Massey University

DEPARTMENT OF APPLIED AND INTERNATIONAL ECONOMICS

DISCUSSION PAPER NO. 05.01
JANUARY 2005

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Discussion Paper 05.01
ISSN.1174-2542
Price: $10

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ABSTRACT

This paper re-examines the theoretical aid-growth nexus by expounding on the issues relating to policies designed for aid delivery and the lack of aid recipient's state institutional capability to enforce policy conditionality. Two propositions have been demonstrated to explain why policy conditionality attached to aid might not always promote sustainable economic growth in Least Developed Countries. First, the model has simulated that a stable aid flow contributes to economic growth even when aid is fungible. Second, the model has also simulated that unstable aid inflow impairs the favourable effect of stable aid inflow. It is suggested that the contribution of aid to economic growth depends not only on the ability of aid to increase investment in the recipient country but also the quality of policy conditionality and the state and institutional capability of the recipient country to implement policy conditionality.

Key words: Foreign Aid, Economic Growth, Policies, State Institutions
JEL Classification: D72; D9; F35; H30

1. INTRODUCTION

Examining the aid-growth nexus has been approached from different ideological and methodological aspects. In the earliest study, the "two-gap" model developed by Chenery and Strout (1966) considers aid as a financial source to supplement domestic savings and foreign exchange earnings. As such, the potential impacts of aid on growth have been assessed on how an increase in aid inflows may affect investments, savings and export performance. A series of aid effectiveness studies in the 1960s-70s period found that aid could accelerate output growth via capital accumulation in the recipient country (see for example; Chenery and Strout, 1966; Papanek, 1973; Gupta, 1975). However, the studies initiated by Griffin (1970) and Griffin and Enos (1970) found that aid inflows could displace domestic savings and in turn slow down investments and output growth. Not much empirical work has been done on the potential impacts of aid on export earnings, but the studies that have been undertaken highlight that a high level of aid inflow has a negative effect on the countries' competitiveness and private investment (Tsikata, 1998).

After the 1980s, the examination of the aid-growth nexus has paid much attention to the recipient country's policy response to accommodate aid inflows. The theoretical aid-growth models were presented by Mosley *et al.* (1987), Boone (1996), Gong and Zou (2001), White (1992a), Burnside and Dollar (1997), Dalgaard *et al.* (2004), Lensink and White (1999) and Dalgaard and Hansen (2000). The first three studies link the impact of aid fungibility[1] and economic growth. While Mosley *et al.* (1987) demonstrate that aid fungibility could affect economic growth via the marginal productivity of public and private capital, Boone (1996) and Gong and Zou (2001) found that aid has no effect on long run growth because aid is used as substitute for consumption. Burnside and Dollar (1997) demonstrate that good policy improves the effectiveness of aid, while Dalgaard *et al.* (2004) show that the size and direction of the impact of aid on productivity depend on policies and the production technology. Lensink and White (1999) demonstrate that an excessive aid inflow over the optimal level has a negative effect on economic growth, while Lensink and Morrissey (2000) demonstrate that the instability of aid inflow has a negative effect on growth. White (1992a) also discusses in detail the macroeconomic impact of aid-growth relationship. In contrast to other studies Dalgaard and Hansen (2000) demonstrate that aid fungibility is not the main problem for the effectiveness of aid but that the interactive effect of aid and good policy on growth is ambiguous.

While the above-mentioned theoretical models suggest that aid may not always promote economic growth, the empirical works on the interdependence among aid, growth and policies have been controversial. The crux of the ongoing dispute is the interpretation and the statistical robustness of the interactive term between aid and policy index in the seminal work by Burnside and Dollar (1997, 2000a, 2000b, 2003a, 2003b). Finding the statistical significance of the interactive term led Burnside and Dollar to conclude that aid can promote growth, but only when policies are right. However, Lensink and White (2000) demonstrate that the interactive term can be interpreted as either aid can promote growth if

[1] Aid fungibility means that a government can increase resources through the aid inflows to increase spending, fund tax cuts, or reduce the fiscal deficit (reducing future tax). This would cause a negative impact of aid on growth (World Bank, 1998).

policies are right or policies work better if supported by aid inflow. The statistical robustness of the interactive term has been re-examined in many studies but there is no sign of agreement on the role of policies in promoting aid effectiveness.[2]

In a theoretical attempt to understand the aid-growth nexus, this paper expounds on the issues relating to policies designed for aid delivery and the lack of the aid recipient's state institutional capability to enforce policy conditionality. The analytical framework is mainly drawn from the development issues of Least Developed Countries (LDCs), as explained in the "two-gap" model. It is also argued that strengthening the ability to raise investment with external viability is the key to achieving sustainable economic growth in LDCs.[3] In this regard, Steger's (2000) linear growth model (LGM) is modified to form a theoretical model of the aid-growth nexus. The simulation technique is employed to demonstrate the interaction between aid and the recipient country's state institutional capability and how this interaction may influence economic growth and economic volatility.[4]

The rest of this paper is organised as follows. Section 2 presents the theoretical model of aid-growth nexus. Section 3 demonstrates the potential impact of aid on growth, savings and consumption. Section 4 presents the interdependence among aid, growth, policies and state institutions. Finally, Section 5 summarises and draws some implications for the empirical investigation of the aid-growth nexus.

2. THE MODEL

The model utilized in this study extends of the LGM of a closed economy developed by Steger (2000). It differs from Steger (2000) by employing an open economy framework to incorporate the external resource constraints into the analysis. As such, the capital accumulation equation of the Steger LGM is modified to include the net per capita foreign capital inflow variable. In this context, the evolution of per capita capital stock is equal to the sum of domestic savings and the net capital inflows minus the depreciation of per capita capital stock ($k(t)$), and thus can be expressed as follows:

$$\dot{k}(t) = s(t) + f(t) - (\delta + n)k(t) \qquad \textbf{(1)}$$

where $s(t)$ is domestic saving per capita, $f(t)$ is the net per capita capital inflow, n is constant rate of population growth and δ is the depreciation rate of capital stock.

