

Foreign Aid, Fertility and Population Growth: Evidence from Africa

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Abstract

This article investigates the relationship between foreign aid and population growth in sub-Saharan Africa. The work considers population growth rate and a directly related to fertility demographic indicator – total fertility rate. Using a panel of 43 African countries over the last four decades of the 20th century, it demonstrates the positive association between foreign aid and population growth and suggests that foreign aid affects population growth primarily through its effect on fertility. These findings suggest that the appreciation of the demographic effect of foreign aid can have important implications for the design of policies regarding to foreign aid for presently developing countries, particularly in sub-Saharan Africa.

JEL classification: F35, J11, O11.

Keywords: Foreign aid, Fertility, Population growth

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1. Introduction

Sub-Saharan Africa has long been the most aided region of the developing world. Thus, for more than one-third of Sub-Saharan countries, foreign aid has constituted more than 10% of their Gross National Income (GNI) since independence. During the 1990s, foreign assistance averaged over 10% of GNI in nearly two-thirds of the countries of the region (World Bank, *WDI*, 2001). At the same time, the sub-Saharan African population has been growing faster than that of any other major world region. In the mid-1990s, African population was growing by about 2.7% per year. Moreover, in several countries in the region population growth rate even increased from the 1960s to the 1990s. As a result, over last four decades of the 20th century, the region's total population increased almost three-fold – from 229 million people in 1961 to 659 million in 2000.¹ Although an enormous literature has been devoted to different aspects of foreign aid, existing works do not consider a possible connection between the two aforementioned facts. This paper attempts to shed some light on the previously unobserved effect of foreign aid on fertility and population growth that might have important policy implications.

Large-scale foreign aid to impoverished nations has long been viewed as necessary to stimulate capital formation and promote economic growth in the recipient countries. The findings of the large literature with regard to aid are generally not very encouraging and as a result aid policy has come under increasing scrutiny. Several observers have argued that a large portion of foreign aid is wasted and only increases unproductive consumption (e.g., Boone, 1996). Researchers argue that if recipient economies do not have the appropriate economic and political environment, foreign assistance will have no positive impact on their macroeconomic policies and growth. Insufficient institutional development, economic distortions and bureaucratic inefficiency are often cited as reasons for this result (for an extensive discussion of these issues, see World Bank, 1998). The influential article on the link between the effectiveness of aid and recipients' economic policy by Burnside and Dollar (2000) triggered an extensive debate in the literature (see Roodman (2004) for a review of the literature). It has also been argued in the literature that aid can generate more problems than it solves with

¹ For detailed descriptions of the long-term trends in African population growth, see, for instance, Foote et al. (1993), Tarver (1996), Goliber (1997); cf. also United Nations (2004).

regard to development.² In their meta-analysis of 68 aid-growth studies, Doucouliagos and Paldam (2008) found that aid effectiveness literature that amassed during 40 years of research has failed to prove that the effect of development aid on growth is statistically significantly larger than zero and concluded that aid has not achieved its aimed goal of generating development. In the specific case of Africa, it has been suggested that the region has been overaided and that a substantial decrease in aid might be to the benefit of many African countries (Lancaster, 1999).

The present study enriches the existing literature with a novel way of evaluating the macroeconomic impact of foreign aid. It examines aid's effect on fertility and population growth. The reason to expect such relationship is simple. As we know from Malthus, a rise in aggregate income could bring about a proportional rise in population without improvement in living standards. If aid even partly reaches the general population, it will increase the aggregate income of households. If a selection of African countries is in Malthusian regime, where increases in income translate into increasing fertility, and if aid even partly reaches the general population in these countries, then we might expect aid to increase fertility.

The argument I lay out in the paper is chiefly related to the literature on endogenous fertility and growth. Many recent growth models with endogenous fertility, such as, for example, Dahan and Tsiddon (1998), Galor and Weil (2000), Galor and Moav (2002), among others, have implied that non-labor income transfers to the poor increase population growth because the income effect entices the poor to increase their family size.³ More recently, researchers explicitly studied the implications of income redistribution in favor of the poor for fertility differentials between the rich and the poor, population growth and economic growth in more (Azarnert, 2004) or less (Morand, 1999; Moav, 2005) detail. Azarnert (2008) expands the theory to show that aid flows from advanced economies to the impoverished nations foster population growth in the

² This point of view can be traced back to Milton Friedman (1958) and Bauer (1976) who argued that foreign aid detracts from development. For a voluminous literature that points to a diverse set of potential causes of sub-Saharan African ills, see, for example, Easterly and Levine (1997).

