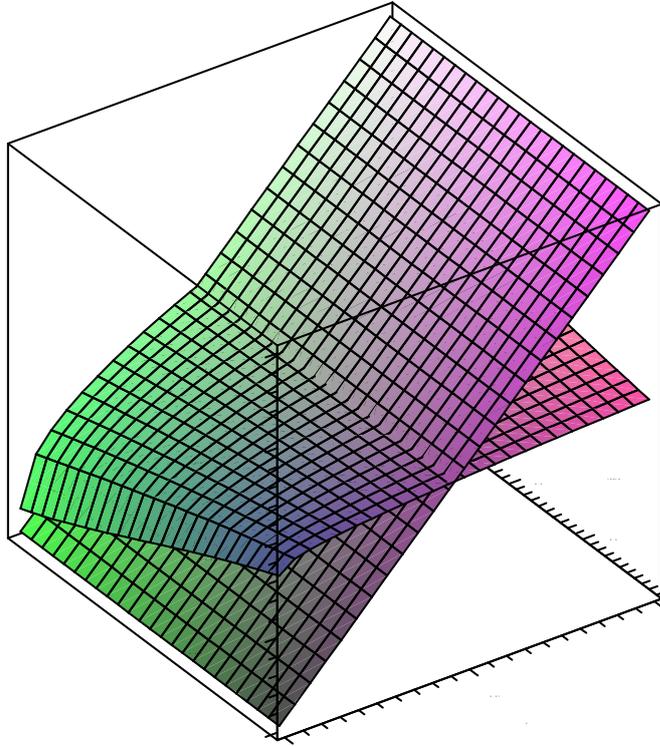


Figure 1: k_{t+1} as function of k_t and θ

resort according to the characteristics and preferences of the recipient agents (aid "cannot buy reforms", as popularized by Burnside and Dollar (2000)). Nevertheless, we may wonder whether the donor has the capacity to provide aid according to the difference between the actual GNI per capita and the steady-state level of each country assisted. In reality, the donor sets thresholds in terms of GNI per capita. For instance, the operational cutoff for IDA (the World Bank subsidiary for financing low-income countries) eligibility for 2010 is \$1,135.

But the very aim of aid, according to donors, is to achieve development or more specifically poverty alleviation. In the setting of growth models, this could be understood as allowing the domestic developing economy to achieve the Golden Rule (GR), i.e. the maximal amount of steady-state average consumption per head. This approach is consistent with the donor playing the role of a benevolent planner, trying to enhance the well-being of the

representative agent irrespective of the generation.

Interestingly, in this setting, even if donors are assumed to have no control over the use of their money, we shall show that they could manipulate the process of capital accumulation in order to make it converge towards the golden-rule (GR) steady-state level. Solving the model without foreign aid leads to the following golden-rule level of capital per capita:

$$k_{gold} = \left[\frac{(\delta + n)}{\alpha} \right]^{\frac{1}{\alpha-1}} \implies y_{gold} = (k_{gold})^\alpha$$

The way in which the donor should behave is not that straightforward. A rule like the former one (equation 12) does not make the economy converge spontaneously to the GR steady state (see Appendix).

The simplest way of achieving this convergence is to provide a constant amount of aid per capita, denoted by *aid*. In this new setting, the dynamic equation results immediately from equations (4) and (8).

$$k_{t+1} = A \left[(1 - \alpha) k_t^\alpha + \left((1 - \theta) - \frac{\theta(1 + n)}{\beta (\alpha k_{t+1}^{\alpha-1} - \delta)} \right) aid \right] \quad (16)$$

Solving equation (16) by replacing k_t and k_{t+1} by k_{gold} gives this constant amount of foreign aid, denoted aid_{gold} , needed to reach the GR steady state.

4 Simulation of the relationship between savings, aid and the repartition of aid

The impact of foreign aid on transitory growth is obviously related to savings per young person in this kind of model. For this reason, we simulate the relationship between foreign aid and the young's savings in the two cases considered above.

4.1 Speeding the convergence to the decentralized steady-state equilibrium

In this subsection, we simulate the relationship between $e_{y,t}$ (savings of the young) and aid and its distribution. In this first setting, the decision of the donor to provide more or less aid to the country is linked to the parameter ϕ . Figure 2 shows the results for $k_0 = 0.0001$ (about one-tenth of the steady-state value). For a fixed value of θ , the relationship between $e_{y,t}$ and ϕ may be either positive or negative. If $\theta < \theta^{**}$, the relationship is positive,

and negative otherwise. When aid increases, savings falls from its "without aid" value if $\theta < \theta^{**}$, and increases in the opposite case. With the former values of the parameters, $\theta^{**} \approx 0.7927$. Figure 2 provides an insight into the relationship for values of $\theta \in [0, 1]$ in order to highlight the reversal in the relationship between $e_{y,t}$ and ϕ . When $\phi = 0$, Figure 2 plots the value of $e_{y,t}$ without aid (that is with $\phi = 0$), of course independent of θ .