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[2] See for example Beynon (2001) for the summary of the earlier debate as to whether policies are a necessary condition to improve the effectiveness of aid. Recent studies by Akhand and Gupta (2002), Dayton-Johnson and Hoddinott (2003), Easterly (2003), Roodman (2004) and Easterly et al (2004) cast doubt on the robustness of the Burnside and Dollar finding.

[3] External viability means that current account deficits can be financed by normal capital inflow at a sustainable level.

[4] Economic volatility is a situation where a volatile macroeconomic environment (high inflation, rapid currency devaluation) leads to a significantly lower rate of investment, undermines educational attainment, harms the distribution of income and increase poverty.

According to the "two-gap" model, poor countries face the fundamental constraint of lacking enough domestic savings and foreign exchange to meet the desired level of domestic investment. Consequently, such countries are limited in their ability to achieve a target growth rate and hence rely on external finance, including foreign aid, to achieve their objective. For self-sustaining economic growth, they have to mobilise domestic resources to finance investment and reduce their heavy reliance on external finance. In addition, they have to raise foreign exchange earnings to finance imported intermediate and capital goods as well as repay their debts. Whether they can overcome these financial constraints and achieve their objective depends on their *ability to increase investment* with external viability.[5]

In equation (1), $s(t)$ and $f(t)$ capture the LDCs' ability to raise investment from internal and external resources, respectively. The LDCs' ability to maintain economic growth with external viability is also captured by $f(t)$. This is because $f(t)$ there will be a particular level of $f(t)$ that will be consistent with the sustainable level of the external account. Any changes that affect the flow of external capital (i.e., unstable aid inflow) will affect the LDCs' ability to raise investment. Therefore, equation (1) captures the LDCs' ability to raise investment with external viability.

Based on equation (1), it is further assumed that net per capita capital inflow comprises only foreign aid inflows. It is also assumed for now that net per capita aid inflow grows at a constant rate (μ). Therefore, the amount of net per capita aid inflow takes the following form:

$$f(t) = F_0 e^{\mu t} \qquad \textbf{(2)}$$

where $f(t)$ and (μ) are defined as above and F_0 is the initial stock of total capital.

The model is also extended to include a modification of Steger's (2000) distortion index in the production function, which reflects the level of structural distortion in the economy created by poor policies and institutional rigidities in the LDCs. It is further assumed that the only factors of production are capital and labour and that technology exhibits constant returns to scale. Although this kind of technology is simple, it can capture a change in productivity that can be derived from the improvement of technical and management skills gained from

[5] The view on demand side driven economic growth suggests that output growth is subject to balance of payment constraints. Thirlwall (1980) illustrates that the balance-of-payments constrained growth rate depends on capital inflows and trade performance, and that "in the long run a country cannot grow faster than the rate of growth of output consistent with the balance-of-payments equilibrium on current account" (Thirlwall, 1980. p. 251). For an up-to-date survey of the literature, see McCombie and Thirlwall (1997). On the supply-side approach, at least during the early stages of economic growth and development, it is necessary to accumulate capital from foreign capital. As foreign capital increases, it could raise the productivity of capital through the introduction of modern technology and management and by raising the skill base of the labour force. For the role of capital accumulation on economic growth and development in underdeveloped countries, see for example Nurkse (1953), Lewis (1955) and Arndt (1987). Moreover, to achieve sustainable economic growth it is required to establish a virtuous circle among savings, exports and investments. In this context, an increase in exports not only raises foreign exchange for imports and investments, but also provides markets for goods which would not otherwise be produced, or produced only to meet domestic demand. As investments increase, accelerated economic growth is expected, which in turn increasingly provides additional resources for capital accumulation though an increase in the ability to save (UNCTAD, 1999, Part II, and UNCTAD, 2000b).

learning-by-doing and knowledge spillovers (Barro and Sala-i-Martin, 1995, p. 140). Besides, this production function has possible implications for desirable government policy (*ibid.*, p. 140). It is therefore appropriate to apply constant returns to scale to capture the positive effects of technology transfers and changes to the liberal policy regime because of aid inflows. For the sake of simplicity, the size of the labour force and population are assumed to be equal so that per capita output net of distortion can be expressed in the following form:

$$y(t) = (1 - \pi)\Phi k(t) \qquad \textbf{(3)}$$

where *y(t)* is per capita output, *k(t)* is per capita capital stock, π is the distortion index, and Φ is total productivity.

Now, a benevolent social planner with dictatorial powers will choose to maximise the total discounted life-time utility of the representative infinitely lived household subject to the economy's resource constraints, thereby allowing the complete model to read as follows:

$$\underset{c(t)}{\text{Max}}\, U[c(t)] = \int_0^\infty \frac{[c(t) - \bar{c}]^{1-\theta} - 1}{1-\theta} e^{-(\rho - n)t} dt$$

subject to resource constraints $\dot{k}(t) = s(t)y(t) + f(t) - (\delta + n)k(t)$

$$k(0) = k_0, k(t) \geq 0 \text{ for } \forall\, t, \text{ and } \bar{c} \leq c(t) \leq \Phi k(t) \qquad \textbf{(4)}$$

where $\bar{c}$ is the subsistence level of per capita consumption, θ is a constant risk preference coefficient and ρ is the individual time preference discount rate. Following the standard way to solve the preceding dynamic problem, it can be expressed as the optimal path of per capita consumption and capital, as follows:[6]

$$c(t) = \bar{c} + [c(0) - \bar{c}]e^{\theta^{-1}[(1-\pi)\Phi - \delta - \rho]t} \qquad \textbf{(5)}$$

$$k(t) = \bar{k} + [k(0) - \bar{k}]\left[e^{\theta^{-1}[(1-\pi)\Phi - \delta - \rho]t} + F_1 e^{\mu t}\right] \qquad \textbf{(6)}$$

where $\bar{k}$ is the per capita subsistence capital stock and its value is defined as follows: $\bar{k} \equiv \dfrac{\bar{c}}{(1-\pi)\Phi - \delta - n}$

In the case of no foreign aid inflow (i.e., $F_1=0$), the model has a similar property to the linear growth model with subsistence consumption developed by Steger (2000), in which the economy is caught in the poverty trap when both per capita consumption and capital stock are equal to their subsistence level and the net marginal product of capital is relatively lower than the time preference. Intuitively, at the subsistence level of income individuals do not have the *ability to save* or the *ability to raise investment* (*ibid.*). Escaping the poverty trap in a world without foreign aid can only be achieved when the net marginal product of capital exceeds the time preference rate and consumption exceeds the subsistence level (*ibid.*). In other words,

[6] See Appendix 1 for a detailed mathematical solution to the model.

whenever individuals are *willing to save* and have the *ability to save and invest*, the economy will take off. Both per capita consumption and capital stock will grow and reach their asymptotic balanced-growth equilibrium at a certain time.