³ The direct income effect may also be accompanied by the influence on the quantity-quality tradeoff of endogenous fertility models to induce a reallocation of parental resources away from quality of children toward quantity.

recipient countries and adversely affects the recipients' incentive to invest in human capital. This provides a theoretical basis for the present empirical hypothesis.

Equipped with the Malthusian theory, the present work concentrates on the poorest region of the world – sub-Saharan Africa. The study considers the following two demographic indicators. One is population growth rate (PGR) – the only demographic indicator, for which systematic yearly data are available. Another is the directly related fertility total fertility rate (TFR).⁴ The data used in this paper are from the World Bank's *World Development Indicators, 2001*. The data set includes main 43 Sub-Saharan African countries during the period 1962 – 2000 (see Appendix A). The analysis of population growth rate is performed separately in a balanced panel of 22 countries, for which the annual data are available throughout all of the period, and in an unbalanced panel that includes all the countries. Since for the most of the countries that are not in the balanced panel only a few observations are available, the analysis of fertility is limited to the balanced panel.

A graphical presentation of a strong positive correlation between the average yearly population growth rate in Africa and the average foreign aid lagged one year in Section 2 starts the discussion. In the formal analysis in Section 3, two sets of regressions are presented. In the first specification of the regression model population growth rates are the dependent variable. This specification demonstrates a positive association between population growth and foreign aid received in the previous year. Given the period of gestation, the positive and statistically significant coefficients observed on foreign aid lagged one year probably suggest that aid affects population growth via its effect on fertility. A re-estimation of the regression model with both linear and quadratic functional forms of foreign aid shows that the effect of aid on population growth rate is characterized by diminishing returns. The second set of regressions directly concentrates on fertility, as measured by the total fertility rate. The estimated effect of aid is also shown to be positive and statistically significant. As in the regressions of population growth, it is also characterized by diminishing returns.

⁴ Total fertility rate (TFR) represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with prevailing age-specific fertility rates.

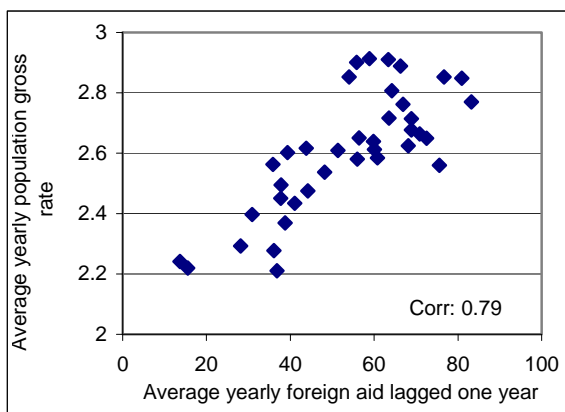
Moreover, if foreign aid increases population growth in the recipient countries, it may thus not only directly lead to the expansion of the poor populations, but, as follows from the standard theory on the link between population growth and economic growth,⁵ it may also indirectly lead to their further impoverishment. Taking into consideration this indirect effect of foreign aid may thus probably help to partly explain the discouraging results of development efforts in Africa to date. These findings suggest that the appreciation of the demographic effect of foreign aid can have important implications for the design of policies regarding of foreign aid (especially, humanitarian foreign aid) for presently developing countries, particularly in sub-Saharan Africa.⁶

2. Evidence: A First Look

This section illustrates the potential of the hypothesis postulated in the paper. A formal examination follows in Section 3.

The graphs present in this section refer to the balanced sample of 22 African countries, for which the data are available throughout all of the period (see Appendix A).

Graph 1: Population gross rate vs. foreign aid in constant 1995 US\$ lagged one year



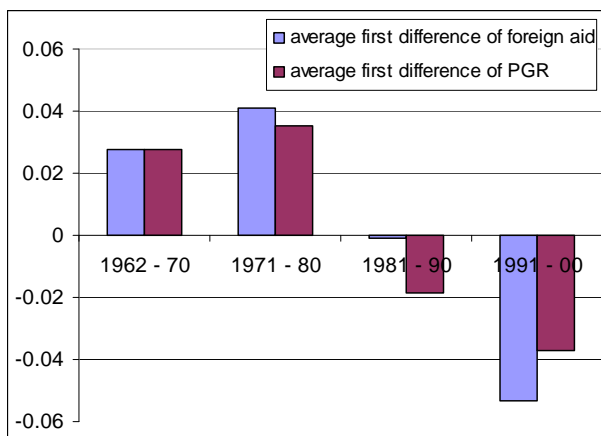
Notes: Yearly averages are calculated over the whole sample. Each dot refers to a year.