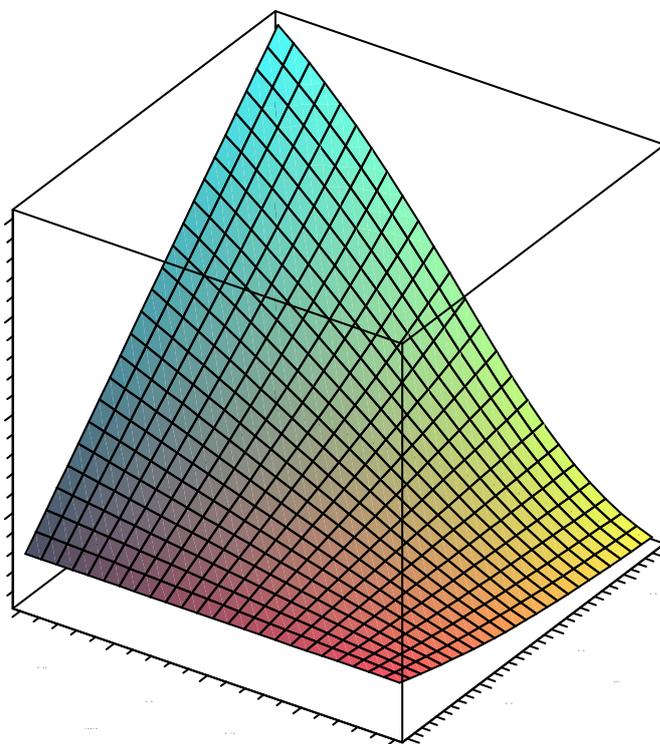


Figure 2: Savings as a function of aid (ϕ) and of the repartition of aid between old and young (θ)

This result should not be surprising. In that first setting, foreign aid may affect negatively savings per capita as does PAYG schemes (vs. fully funded schemes) because of the asset substitution effect. Moreover, empirical research often shows a non-linear impact of aid on growth (Collier & Dollar (2001), (2002)). Hansen & Tarp (2000) find negative returns to aid when

the ratio of aid to GNI is greater than 25%. Lensink & White (1999) find a threshold of 40-50% of GNI, but Gomanee, Girma & Morrissey (2003) find that aid only becomes effective (in contributing to growth) beyond a critical level (two per cent of GNI), and find no evidence of diminishing returns to aid. Burnside & Dollar (2000) find no direct impact, but an effect only when policies are good (which might be interpreted in our model as a low θ , if bad policies are linked with aid capture by elders).

The fact that aid resulted in rapid growth in some Asian countries (like South Korea or Taiwan), and generally fails to do so in Africa may be explained by the external pressure on the Asian governments in the period of the cold war, as shown by Bates (2001). Even governments dominated by elders should have reduce their greed in order to face the threat of China and North Korea.

Moreover, the relationship between aid and savings (and, by way of consequence, growth) is likely to be non-linear, but not quadratic either, as is assumed in most empirical research. A misspecification of the econometric estimation is likely to result when the share of aid accruing to old people is not taken into account. In a cross section of countries, the relation between aid and savings will depend on the repartition of countries with high elders capture in the sample.

4.2 Using aid as a means of reaching the Golden Rule (GR) steady-state equilibrium

In order to converge to k_{gold} , the GR steady state, the donor has to provide an optimal value of aid. With the same parameters, $k_{gold} = 0.102$. and depends on θ . For instance, $aid_{gold} = 1.56$ with $\theta = 0.05$ and $aid_{gold} = 0.84$ with $\theta = 0.01$.

The value of aid_{gold} may be either positive or negative. With the former parameters, aid_{gold} is positive from $\theta = 0$ up to a threshold value of $\theta^g \approx 0.097$. Afterwards, aid_{gold} is negative. Figure 3 plots the value of aid_{gold} as a function of θ . As shown in this figure, aid_{gold} is very rapidly increasing and tends to infinity as θ approaches the threshold value.