In the case where a country receives foreign aid, policy conditionality attached to aid will raise the ability to invest. The growth rate of per capita consumption and capital stock will approach asymptotic balanced-growth equilibrium at the following rate:

$$\lim_{t\to\infty}\frac{\dot{c}(t)}{c(t)} \to \theta^{-1}\left[(1-\pi)\Phi-\delta-\rho\right] \qquad \textbf{(7)}$$

$$\lim_{t\to\infty}\frac{\dot{k}(t)}{k(t)} \to \theta^{-1}\left[(1-\pi)\Phi-\delta-\rho\right] \qquad \textbf{(8)}$$

Whenever the economy moves on the transitional path from the subsistence level of income to the self-sustained balanced-growth equilibrium, the saving rate (s_y) is increased along with per capita income and approaches its asymptotic balanced-growth equilibrium at the following rate:

$$s_y(t) = \left\{\frac{\left[(1-\pi)\Phi-\delta-\rho\right]}{\theta\left[(1-\pi)\Phi-\delta-n\right]}\right\}\left\{\frac{k(t)-\bar{k}}{k(t)}\right\} \qquad \textbf{(9)}$$

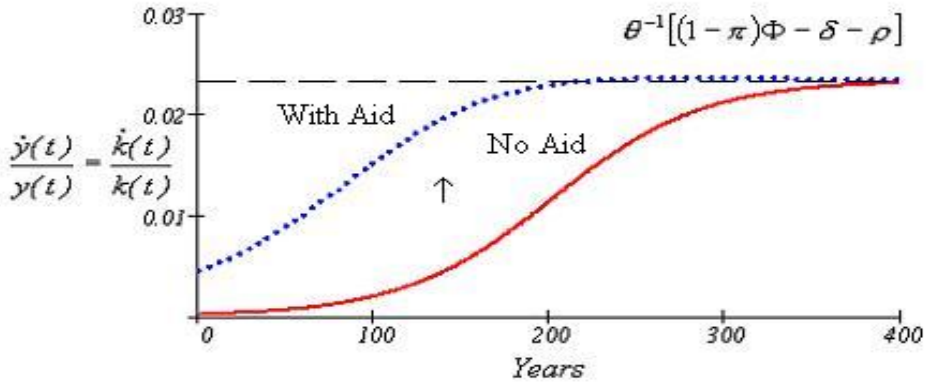
$$\lim_{t\to\infty} s_y(t) \to \frac{\left[(1-\pi)\Phi-\delta-\rho\right]}{\theta\left[(1-\pi)\Phi-\delta-n\right]} \qquad \textbf{(10)}$$

It should be noted that the economy would no longer need foreign aid when it achieves its asymptotic balanced-growth equilibrium. At this stage the property of economic growth is similar to Steger's (2000) linear growth model. As Steger demonstrated, economic growth is driven by the saving rate (similar to equation (9)), which in turn is determined by two terms. The first term represents the *willingness to save* which is determined by the preference and technology coefficients (*ibid.*). The second term represents the *ability to save or invest* which is measured by the relative distance between the starting value of the capital stock and its subsistence level (*ibid.*). The closer *the ability to save and invest* is to zero (i.e., $a \equiv k(0)-\bar{k}/k(0)\approx 0$), the longer the time required for the economy to take off (*ibid.*).

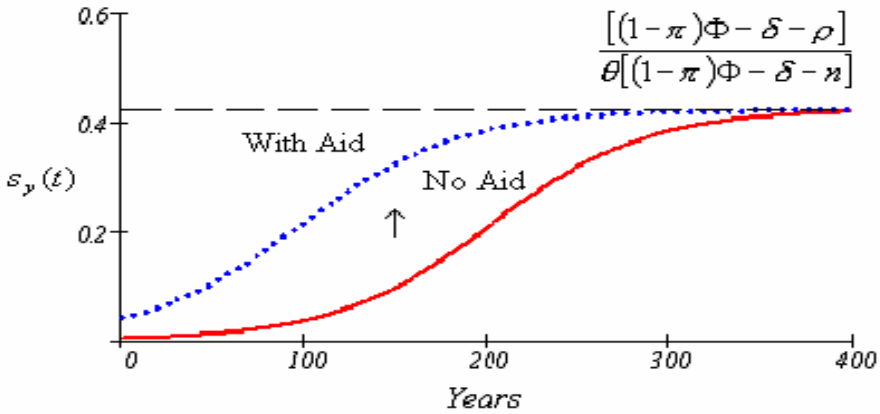
3. POTENTIAL IMPACTS OF AID ON GROWTH, SAVINGS, CONSUMPTION AND INVESTMENT

To analyse the aid-growth nexus, a simulation technique is employed. The coefficient values used here are similar to those employed by Steger (2000).[7] The economy is assumed to start at the point where the ability to save and invest are close to zero. It is also assumed that the recipient country satisfied policy conditionality imposed by aid donors, which in turn contributed to stable aid inflow. The stable aid inflow is assumed to raise the *ability to invest* from a=0.009 up to a=0.09, and the per capita capital stock is assumed to grow at the rate of 1 percent per year. The simulation results are displayed in Figure 1..