⁵ See Galor (2005) for a survey of the literature.

⁶ In an interesting theoretical study Blackorby et al. (1999) postulate that foreign assistance can be given in a form of population-control aid.

Graph (1) shows the strong positive relationship between the average population growth rate and the average foreign aid in constant 1995 US\$ lagged one year. The graph demonstrates that during the period of 40 years in a recipient African country on average the years with higher population growth rate have been associated with relatively generous aid received in the previous year. Coefficient of correlation between these two variables is 0.79.

Graph 2: Average first difference of foreign aid in constant 1995 US\$ per capita (in \$100) vs. average first difference of population growth rate (four decades)



Graph (2) presents average data on each of the four decades within the period separately. It shows that in each decade the average first difference of population growth rate in sub-Saharan Africa moved in the same direction as the average first difference of yearly foreign aid. During the first decade of the period positive average first difference of foreign aid coincided with the positive average first difference of PGR. An increase in aid granted to African countries in the second decade, 1971 – 1980, is associated with an increase in population growth rate in the recipient countries. The subsequent two decades show that the change in the generosity of foreign aid was associated with the corresponding change in the behavior of population growth. The 1981 – 1990 decade demonstrates that the slightly negative average first difference of foreign aid coincided with a start of a slow down of the increase of African population, as captured by the negative average first difference of population growth rate. The last decade of the period

under consideration shows that a continuing at a faster rate slow down of PGR followed a large decline in aid allocated to sub-Saharan Africa.

Next section analyzes the effect of foreign aid on population growth rate and fertility in Africa in a formal panel regression framework.

3. Panel Regression Framework

This section presents the formal analysis of the effect of foreign aid on fertility and population growth in Africa in a panel regression framework. The method of estimation is pooled least squares. The results of estimation are shown in Table (1) in Appendix. To take into account historical, religious, cultural or other country specific factors that may affect population growth rate, the regression model is estimated with country specific fixed effects. In every specification, the estimated coefficient on once-lagged foreign aid is shown to be positive and statistically significant.

3.1. Foreign Aid and Population Growth

This section shows the effect of foreign aid on population growth rate – the only demographic indicator, for which systematic yearly data are available. The analysis is performed separately in a balanced sample that includes 22 countries, for which the data are available throughout all of the period, and in an unbalanced panel that includes all 43 African countries (see Appendix A). Along with foreign aid and the recipient's income per capita in constant 1995 US\$, the set of explanatory variables include the percent of urban population and the percent of female in total population in previous year, the time trend, and two lags of the dependent variable.

Consider first the basic specification with foreign aid along with the other explanatory variables lagged one year. Column (1) presents the results of estimation in the balanced panel of 22 countries, whereas Column (4) shows the results of estimation in the unbalanced panel of 43 countries. In both regressions the estimated coefficient on aid received in the previous year is positive and statistically significant at a 1% level in the balanced panel and at a 4% level in the unbalanced panel of all the countries. Given the period of gestation, the positive and significant coefficient observed on aid lagged one year probably suggests that aid affects population growth via its effect on fertility.

Interestingly, the estimated coefficient on aid is higher and more statistically significant than that of the recipient's GNI. In fact, in the balanced panel the coefficient on the recipient's GNI is not significant even at a 35% level. This result probably suggests that, whereas foreign aid captures only income effect of non-labor income transfers, the recipient's GNI may capture both income and substitution effects of labor income that affect fertility in the opposite directions. As to the effect of the other explanatory variables, as expected, the percent of female in population affects population growth positively, whereas the percent of urban population affects it negatively.

To test the robustness of the theoretical prediction that aid affects population growth primarily via its effect on fertility postulated in Columns (1) and (4), the regression model is re-estimated with foreign aid in current period in addition to the first lag of aid. As shown in Columns (2) and (5), in these regressions the estimated coefficient on once-lagged aid is still positive, although in the unbalanced panel the level of significance of the once-lagged aid declined. In contrast, the estimated coefficients on current foreign aid are statistically insignificant in both estimations and are of opposite sign: positive in the balanced panel and negative in the unbalanced panel of all 43 countries. Given that in such a setting an effect of foreign aid through the reduction of mortality should be captured by the estimated coefficient on aid in the current period, this result also suggests that foreign aid affects population growth primarily through its effect on fertility rather than through decreases in mortality or increases in life expectancy.⁷

In Columns (3) and (6) the regression model is re-estimated with both linear and quadratic functional forms of foreign aid. In such specification the positive linear effect of aid is much stronger than the negative effect of aid in square thus testifying the positive overall effect that is characterized by the diminishing returns to scale. In both regressions adding aid in square also slightly decreases the magnitude and significance of the recipient's own income.

