Foreign Aid, Foreign Direct Investment and Economic Growth in Sub-Saharan Africa: Evidence from Pooled Mean Group Estimator (PMG)

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Abstract

In this paper we investigate the long-run relationship between foreign aid, foreign direct investment and economic growth in 36 Sub-Saharan Africa countries over the period 1980-2007. Following the recent dynamic panel data of mean group (MG), pooled mean group estimator (PMG), and dynamic fixed effect (DFE) proposed by Pesaran et al. (1999), we find strong evidence of positive impact of foreign aid and foreign direct investment on economic growth. However, the effect of foreign aid on growth in SSA is low. For example, an increase by 1% of foreign aid induces only 0.05% point of economic growth for PMG and 0.13% point for DFE, while it's ten times greater for employment in PMG and approximately six times greater in DFE. As economic policy implication, it's much better to focus on internal factors than external factors to boost economic growth in SSA.

Keywords: Economic growth, Pooled mean group, Foreign aid, Sub-Saharan Africa

1. Introduction

The issue of economic development in Sub-Saharan Africa (SSA) countries remains a crucial challenge not only for the governments of those countries, but also for international organizations. These latter have already set up the economic and social programs with developing countries, particularly with countries in SSA region considered as one of the poorest in the world. Unfortunately, most of the economic and social programs in SSA seem to be ineffective on economic and social development. Among most of the economic and social programs, the case of foreign aid has a great interest, not only for the donors, but also for receiving countries. Although the effectiveness of foreign aid on economic growth has been extensively discussed in the literature, the way to improve it remains the most important issue nowadays as well. That issue concerns the methodology approach to set up the relationship between foreign aid and economic growth. The main idea behind this paper is to analyze the link between foreign aid and economic growth based on theoretical model and earlier empirical results by using the recently developed panel units root tests, Mean group (MG), Panel Mean Group (PMG) and Dynamic Fixed Effects (DFE) estimation on cross-country panel data.

Empirical studies have found positive relationship between foreign aid and economic growth (Asteriou, 2009; Michael et al., 2004; Burnside and Dollar, 1997; Karras, 2006). On the contrary, there are also some studies that don't confirm the positive relationship between foreign aid and economic growth (Bhandari et al., 2007). Moreover, some studies claim good fiscal, monetary and trade policies as a necessary condition for effectiveness of foreign aid on economic growth (Burnside and Dollar, 1997). Hansen and Tarp (2000) and Tan (2006) found results somewhat contradictory. Their findings suggest that the impact of foreign aid on growth is not conditional to good policy. It seems obvious that the relationship between foreign aid and economic growth is sensitive to methodological approach and nature of control variables. Hansen and Tarp (2000) found that, although there is positive link between foreign aid and growth, there is not positive effect of foreign aid on growth when human capital and investment are used as control variables. Once again, theoretical link between foreign aid and economic growth seems to remain robust and stable, despite some contradictory findings. Using annual data from 1960 to 1997 for a sample of 71 aid-receiving developing countries, Karras (2006) found that the effect of foreign aid on economic growth is positive, permanent, statistically significant, and sizable.

Considering the fact that foreign aid and foreign direct investment have been used as a supplement of capital accumulation, their impact on economic growth has also received extensive investigation. These empirical

researches focused not only on the simultaneity of the capital supplements on economic growth, but also on their importance on the latter as well.

Ericsson and Irandoust (2005) using likelihood-based panel cointegration for five Sub-Saharan Africa countries over the period 1965-2000 found that foreign aid and foreign direct investment positively affect economic growth in all countries. In that case, he concludes that foreign aid is not only an additional domestic resource, but also a supplement for domestic saving. Furthermore, it has been shown that domestic saving significantly affects investment, and therefore economic growth, when foreign aid is included in the regression (Isakson, 2000; Kasuga, 2007). Though foreign aid attempts to enhance the effects of domestic saving on growth, the foreign aid-growth nexus remains ambiguous, as noticed by Bowles (1987). That ambiguity has been found in empirical studies assessing the link between foreign direct investment and economic growth as well. More precisely, channels through which foreign direct investment affects economic growth seem to be controversial.