Figure 1: Simulation of the effects of an increase in stable aid flow on economic growth, investment, savings and consumption

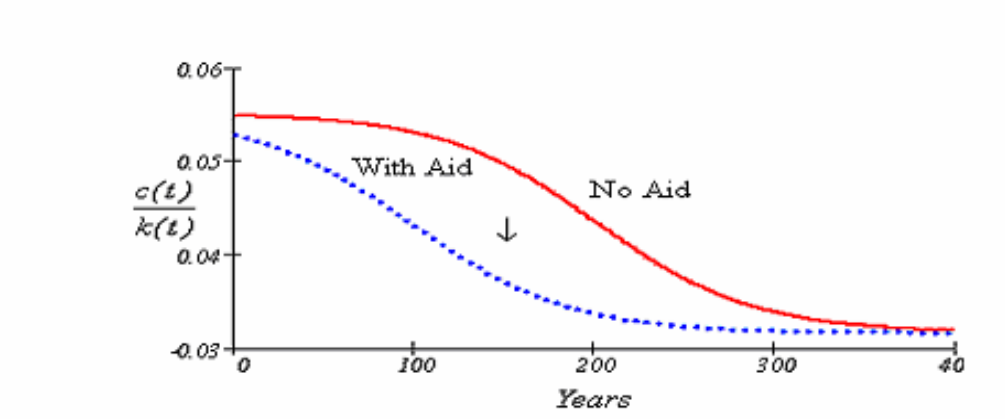


(a)



(b)

[7] Coefficients used for the simulation are: Φ=0.1, θ=3, δ=0.02, ρ=0.01, n=0.025, $\bar{c}$ =2, F_1=0.009, μ=0.01, a=0.009, and MATHCAD is employed to perform the simulation analysis.



(c)

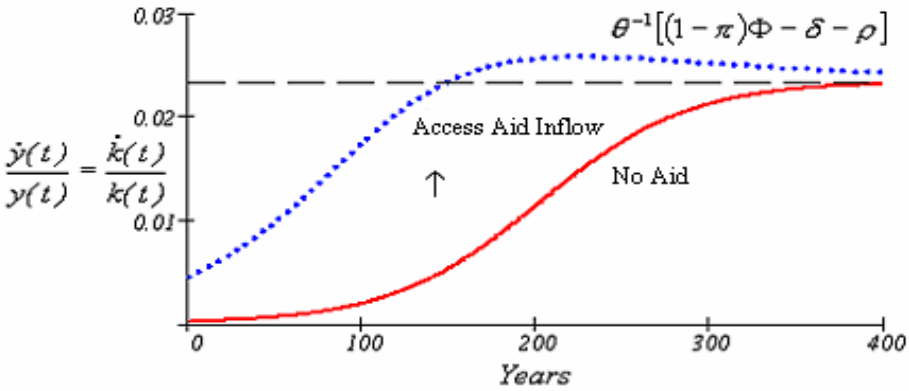
Panel (a) of Figure 1 indicates that an increase in aid raises the growth rate of per capita income by shifting up the transitional growth path of per capita income, and that an increase in aid by 1 percent per year shortens the time required for the economy to achieve its balanced-growth equilibrium value.

Besides, as illustrated in Panel (b), an increase in aid shifts up the transitional path of saving rate to a relatively higher path than in an economy without aid inflows. It is therefore obvious that an increase in aid inflow gives rise to an increase in per capita income growth and domestic savings.

Panel (c) of Figure 1 shows the effects of aid on consumption and investment. It is indicated that an increase in aid inflow causes a downward shift of the transitional path of the consumption-capital stock ratio. Initially, the ratio declines sharply. This indicates that the growth path of capital stock is rising faster than the growth path of consumption. On the transitional path both consumption and capital pursue an unbounded growth rate. It is therefore not surprising to observe an increase in consumption along with an increase in aid inflows in the economy. Since the substitution of foreign aid for consumption is small at the beginning of the transitional path, aid fungibility is not important. This is in line with the model used by Dalgaard and Hansen (2000). They demonstrate that aid fungibility is not the main problem for the effectiveness of aid because an increase in aid inflow gives rise to an increase in the expected return on investment, which in turn is a reason for consumption growth along with increased aid inflows. When the economy reaches its optimal level, it is expected that consumption will increase at a similar rate to the increase in the growth rate of capital stock, in which the consumption-capital stock ratio changes at a constant rate when it approaches its balanced-growth equilibrium. This is so because the need to improve standard of living can be achieved only by keeping investment growth at the same level as consumption growth.

While it has been shown that the stable aid does contribute to economic growth, in Figure 2 on the next page, it is illustrated that excessive inflow of stable aid inflow can have the negative effect on economic growth.

Figure 2: Simulation of the effects of excess aid inflow on the growth of output and capital accumulation: the Aid Laffer Curve effect



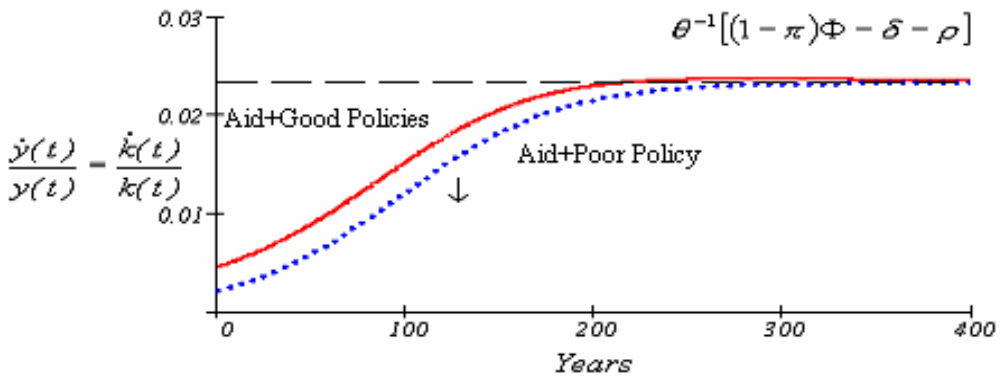
In the simulation, it was assumed that the growth rate of aid inflow has increased by 50 percent. The increased aid boosts the economy to overshoot the steady state equilibrium growth rate of per capita capital stock.[8] After the overshooting point, the economy travels along the optimal growth path and approaches the asymptotic-balanced growth equilibrium with a negative growth rate of per capita capital stock so that the increased aid inflow causes a negative rate of economic growth on average. This simulation result reveals a prediction that is consistent with the model of the "Aid Laffer Curve" used by Lensink and White (1999). Hadjimichael *et al.* (1995) and Hansen and Tarp (1999) estimate the optimal level of aid inflows to GDP as equivalent to 25 percent, while Durbarry *et al.* (1998) and Lensink and White (1999) have estimation results which range between 40 to 50 percent of GDP.