When the magnitude of elders capture θ increases, savings decreases, which explains why a bigger amount of aid is needed in order to converge to the GR steady state (remember that the simulation is based on a situation of undercapitalisation). After the threshold, aid has to be negative (an outflow of the economy) to make the economy converge. This has no economic meaning, as in this case (at least when θ is not very high), the income of the young and of the old is negative, which is not possible in a framework were there is

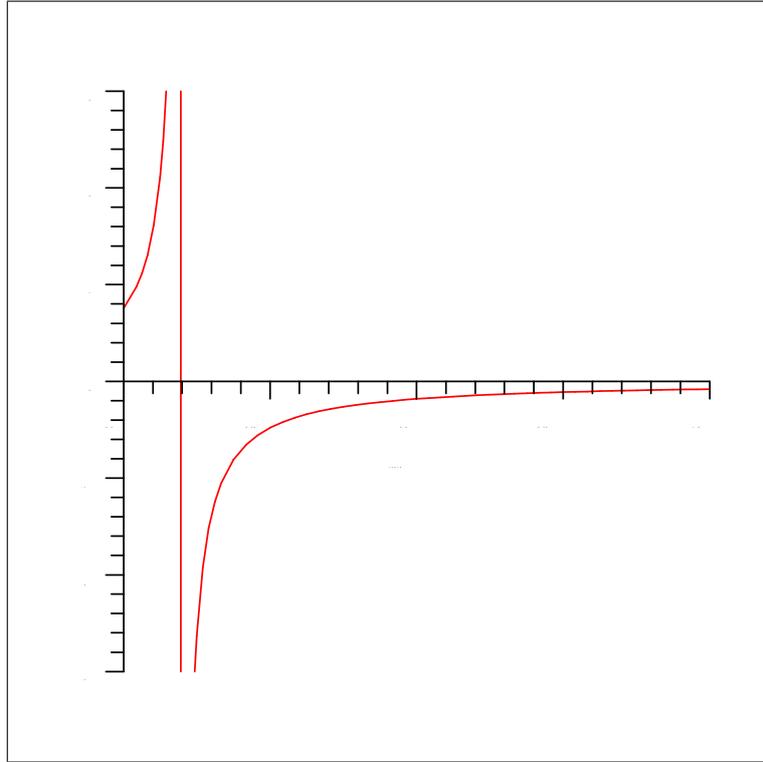


Figure 3: Optimal aid aid_{gold} as a function of θ , the share of elders in aid income

no capital market, i.e. no possibility to borrow.

Assuming that donors provide the relevant amount of aid for reaching the GR steady state, the short term dynamics is very alike the previous one (see figure 4).

This result shows that it is theoretically possible to use foreign aid as a device to reach the golden rule, a Pareto-improving situation that agents are not able to achieve without aid. This is however only possible if the share of aid accruing to elders θ is very small, as the amount of optimal aid is rapidly growing with θ . In our example, even at low levels of θ , the aid to GDP ratio is very high. This is partly the result of the choice of the parameters: in our example, the GR GDP is much higher than the decentralized steady state GDP. Lower values of the pure preference for the present β would result in a lower difference between both. The value of the pure preference for the present is widely assumed to be very high in low income countries, but this view has been challenged (Holden et alii (1998), Moseley (2001)).

Of course, it seems fairly unlikely that, in reality, donors would stick to

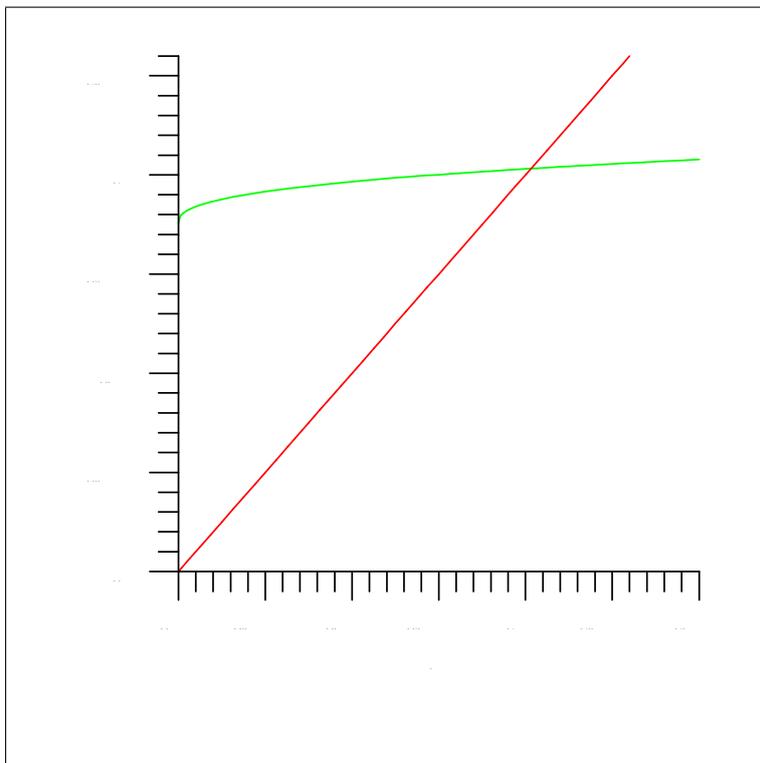


Figure 4: k_{t+1} as function of k_t with $\theta=0.05$ and $aid = aid_{gold}$

this kind of rule. Providing aid for eternity can hardly be justified, and all the more so since if aid stops, the income of the recipient economy will revert to its lower decentralized steady state. Nevertheless, one should note that in the sixties, the idea was to provide aid only in the medium term, not for the long run. Fifty years later, one may wonder what is the relevant time span. Nevertheless, even if they wanted, donors might be incapable to implement such a rule, which is difficult to compute and to operationalize in a rapidly-changing economy. Moreover, in reality, the multiplicity of donors would require a substantial degree of coordination and no other motive for aid but increasing the well-being in the recipient country, which is not in line with empirical research in this field.