As noticed by the previous studies, the effects of foreign direct investment on economic growth are positive and statistically significant (Khawar, 2005; Roy and Berg, 2006; Xu and Wang, 2007; Bhandari et al., 2007; Li and Liu, 2005). These effects have been found to be supported by some institutional factors such as level of education, basic physical infrastructure, and appropriateness of institutions (Adam, 2008). However, attractiveness of FDI which is based on good policy, economic and political stability of host country is a necessary condition, but not sufficient to stimulate positive relationship between FDI and economic growth. Concerning channels controversy, it seems obvious that domestic investment is likely the most important. While Khawar (2005) finds that foreign direct investment positively affects real income per capita, irrespective of any human capital requirements, Li and Liu (2005) found that the interaction of FDI with human capital exerts a strong positive effect on economic growth in developing countries.   In the case of Sub-Saharan Africa, it has been stressed that factors such as political and macroeconomic instability, low growth, weak infrastructure, poor governance, inhospitable regulatory environments, and ill-conceived investment promotion strategies, are identified as responsible for the poor FDI record in the region (Dupasquier and Osakwe, 2006). By contrast, despite the low growth effect on FDI, Adam (2008) finds that FDI positively affects economic growth in the region. This conclusion has to be used cautiously given the fact that it seems sensitive to model specification.

The specificity of the paper is to analyze the simultaneous effects of foreign aid and foreign direct investment on economic growth given the level of domestic saving and labor. Given the fact that foreign aid and foreign direct investment are considered as externals additional capital, whereas labor and domestic saving are internals capital which are necessary to sustain economic growth process, the aim of this study is to analyze the importance between external capital (foreign aid and foreign direct investment) and internal capital (domestic saving and labor) on economic growth in SSA. The main hypothesis is that internal factors contribute more to economic growth than external factors which are considered as additional factors to growth process in the region. This hypothesis will be investigated through the long-run and short-run dynamic relationships following the economic growth framework. More accurately, we follow the model specified by Asteriou (2009) in the recent study by adding foreign direct investment as a component of capital formation. We use a large panel of data for 36 Sub-Saharan African countries over the period 1980-2007 (Note1). The source of data is World Development Indicators (WDI). Having a long time series, we can apply a recent techniques of dynamic panel estimation based on auto-regressive distributed lags (ARDL) specification, which is consistent to correct the heterogeneity bias of traditional panel data estimation. The paper is organized as follows: section 2 provides a brief review of theoretical considerations and estimating model. Section 3 presents the empirical methodology and results, while section 4 concludes.

2. Data and methodology

Following the economic growth framework, we start with aggregates function of production given as follows:

$$Y_t = A_t K_t^{1-\theta} L_t^{\theta} \tag{1}$$

Where Y is output, K and L denote stock of capital and labor input, respectively. Equation (1) can be re-written as follows:

$$\frac{Y_t}{A_t^{1/\theta}} = \left(\frac{K_t}{A_t^{1/\theta}}\right)^{1-\theta} L_t^{\theta} \tag{2}$$

We can also re-written equation (2) as follows:

$$Y_t = K_t^{1-\theta} L_t^{\theta} \tag{3}$$

Where Y and K denote output and capital for which the stochastic trends have been removed, as noted by Asterious (2009). Taking the natural logarithm from the both sides of equation (3) we obtain

$$y_t = (1 - \theta)k_t + \theta l_t \tag{4}$$

Where small size letters denote logged variables.

Following Asteriou's assumption, which relates capital accumulation with aid and investment, we assume that in SSA countries, capital accumulation is closely related to the following process.

$$k_t = (1 - \delta)k_{t-1} + s_t + aid_t + fdi_t \quad \Rightarrow \quad k_t = (1 - \gamma L)^{-1}(s_t + aid_t + fdi_t) \tag{5}$$

Where δ is depreciation rate of capital stock, s denotes domestic savings, aid denotes foreign aid and fdi denotes foreign direct investment. All variables are expressed in ratio of GDP except output and labor expressed in terms of growth rate. Furthermore, we assume that aid and foreign direct investment follow an autoregressive process given by:

$$aid_t = \alpha + \beta aid_{t-1} + u_t \, , \qquad\qquad u_t \sim N(0, u_t) \tag{6}$$

$$fdi_t = e + \rho fdi_{t-1} + \varepsilon_t \, , \qquad\qquad \varepsilon_t \sim N(0, \varepsilon_t) \tag{7}$$