4. INTERDEPENDENCE OF AID, POLICY, STATE INSTITUTIONS AND ECONOMIC GROWTH

The analysis of the interdependence among aid, policy and state institutional regimes is carried out by employing two different simulation approaches. Firstly, the simulation process takes into account a favourable impact of aid on economic growth that is impaired by the distortions of economic structure created by poor policies and institutional rigidities. This assumption is based on the view that the problems of structural distortion have resulted from the implementation of an inward-oriented development strategy, and the lack of state and institutional capability to enforce the rule of law. In this context, poor policies and institutional rigidities render the supply side of the economy less responsive to market signals. Therefore, poor policies and the lack of state and institutional capability could create high transaction costs thus lowering the country's total productivity and leading to a decline in economic growth (North, 1990). The simulation result is illustrated in Figure 3 on the next page.

[8] The growth rate of aid inflow causing the economy to overshoot its steady state can vary and depend on coefficients employed in the simulation model.

Figure 3: Simulation of the effect of an increase in stable aid flow on the growth of output and capital accumulation in an economy with poor policy environment



Note: Solid line represent the case of a stable aid inflow while the dotted line represents the impact of economic distortion created by the recipient government's poor policies and inefficient institutions. The distortion index is assumed to increase from π =0 to π=*0.02*.

Secondly, the simulation process takes into account the impact of aid on economic growth that is impaired by instability in aid inflows given that the "adjustment programme" has been designed to support economic growth at the level that external current account deficits can be financed by normal capital inflow (UNCTAD, 2000a). In practice, the policies designed to accomplish such an objective have often overlooked the underdeveloped nature of the LDCs. As indicated in the *Least Developed Countries Report* (UNCTAD, 2000a, p. 116), "terms-of-trade deterioration and shortfalls in external financing were often considered by IMF staff to be risks *ex ante*, but contingency measures and adjusters were not built into the programme". And under the stabilising policy prescription, "any financing shortfall would have to be offset fully and immediately by a tightening of policies or a contraction of imports" (Mecagni, 1999, p. 236). However, it has been acknowledged that stabilising policy prescriptions, which seek to reduce aggregate demand as quickly as possible, often create political difficulty and even lead to nationalistic reaction (see for example, Haggard, *et al.* 1995).

Poor economic performance in the LDCs is also attributable to policy mismanagement and the lack of enforcement of the rule of law, which often relates to the lack of state institutional capability to create good governance. These problems are also compounded by many factors such as: (i) the extreme poverty in the LDCs that makes it very difficult for the mobilisation of domestic resources to be realised; (ii) the structural weakness of LDC economies characterised by lack of infrastructure (telecommunication, roads, electricity, etc); (iii) a vulnerable indigenous private sector which makes supply side capacity very rigid and heavily dependent on foreign direct investment (FDI); and (iv) the complex international trade barriers and lack of markets for key exports making it difficult for LDCs to maintain a current account balance.[9] These are the biggest problems affecting the LDCs' ability to raise investment with external viability.

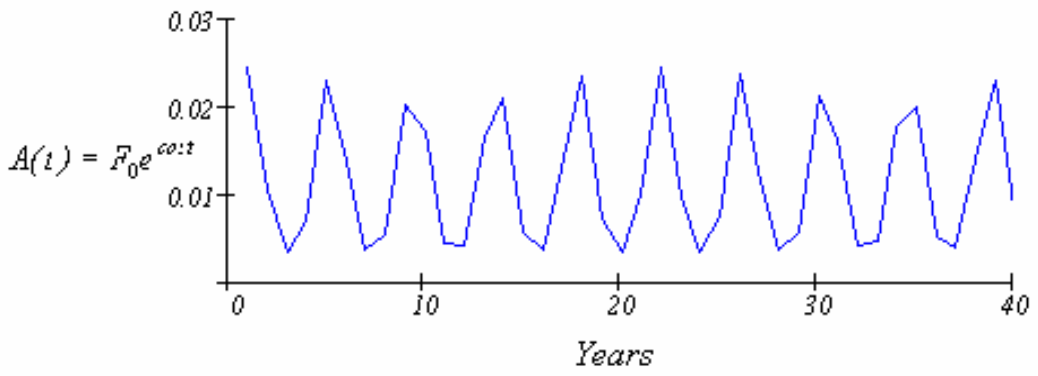
[9] See Murshed (2000) for a detailed discussion of the obstacles to the successful participation of the LDCs in the international system.

The above mentioned obstacles are not only a fundamental source of LDCs exposure to the negative effects of domestic and external shocks but also the causes of policy slippage (i.e., the interruptions that often result in LDC failure to accomplish the policy conditionality they agreed to). As the disbursement of foreign aid is subject to the prior action and ability of the LDCs to fulfil certain policy conditions, it is quite often the case that the IMF withholds financial support when efforts to implement the "adjustment programme" are interrupted. Mecagni (1999) classifies the causes of programme interruption into three episodes: (1) no major policy slippage but there is disagreement over policy formulation in response to external shocks, (2) political disruptions that are serious enough to prevent meaningful negotiations or call into question the continuing authority of current government, and (3) policy slippage arising from fiscal issues and structural constraints which are often linked to four circumstances: (i) external shocks, (ii) natural disasters, (iii) social unrest related to structural adjustment effects, and (iv) democratisation or pre-electoral climate.