3.2. *Foreign Aid and Fertility*

⁷ This result does not question the effect of various public health programs, such as, for instance, immunization of children against infectious and parasitic diseases that have substantially contributed to child mortality decline in Africa. For the effect of an exogenous decline in child mortality on human capital accumulation and economic growth in the developing world, see Azarnert (2006).

This section demonstrates the effect of foreign aid on fertility in Africa. It considers the directly related to fertility demographic indicator – total fertility rate (TFR). The regressions are run over 16 yearly observations for which data on TFR are available (see Appendix A). Since for the most of the countries that are not in the balanced panel only a few observations are available, the analysis is performed in the balanced panel of 22 African countries only.

Fertility is assumed to depend on foreign aid and the recipient's income per capita in constant 1995 US\$, infant mortality rate, life expectancy, and the percent of urban population. Given that total fertility rate is calculated per woman, the percent of female in population is not included. The set of explanatory variables also includes the time trend.⁸ All the regressors are lagged one period. Data on life expectancy and infant mortality are available for the same years as the data on fertility. For foreign aid, the recipient's income, the percent of urban population, and the percent of female in population, for which data are available for every year, averages of the corresponding variables are used (see notes to Appendix A for details).⁹

Table (1) in Appendix presents the results of estimation. Column (7) shows the main results of a pooled LS estimation with country specific fixed effects. The regression demonstrates that the coefficient estimated on foreign aid is positive and statistically significant. In contrast, the estimated coefficient on the recipient's own income, although positive, is not significant even at a 35% level. The coefficient on the recipient's income is also much lower than that on foreign aid. Thus the direct fertility estimation supports the hypothesis postulated in the previous sub-section on PGR that foreign aid captures the positive income effect of non-labor income transfers on fertility, whereas the recipient's GNI may capture both income and substitution effects of labor income.

Following the approach employed in the analysis of population growth, if the model is re-estimated with both linear and quadratic functional forms, as shown in Column (8), the positive and statistically significant linear effect of aid is much stronger than the negative effect of the quadratic form. This observation confirms the result from

⁸ Systematic data on schooling (particularly, that of female) and contraceptive prevalence that are generally used in the literature to estimate fertility decisions (e.g., Schultz, 1997) are not available for the early part of the period.

the PGR estimation that the positive overall effect of aid on fertility is characterized by the diminishing returns to scale.

4. Conclusion

This work investigates the effect of foreign aid on fertility and population growth in sub-Saharan Africa. The work considers population growth rate (PGR) and the directly related to fertility total fertility rate (TFR). Using a panel of main 43 sub-Saharan African countries during the last four decades of the 20th century, it demonstrates the positive association between population growth rate and foreign aid received in the previous year and suggests that foreign aid affects population growth primarily via its effect on fertility. The work also shows that in the direct estimation of the total fertility rate the coefficient estimated on once-lagged foreign aid is positive and significant as well.

These findings suggest that the appreciation of the demographic effect of foreign aid can have important implications for the design of policies regarding to foreign aid for presently developing countries, particularly in sub-Saharan Africa.

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⁹ Using data lagged one year instead of the averages does not affect the results concerning the effect of aid

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Appendix A: List of main sub-Saharan African countries and data availability
(the period 1962 – 2000)

Country	Aid and GNI	Country	Aid and GNI
Benin*	1962 – 2000	Angola	1987 – 2000
Botswana*	1962 – 2000	Capo Verde	1988 – 2000
Burkina Faso*	1962 – 2000	Congo, Dem. Rep.	1962 – 69; 1973 – 98
Burundi*	1962 – 2000	Equatorial Guinea	1987 – 2000
Cameroon*	1962 – 2000	Eritrea	1994 – 2000
Central African Rep.*	1962 – 2000	Ethiopia	1983 – 2000
Chad*	1962 – 2000	Gambia	1968 – 2000
Congo, Rep.*	1962 – 2000	Guinea	1988 – 2000
Cote d'Ivoire*	1962 – 2000	Guinea-Bissau	1975 – 2000
Gabon*	1962 – 2000	Liberia	1962 – 1987
Ghana*	1962 – 2000	Mali	1969 – 2000
Kenya*	1962 – 2000	Mozambique	1982 – 2000
Lesotho*	1962 – 2000	Namibia ¹	1990 – 2000
Madagascar*	1962 – 2000	Rwanda ²	1962 – 2000
Malawi*	1962 – 2000	Senegal	1970 – 2000
Mauritania*	1962 – 2000	Sierra Leone	1966 – 2000
Mauritius*	1962 – 2000	Somalia	1962 – 1990
Niger*	1962 – 2000	Swaziland	1972 – 2000
Nigeria*	1962 – 2000	Tanzania	1990 – 2000
Sudan*	1962 – 2000	Uganda	1984 – 2000
Togo*	1962 – 2000	Zimbabwe ¹	1980 – 2000
Zambia*	1962 – 2000		

Notes to Appendix A: Countries with asterisk are in the balanced sample.