Equations (4)-(7) constitute a system of three linear equations. Substituting (6) and (7) to (5) and then (5) to (4), we have:

$$y_t = (1 - \theta)[(1 - \gamma L)^{-1}(s_t + \alpha + \beta aid_{t-1} + u_t + e + \rho fdi_{t-1} + \varepsilon_t)] + \theta l_t \tag{8}$$

$$(1 - \gamma L)y_t = (1 - \theta)[(s_t + \alpha + \beta aid_{t-1} + u_t + e + \rho fdi_{t-1} + \varepsilon_t)] + (1 - \gamma L)\theta l_t \tag{9}$$

$$y_t = C + \gamma y_{t-1} + ((1 - \theta), 0, 0, \theta)x_t + (0, (1 - \theta)\beta, (1 - \theta)\rho, -\gamma\theta)x_{t-1} + v_t \tag{10}$$

Where

$$C = (1 - \theta)(\alpha + e)$$

$$x_t = (s_t, aid_t, fdi_t, l_t)'$$

$$v_t = (1 - \theta)(u_t + \varepsilon_t)$$

Equation (10) is our main estimating model, relating output growth to the share of domestic saving to GDP, the share of foreign aid to GDP, the share of foreign direct investment to GDP and employment growth. In the next section, we first test for the presence of unit root before using panel dynamic ECM specification.

2. Empirical results

2.1 Panel unit root tests

In this study, we only implement three panel unit root tests. Im et al. (2003) and Maddala and Wu (1999) use nonstationary as the null hypothesis, while Hadri (2000) use stationary as the null hypothesis. Furthermore, the two former tests are a generalization of ADF test from single time series to panel data, while the latter is a generalization of KPSS test from single time series to panel data (Baltagi, 2005). The results of all these tests are given in table 1.

Although all variables are stationary in difference, employment and growth are both stationary at level for Fisher and IPS unit root tests. Due to the highest power of Fisher test over IPS test, we only consider that there is no unit root for the two series. Thus, all variables should be considered as integrated in order one.

2.2 The MG and PMG estimation methodology

After testing for the presence of unit root, we start by specifying the recently developed dynamic panel data methodology. Pesaran et al. (1999) suggest two different estimators which are consistent when both T and N are large. The difference between these two estimators is that the mean group estimator (MG) seems to be more consistent under the assumption that both slope and intercepts are allowed to vary across country, while pooled mean group estimator (PMG) is consistent under the assumption of long-run slope homogeneity. An alternative estimator being set up under the assumption of homogeneity slope is dynamic fixed effects (DFE), in which the slopes are fixed and the intercepts allow to vary across country. The MG estimator derives the long-run parameters for the panel from an average of the long-run parameters from ARDL models for individual countries. The ARDL for each country is specified as follows:

$$y_{it} = \alpha_{1i} + \alpha_{2i}t + \gamma_i y_{it-1} + \beta_{i1}s_{it} + \beta_{i2}aid_{it} + \beta_{i3}fdi_{it} + \beta_{i4}l_{it} + \delta_{i1}s_{it-1} + \delta_{i2}aid_{it-1} + \delta_{i3}fdi_{it-1} + \delta_{i4}l_{it-1} + \varepsilon_{it} \tag{11}$$

Where the variables are defined as previously, $i = 1, 2, ..., 36$, $t = 1, 2, ..., 27$, then the long-run parameter θ_i for country i and variable k is given as follows:

$$\theta_{ik} = \frac{(\beta_{ik} + \delta_{ik})}{1 - \gamma_i} \tag{12}$$

And the MG estimator for the whole panel will be given by:

$$\theta_k = \frac{1}{N}\sum_{i=1}^{N} \theta_{ik} \tag{13}$$

We also use PMG as an intermediate estimator because it involves both pooling and averaging. This estimator allows the intercepts, short-run coefficients, and error variances to vary across country, but constrains the long-run coefficients to be the same (Pesaran et al., 1999). Knowing that all variables are I(1), we follow the model specified by Pesaran et al. (1999) assuming one as optimal lag. Thus the autoregressive distributed lag (ARDL)(1,1,1,1,1) is given as follows:

$$y_{it} = \alpha_{1i} + \alpha_{2i}t + \gamma_i y_{i,t-1} + \beta_{i1} s_{it} + \beta_{i2} aid_{it} + \beta_{i3} fdi_{it} + \beta_{i4} l_{it} + \delta_{i1} s_{it-1} + \delta_{i2} aid_{it-1} + \delta_{i3} fdi_{it-1} + \delta_{i4} l_{it-1} + \varepsilon_{it}$$

$$\tag{14}$$

And the error correction equation is

$$\Delta y_{it} = \varphi_i\big(y_{i,t-1} - \theta_{0i} - \theta_{i1} s_{it} - \theta_{i2} aid_{it} - \theta_{i3} fdi_{it} - \theta_{i4} l_{it}\big) - \beta_{i1}\Delta s_{it} - \beta_{i2}\Delta aid_{it} - \beta_{i3}\Delta fdi_{it} - \beta_{i4}\Delta l_{it} + \varepsilon_{it}$$

$$\tag{15}$$

We consider a common ARDL (1,1,1,1,1) specification for all countries. That specification is reliable with strong balanced panel and very large T. The data that we use meet these assumptions.

2.3 The MG and PMG estimation results

The results of MG and PMG are given in table 2. The difference between the two models is rejected by the Hausman test, even for each variable. Due to convergence theory in economic growth, we prefer model with common long-run coefficient (PMG). There is strong evidence that all variables positively affect economic growth. Though these results meet theoretical assumption, the most important aspect is the magnitude of effects. The estimated effect of foreign aid on economic growth suggests that 1% increase in foreign aid results in 0.05% increase in economic growth. Moreover, the most important effect is provided by employment. Thus, a 1% increase in labor results in a 0.18% increase in economic growth. The result is somewhat low for saving. Economic growth only increases by 0.11% with respect to 1% increase in domestic saving.

The results of error correction model suggest that there is negative relationship between foreign aid and economic growth in the short-run. The short-run impact of domestic saving on economic growth is not much different than in the long-run, but the results for employment and foreign direct investment are not conclusive. All the results are given in table 3.

2.4 MG and DFE estimation results

The results obtained from the estimation of dynamic fixed effects are given in table 4. With respect to those provided by pooled mean group estimates, the results of DFE again satisfy the theoretical assumptions, but foreign direct investment prove to be insignificant. However, the impacts of foreign aid and labor on growth are more important in that case. An increase of foreign aid by 1% will lead economic growth to increase by 0.13%, while following the same movement, labor will help growth to increase by 0.79%. On the contrary, the effects of domestic savings on growth seem to be low in dynamic fixed effects regression. Economic growth rises to 0.08% when domestic savings increase by 1%.

The choice between mean group estimator and dynamic fixed estimator is not clear because of the non availability of Hausman test statistic. This result does not affect the consistency of estimates, but rather will be considered as checking test. The results of error correction model given in table 5 are not significantly different from those obtained previously with Pooled Mean Group estimator.

3. Conclusion

Previous studies have already discussed the effectiveness of foreign aid and foreign direct investment on economic growth but the results are somewhat unreliable, due to the short span of data or the problem of misspecification. In this study we use data in the most efficient manner to test the relationship between foreign aid, foreign direct investment, employment, domestic saving and economic growth in 36 Sub-Saharan African countries over the period 1980-2007. Furthermore, we use mean group (MG), panel mean group (PMG) and dynamic fixed effect (DFE) to derive strong positive evidence between economic growth and internal factors

(saving and labor) and external factors (foreign aid and foreign direct investment). These results launch again the debate around the long-run economic growth factors in Sub-Saharan Africa. Such factors were derived from neoclassical growth theory in which foreign aid and foreign direct investment are considered as capital factors supplementary. However, external factors could match internal factors only if the host countries satisfy some initial conditions that we already expressed. As stated earlier , some conditions such as good fiscal policy, good governance, sound financial infrastructure are required to effectively channeled the positive effects of external capital on growth process in the region, but internal factors should not be put aside of global policy focusing on economic development strategies as it seems to be in the region.

Although the effects of foreign aid and foreign direct investment on economic growth are positive and statistically significant, human capital (labor) remains the key factor that can foster economic growth in SSA. The results derived from this study might be useful for SSA countries growth policy. It's much better to focus on internal factors than external factors to boost economic growth in SSA. Indeed, labor and domestic saving are much more accessible than external factors which can be uncertain mostly when donor countries face a long recession. Some strategies should be built up around labor and domestic saving. An improvement of educational system could be view as a way to improve the quality of labor. Concerning domestic saving, the situation is more complicated given the weak level of labor income in the region. Thus, external capital inflows can only solve the problem of capital scarcity, but cannot be considered as a panacea to foster growth in Sub-Sahara Africa.