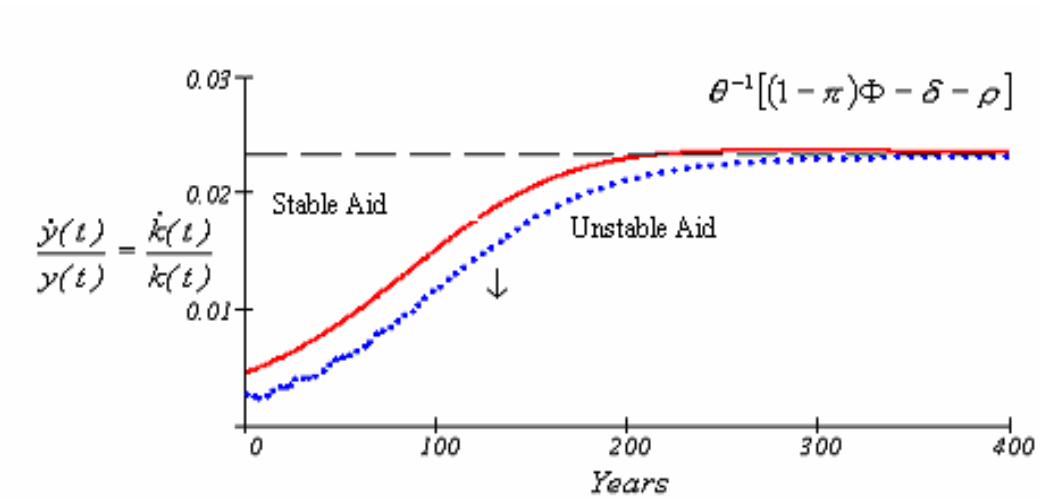
The *Least Developed Countries Report* (UNCTAD, 2000a, Table 26) indicates that a substantial proportion of programme interruptions occurred due to the tension between policy conditionality and the recipient country's national sovereignty (i.e., policy ownership issues), in which 14 out of 34 interruption episodes were attributable to policy disagreements between recipient governments and the Fund's staff. This is not surprising as it has long been acknowledged that conditionality is regarded not only as a technique to tackle economic issues but also to handle political issues (see for example Haggard *et al*. 1995). Five episodes of programme interruptions are related to political turmoil and social unrest. The incidence of the interruptions is either strongly or weakly linked to the effects of the "adjustment programme" themselves. The rest of the interruptions are related to external shocks such as terms-of-trade deterioration and natural disasters (UNCTAD, 2000a, Table 26).

When an interruption occurs, it disrupts capital accumulation in the recipient country. As Sachs *et al*. (1999, p. 7) point out, suspension of the IMF's aid disbursement can deny the recipient government access to other sources of concessional finance from other major creditors, including the World Bank and bilateral donors. It is often the case that the interruption is followed by difficult negotiations to restart the programme. There can thus be a prolonged shortage of foreign exchange resulting in an inability to maintain external viability. This in turn worsens the budget situation, creating a balance-of-payments crisis, economic volatility, and instability of aid inflow. To capture the effect of unstable aid inflows on the growth of output and capital accumulation, the flow of aid is assumed to fluctuate over time. Here the growth rate of aid flow is assumed to grow at the rate of $\mu(t)=\cos(t)$. The simulation result of unstable aid flow is displayed in panel (a) of Figure 4 on the next page.

Figure 4: Simulation of the effect of unstable aid inflows on the growth of output and capital accumulation



(a)



(b)

Panel (a) of Figure 4 shows that aid flows are interrupted twice during a 10-year period. The impact of this unstable aid flow is illustrated in Panel (b), in which the instability of aid inflow reduces the growth rate of per capita capital stock and hence per capita income. As financial aid is mainly given for budget support, the decline in aid inflow by itself lowers public investment, which in turn, has a negative effect on the indigenous private sectors reliant on government contracts. Also, when investors are faced with the uncertainty of aid inflows, they may delay or cancel investment decisions.

From the above analysis, it can be said that the extent to which aid may have a negative effect on economic growth depends on whether the interplay between aid and the LDCs' incentive regimes creates either structural distortions or economic volatility. Given UNCTAD's (2000a) report that LDCs have moved decisively in the direction of economic liberalisation (i.e., removed structural distortions resulting from the implementation of the inward-oriented development strategy), it is not hard to claim that LDCs' poor economic performances are rooted in the policy mismanagement posed by the lack of state institutional capability, and the shortcomings of the policy conditions designed for aid delivery.

5. SUMMARY AND CONCLUSION

This paper presents the theory of aid-growth nexus models focusing on the issues relating to policies designed for aid delivery and the lack of aid recipient's state institutional capability to enforce policy conditionality. It has been argued that the interactive effects of aid and policy designed for aid delivery may influence the recipient country's ability to raise investment from internal and external sources. Also, whether foreign aid may or may not contribute to sustainable economic growth depends on the recipient country's ability to raise investment with external viability.

Two propositions that lead to stable and unstable aid inflows have been demonstrated that explain why policy conditionality attached to aid might influence the flow of aid (or aid delivery) and thus affect the recipient country's ability to raise investment with external viability. First, the model has simulated that a stable aid flow raises the recipient country's ability to raise investment with external viability, thus contributes to economic growth even when aid is fungible. Second, the model has also simulated that unstable aid inflow impairs on the recipient country's ability to raise investment with external viability, thus has a negative effect on the favourable effect of stable aid inflow. It is suggested that a country that satisfied the requirement of policy conditionality received stable aid inflow. The weakness of policy design coupled with the problems caused by lack of state institutional capability have been attributed as the main problems of unstable aid inflows that result in Least Developed Countries' failure to achieve sustainable economic growth.

Appendix 1: Solving the model

Before solving the model, the resource constraint equation is re-written as follows:

Substituting $s(t) = y(t) - c(t) = (1-\pi)\Phi k(t) - c(t)$ and $f(t) = F_0 e^{\mu t}$ into equation (1) yields $\dot{k}(t) = (1-\pi)\Phi k(t) - c(t) - (\delta + n)k(t) + F_0 e^{\mu t}$

Now the problem of a benevolent social planner can be solved as follows:

$$\underset{c(t)}{Max} \int_0^{\infty} \frac{[c(t)-\bar{c}]^{1-\theta} - 1}{1-\theta} e^{-(\rho-n)t} dt$$

with respect to the resource constraint:

$$\dot{k}(t) = (1-\pi)\Phi k(t) - c(t) - (\delta + n)k(t) + F_0 e^{\mu t}$$

Setting the current value of Hamiltonian gives:

$$H = \frac{[c(t)-\bar{c}]^{1-\theta} - 1}{1-\theta} + \lambda\left[(1-\pi)\Phi k(t) - c(t) - (\delta + n)k(t) + F_0 e^{\mu t}\right]$$