5 Conclusion

In this paper, we assess the impact of foreign aid on economic growth in a very simple two-period *OLG* model. We have shown that the effectiveness

of aid depends on the distribution of aid between elders and the younger generation.

If aid is provided to accelerate growth during the transition period, above a certain threshold θ^* , more aid results in decreasing savings, and hence capital accumulation; under this threshold, the impact of aid on savings and growth is positive; providing aid to young people results in an increase of investment, and the opposite occurs when providing aid mainly to elders. The (probably) frequent case of elders' aid capture will result, after a certain threshold, in a decrease in savings and the current growth rate of the economy. This is likely to be the case in African countries, because of their "system of deference" vis-à-vis the elders which is deep-rooted in their cultural and social values.

The donor can also be seen as a benevolent planner, trying to make the economy maximise its long-term average consumption (Golden Rule). The donor has to set the value of aid at an optimal level that will allow the economy to converge spontaneously to the Golden Rule (the donor is not assumed to be able to manipulate the behaviour of individuals in the economy). The elders' capture of aid results in an increase of the level of aid needed to reach the Golden Rule steady state.

In both settings, the capture of aid by elders has a negative impact.

Nevertheless, our approach is somehow limited as the share of aid accruing to the elders (θ in our model) is likely to change over time.

The decrease of the power of the elders due to the modernization of African societies is well documented. The increase in market-based relationships in traditional societies undermines the control of elders over the circulation of goods and people. For instance Ensminger (1992, p. 169) shows that in the Orma pastoralist society "As young men gained economic independence through wage labor, many of the institutions of society previously controlled by the elders gave way: gerontocracy, clan, lineage, patron-client relations and marriage. These changes resulted in a transfer of authority to the state, as the elders became incapable of using their institutional control to engineer consensus for the common good". The openness of the economy is likely to act in the same way at the level of the country itself, provided, as underscored by Ensminger, that relative prices be in favor of an increase in transactions with the rest of the world.

Finally, our result provides an alternative to the standard interpretation that aid does not improve economic growth due to corruption. Our result stems mainly from differences in rational choice over consumption and investment between two generations. For this reason, a negative impact of aid on growth should not be explained too quickly by corruption or bad governance. On the contrary, our approach highlights the role of institutions, embedded

in cultural values. As mentioned by Bhardan (1997, p. 1330) it is quite difficult to disentangle corruption from cultural values : "It is widely recognized that in developing countries gift-exchange is a major social norm in business transactions, and allegiance to kinship-based or clan-based loyalties often takes precedence over public duties even for salaried public officials. Under such circumstances use of public resources to cater to particularistic loyalties become quite common and routinely expected". The reverence to elders makes the concentration of wealth in their hands quite legitimate. Only if this concentration results in a striking difference in living standards between the old and the young may it lead to jealousy and potentially result in coups.

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Appendix

To show that providing aid as a proportion of the difference between GDP and GR GDP does not work (in the sense that the economy does not converge to the GR steady state), assume that the donor implements a similar rule to that described in equation (12). Thus, foreign aid at period t is given by:

$$aid_t = \phi(y_{gold} - y_t^a) \quad (17)$$

with y_{gold} being golden-rule steady-state production per capita, and $y_t^a = y_t$ as before (perfect foresight). We then obtain the (per capita) capital-accumulation function:

$$k_{t+1} = A \left[(1 - \alpha) k_t^\alpha + (1 - \theta) \phi(y_{gold} - k_t^\alpha) - \frac{\theta}{\beta (\alpha k_{t+1}^{\alpha-1} - \delta)} \phi(y_{gold} - k_{t+1}^\alpha) \right] \quad (18)$$

In this setting, the economy converges to a steady-state equilibrium denoted by k_a . As can be seen by replacing k_t and k_{t+1} by k_a , k_a is different from k_{gold} .

For instance, with the same parameters as before, $k_{gold} = 0.102$. If $\theta = 0.01$ (1% of aid accrues to elders) and the donor decides to provide an arbitrary value of aid , say 0.00001, the economy will spontaneously converge to $k_a = 0.0095$, an undercapitalised steady state.