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Notes

Note 1. The countries in the sample are: Benin, Botswana, Burkina Faso, Burundi, Cameroon, Chad, Central African Republic, Comoros, Republic Democratic of Congo, Cote d'Ivoire, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Rwanda, Senegal, Sierra Leone, Sudan, Swaziland, Togo, Uganda, Zambia, and Zimbabwe.

Table 1. panel unit root tests

	Hadri		Fisher		IPS	
	level	difference	level	difference	level	difference
AID	8.591	0.815*	71.7735	328.88*	-3.186*	-12.373*
LABOR	3.776	0.161*	132.94*	192.35*	-3.865*	-8.139*
FDI	8.071	2.72*	90.5737	391.05*	0.77	-13.463*
GDP	5.542	1.259*	193.5236*	566.17*	-7.79*	-17.912*
SAVINGS	8.846	2.573*	73.9936	355.33*	-0.412	-12.495*

*indicates significance levels at 1%

Table 2. mean group and pooled mean group estimates

	MG estimates			PMG estimates			Hausman test	
	coefficient	S.E	t-Ratio	coefficient	S.E	t-Ratio	h	p-value
AID	0.08909	0.064987	1.37	0.057591*	0.020005	2.88	0.12	0.7290
LABOR	0.380637	0.702125	0.54	0.480265*	0.108828	4.41	0.01	0.9203
FDI	0.074218	0.323398	0.23	0.185586*	0.037783	4.91	0.06	0.8064
SAVINGS	0.138445**	0.06733	2.06	0.11323*	0.020313	5.57	0.07	0.7913
				joint Hausman test statistic			0.31	0.9891

*indicates significance at 1% levels

**indicates significance at 5% levels

Table 3. ECM for mean group and pooled mean group estimates

	MG estimates			PMG estimates		
	coefficient	S.E	t-Ratio	coefficient	S.E	t-Ratio
daid	-0.18803*	0.070026	-2.69	-0.18492*	0.065085	-2.84
dlabor	0.802151	1.106699	0.72	1.101065	1.162164	0.95
dfdi	0.174707	0.229861	0.76	0.115995	0.134001	0.87
dsavings	0.048495	0.046674	1.04	0.098161	0.038117	2.58
EC	-1.01308*	0.046846	-21.63	-0.81239*	0.053925	-15.07
contant	-1.31308	2.179681	-0.6	-0.17357	0.257331	-0.67

*indicates significance at 1% levels

**indicates significance at 5% levels

Table 4. mean group and dynamic fixed effect estimates

	MG estimates			DFE estimates			Hausman test	
	coefficient	S.E	t-Ratio	coefficient	S.E	t-Ratio	h	p-value
AID	0.08909	0.064987	1.37	0.130681*	0.025669	5.09	5.18	0.0228
LABOR	0.380637	0.702125	0.54	0.795913*	0.211934	3.76	2.48	0.1153
FDI	0.074218	0.323398	0.23	0.130194	0.084601	1.54	0.17	0.6801
SAVINGS	0.138445**	0.06733	2.06	0.084267*	0.029133	2.89	14.87	0.0001
				joint Hausman test statistic			na	

*indicates significance at 1% levels

**indicates significance at 5% levels

Table 5. ECM for mean group and dynamic fixed effect estimates

	MG estimates			DFE estimates		
	coefficient	S.E	t-Ratio	coefficient	S.E	t-Ratio
daid	-0.18803*	0.070026	-2.69	-0.17796*	0.076477	-2.33
dlabor	0.802151	1.106699	0.72	-0.27889	0.160552	-1.74
dfdi	0.174707	0.229861	0.76	-0.01268	0.075358	-0.17
dsavings	0.048495	0.046674	1.04	0.110923	0.088905	1.25
EC	-1.01308*	0.046846	-21.63	-0.94102*	0.057555	-16.35
contant	-1.31308	2.179681	-0.6	-1.73749*	0.738482	-2.35

*indicates significance at 1% levels

**indicates significance at 5% levels