Deriving the first order conditions gives:

$$\frac{\partial H}{\partial c(t)} = 0 \Rightarrow [c(t) - \bar{c}]^{-\theta} = \lambda(t) \qquad \text{(A1)}$$

$$\Rightarrow -\theta[c(t)-\bar{c}]^{-\theta-1}\dot{c}(t) = \dot{\lambda}(t) \qquad \text{(A2)}$$

$$\dot{\lambda}(t) - (\rho - n)\lambda(t) = -\frac{\partial H}{\partial k(t)} = -[(1-\pi)\Phi - \delta - n]\lambda(t)$$

$$\Rightarrow \dot{\lambda}(t) + [(1-\pi)\Phi - \delta - \rho]\lambda(t) = 0 \qquad \text{(A3)}$$

Use resource constraint $\dot{k}(t)$ and substitute (A1) and (A3) into (A2) to find the system differential equations:

$$\Rightarrow \dot{c}(t) = \theta^{-1}[c(0)-\bar{c}][(1-\pi)\Phi - \delta - \rho] \qquad \text{(A4)}$$

$$\Rightarrow \dot{k}(t) = [(1-\pi)\Phi - \delta - n]k(t) - c(t) + F_0 e^{\mu t} \qquad \text{(A5)}$$

Use (A3) to find $\lambda(t)$

$$\int e^{[(1-\pi)\Phi-\delta-\rho]t}\left[\dot{\lambda}(t) + [(1-\pi)\Phi - \delta - \rho]\lambda(t)\right] = 0$$

$$\Rightarrow \lambda(t) = \lambda_0 e^{-[(1-\pi)\Phi-\delta-\rho]t} \qquad \text{(A6)}$$

Substitute (A6) into (A1) to find the optimal path of consumption $c(t)$

$$[c(t)-\bar{c}]^{-\theta} = \lambda_0 e^{-[(1-\pi)\Phi-\delta-\rho]t}$$

$$\Rightarrow c(t) = \bar{c} + [c(o)-\bar{c}]e^{\theta^{-1}[(1-\pi)\Phi-\delta-\rho]t} = C_0 e^{\theta^{-1}[(1-\pi)\Phi-\delta-\rho]t} \qquad \text{(A7)}$$

Substitute (A7) into (A5) to find the optimal path of capital $k(t)$

$$\dot{k}(t) - [(1-\pi)\Phi - \delta - n]k(t) = -C_0 e^{\theta^{-1}[(1-\pi)\Phi-\delta-\rho]t} + F_0 e^{\mu t}$$

$$\int e^{-[(1-\pi)\Phi-\delta-n]t}\left[\dot{k}(t) - [(1-\pi)\Phi - \delta - n]k(t)\right]dt =$$

$$-C_0 \int e^{\theta^{-1}[(1-\pi)\Phi-\delta-\rho]t-[(1-\pi)\Phi-\delta-n]t}dt + F_0 \int e^{\mu t-[(1-\pi)\Phi-\delta-n]t}$$

$$e^{-[(1-d)A-\delta-n]t}k(t) = \frac{-C_0 e^{\theta^{-1}[(1-\pi)\Phi-\delta-\rho]t-[(1-\pi)A-\delta-n]t}}{\theta^{-1}[(1-\pi)\Phi-\delta-\rho]-[(1-\pi)\Phi-\delta-n]} + \frac{F_0 e^{\mu t-[(1-\pi)\Phi-\delta-n]t}}{\mu-[(1-\pi)\Phi-\delta-n]}$$

$$k(t) = \bar{k} + \frac{-C_0 e^{\theta^{-1}[(1-\pi)\Phi-\delta-\rho]t}}{\theta^{-1}[(1-\pi)\Phi-\delta-\rho]-[(1-\pi)\Phi-\delta-n]} + \frac{F_0 e^{\mu t}}{\mu-[(1-\pi)\Phi-\delta-n]}$$

$$\Rightarrow k(t) = \bar{k} + \left[k(0)-\bar{k}\right]\left[e^{\theta^{-1}[(1-\pi)\Phi-\delta-\rho]t} + F_1 e^{\mu t}\right] \qquad \text{(A8)}$$

where $k(0)-\bar{k} = \dfrac{-C_0}{\theta^{-1}[(1-\pi)\Phi-\delta-\rho]-[(1-\pi)\Phi-\delta-n]}$

and $F_1 = \dfrac{\theta^{-1}[(1-\pi)\Phi-\delta-\rho]-[(1-\pi)\Phi-\delta-n]}{-C_0}\dfrac{F_0}{\mu-[(1-\pi)\Phi-\delta-n]}$

where $\bar{k}$ is the level of subsistent capital and its value is similar to the one set by Steger (2000), in that $\bar{k} \equiv \dfrac{\bar{c}}{(1-\pi)\Phi-\delta-n}$

Use (A7) to find the growth rate of consumption at the balanced-growth equilibrium position:

$$\lim_{t\to\infty}\frac{\dot{c}(t)}{c(t)}$$

Differentiating (A7) with respect to time, then dividing the result by *c(t)* gives:

$$\dot{c}(t) = [c(o)-\bar{c}]\theta^{-1}[(1-\pi)\Phi-\delta-\rho]e^{\theta^{-1}[(1-\pi)\Phi-\delta-\rho]t}$$

$$\frac{\dot{c}(t)}{c(t)} = \frac{[c(o)-\bar{c}]\theta^{-1}[(1-\pi)\Phi-\delta-\rho]e^{\theta^{-1}[(1-\pi)\Phi-\delta-\rho]t}}{\bar{c}+[c(o)-\bar{c}]e^{\theta^{-1}[(1-\pi)\Phi-\delta-\rho]t}}$$

Applying the l' hospital rule gives:

$$\lim_{t\to\infty}\frac{\dot{c}(t)}{c(t)} = \lim_{t\to\infty}\frac{[\dot{c}(t)]'}{[c(t)]'} \to \theta^{-1}[(1-\pi)\Phi-\delta-\rho] \qquad \text{(A9)}$$

Use (A8) to find the growth rate of capital at the balanced-growth equilibrium position:

$$\lim_{t\to\infty}\frac{\dot{k}(t)}{k(t)}$$

Differentiating (A8) with respect to time, then dividing the result by *k(t)* gives:

$$\dot{k}(t) = \left[k(0) - \bar{k}\right]\left[\theta^{-1}\left[(1-\pi)\Phi - \delta - \rho\right]e^{\theta^{-1}[(1-\pi)\Phi-\delta-\rho]t} + \mu F_1 e^{\mu t}\right]$$

$$\frac{\dot{k}(t)}{k(t)} = \frac{\left[k(0) - \bar{k}\right]\left[\theta^{-1}\left[(1-\pi)\Phi - \delta - \rho\right]e^{\theta^{-1}[(1-\pi)\Phi-\delta-\rho]t} + \mu F_1 e^{\mu t}\right]}{\bar{k} + \left[k(0) - \bar{k}\right]\left[e^{\theta^{-1}[(1-\pi)\Phi-\delta-\rho]t} + F_1 e^{\mu t}\right]}$$

In the balanced-growth equilibrium position the economy would no longer need to borrow foreign capital, as the economy can rely on domestic savings to finance investment demands. So, the term $f(t) = \mu F_1 e^{\mu t} = 0$.