AID and GNI: Foreign aid and the recipient's GNI per capita in constant 1995 US\$ (deflated by the US CPI), correspondingly. Yearly data on population growth rate (PGR), the percent of female in total population, and urban population as percent of total population are available since 1960 throughout all of the period. Data on total fertility rate (TFR), infant mortality rate and life expectancy at birth during the period 1962 – 2000 are available for the following years: 1962, 1965, 1967, 1970, 1972, 1975, 1977, 1980, 1982, 1985, 1987, 1990, 1992, 1995, 1997, 2000. In TFR regressions, for AID, GNI, the percent of urban population, and the percent of female, for which data are available for each year, for each decade four averages are calculated on 2 or 3 years basis in such a manner: for the year that ends with 2, the average is calculated for two years within the same decade that end with 1 and 2; for the year that ends with 5, the average is for three years that end with 3, 4 and 5; for the year that ends with 7, the average is for the years that end with 6 and 7; for the year that ends with 0, the average is for the years that end with 9 and 0.

(1) For Namibia, data refer to the years since independence only. For Zimbabwe, only the period of the black majority rule is considered.

(2) For Rwanda, the 1994 – 1997 period that saw substantial movements of Rwandans across the county's boundaries as a consequence of the civil war is excluded.

Republic of South Africa that did not receive aid, but suffered from international sanctions throughout almost all of the period is not included in the sample.

Table 1: Population Growth Rate (PGR) and Total Fertility Rate (TFR) Estimation

Dep. Variable	Population Growth Rate			Population Growth Rate			Total Fertility Rate	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Observ.	836	836	836	1279	1279	1279	330	330
AID(-1)	4.97E-04 (2.66)	5.52E-04 (2.59)	1.02E-03 (2.63)	5.10E-04 (2.09)	4.00E-04 (1.18)	1.46E-03 (2.63)	1.62E-03 (1.92)	7.39E-03 (3.64)
AID(-1) ²			-2.06E-06 (-2.15)			-3.80E-06 (-2.50)		-2.71E-05 (-3.47)
AID		-7.99E-05 (-0.48)			1.61E-04 (0.47)			
GNI(-1)	1.03E-05 (0.94)	1.02E-05 (0.93)	9.70E-06 (0.89)	3.30E-05 (1.99)	3.30E-05 (2.00)	3.18E-05 (1.94)	3.12E-05 (0.87)	4.19E-05 (1.25)
TIME	1.13E-03 (1.24)	1.15E-03 (1.27)	7.08E-04 (0.76)	1.91E-03 (1.11)	1.82E-03 (1.06)	1.31E-03 (0.79)	-0.181 (-10.03)	-0.187 (-10.70)
PGR(-1)	1.313 (14.83)	1.313 (14.81)	1.312 (14.85)	1.097 (4.85)	1.096 (4.84)	1.096 (4.84)		
PGR(-2)	-0.423 (-5.35)	-0.423 (-5.35)	-0.423 (-5.36)	-0.297 (-1.49)	-0.296 (-1.49)	-0.297 (-1.49)		
Urban Popul.(-1)	-1.85E-03 (-1.43)	-1.89E-03 (-1.47)	-1.57E-03 (-1.23)	-2.33E-03 (-1.35)	-2.17E-03 (-1.25)	-2.01E-03 (-1.18)	-5.38E-04 (-0.10)	-2.37E-04 (-0.04)
% of Fem.(-1)	5.74E-02 (1.99)	5.75E-02 (2.00)	5.49E-02 (1.90)	5.57E-02 (1.55)	5.61E-02 (1.56)	5.33E-02 (1.50)		
Life Exp.(-1)							3.49E-02 (2.56)	3.03E-02 (2.22)
Infant Mort. Rate(-1)							-1.23E-02 (-4.78)	-1.25E-02 (-4.92)
Adj. R ²	0.933	0.933	0.933	0.797	0.797	0.797	0.855	0.858

Notes: Columns (1) to (3) and (7), (8): Balanced Sample, Columns (4) to (6): Unbalanced Panel.

Method of estimation: LS with country specific fixed effects.

White heteroskedasticity-consistent *t*-values in parentheses.

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