Then $$\frac{\dot{k}(t)}{k(t)} = \frac{\left[k(0) - \bar{k}\right]\left[\theta^{-1}\left[(1-\pi)\Phi - \delta - \rho\right]e^{\theta^{-1}[(1-\pi)\Phi-\delta-\rho]t}\right]}{\bar{k} + \left[k(0) - \bar{k}\right]\left[e^{\theta^{-1}[(1-\pi)\Phi-\delta-\rho]t}\right]}$$

Applying the l' hospital rule gives:

$$\lim_{t\to\infty}\frac{\dot{k}(t)}{k(t)} = \lim_{t\to\infty}\frac{\left[\dot{k}(t)\right]'}{\left[k(t)\right]'} \to \theta^{-1}\left[(1-\pi)\Phi - \delta - \rho\right] \qquad \text{(A10)}$$

Use the system differential equation (A4) and (A5) and apply the time-elimination method to find the policy function

$$\dot{c}(t) = \left[c(t) - \bar{c}\right]\theta^{-1}\left[(1-\pi)\Phi - \delta - \rho\right]$$

$$\dot{k}(t) = \left[(1-\pi)\Phi - \delta - n\right]k(t) - c(t) + F_0 e^{\mu t}$$

$$c'(k) = \frac{\dot{c}}{\dot{k}} = \frac{\left[c(k) - \bar{c}\right]\theta^{-1}\left[(1-\pi)\Phi - \delta - \rho\right]}{\left[(1-\pi)\Phi - \delta - n\right]k - c(k) + F_0 e^{\mu t}} = \frac{c'(k)\theta^{-1}\left[(1-\pi)\Phi - \delta - \rho\right]}{\left[(1-\pi)\Phi - \delta - n\right] - c'(k)}$$

Simplifying the result gives:

$$c'(k)\left[\left[(1-\pi)\Phi - \delta - n\right] - c'(k)\right] = c'(k)\theta^{-1}\left[(1-\pi)\Phi - \rho - \delta\right]$$

$$\left[c'(k)\right] = \frac{c(t) - \bar{c}}{k(t) - \bar{k}} = \left[(1-\pi)\Phi - \delta - n\right] - \theta^{-1}\left[(1-\pi)\Phi - \delta - \rho\right]$$

$$\Rightarrow c(t) = z\left[k(t) - \bar{k}\right] + \bar{c} \qquad \text{(A11)}$$

wher $z = \left[(1-\pi)\Phi - \delta - n\right] - \theta^{-1}\left[(1-\pi)\Phi - \delta - \rho\right]$

Find the transitional path of saving rate: $s_y(t) = \left(1 - \frac{c(t)}{y(t)}\right)$

Simplifying (A11) gives:

$$c(t) = \left\{\left[(1-\pi)\Phi - \delta - n\right] - \theta^{-1}\left[(1-\pi)\Phi - \delta - \rho\right]\right\}\left[k(t) - \bar{k}\right] + \left[(1-\pi)\Phi - \delta - n\right]\bar{k}$$

$$c(t) = \left[(1-\pi)\Phi - \delta - n\right]\left[k(t) - \bar{k}\right] - \theta^{-1}\left[(1-\pi)\Phi - \delta - \rho\right]\left[k(t) - \bar{k}\right] + \left[(1-\pi)\Phi - \delta - n\right]\bar{k}$$

$$-c(t) = \theta^{-1}\left[(1-\pi)\Phi - \delta - n\right]\left[k(t) - \bar{k}\right] - \left[(1-\pi)\Phi - \delta - n\right]k(t)$$

In an equilibrium position of the balance of payments the following identity holds:

$$i(t) + f(t) = s(t) + f(t)$$

$$[(1-\pi)\Phi - \delta - n]k(t) - c(t) + f(t) = s(t) + f(t)$$

$$[(1-\pi)\Phi - \delta - n]k(t) - c(t) = y(t) - c(t)$$

Deleting *c(t)* from the above equation then multiplying both sides by $\frac{c(t)}{y(t)}$ yields:

$$[(1-\pi)\Phi - \delta - n]k(t)\frac{c(t)}{y(t)} = c(t)$$

Substituting $-\frac{c(t)}{y(t)} = s_y - 1$ into the above equation gives:

$$[(1-\pi)\Phi - \delta - n]k(t)[s_y(t) - 1] = -c(t)$$

$$[(1-\pi)\Phi - \delta - n]k(t)[s_y(t) - 1] = \theta^{-1}[(1-\pi)\Phi - \delta - n][k(t) - \bar{k}] - [(1-\pi)\Phi - \delta - n]k(t)$$

$$[(1-\pi)\Phi - \delta - n]k(t)s_y(t) = \theta^{-1}[(1-\pi)\Phi - \delta - n][k(t) - \bar{k}]$$

$$s_y(t) = \frac{[(1-\pi)\Phi - \delta - \rho]}{\theta[(1-\pi)\Phi - \delta - n]}\frac{k(t) - \bar{k}}{k(t)} \qquad \text{(A12)}$$

Find the transitional dynamic of growth rate of per capita capital and output

$$\frac{y(t)}{y(t)} = \frac{k(t)}{k(t)} = [(1-\pi)\Phi - \delta - n] - \frac{c(t)}{k(t)} + \frac{f(t)}{k(t)} \qquad \text{(A13)}$$

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