The determinants of public expenditure and expenditure on education in particular in a selection of African countries[1]

Olusegun A Akanbi and Niek J Schoeman
Department of Economics, University of Pretoria
Accepted July 2009

Abstract

This study reports on research aimed at measuring the drivers behind public expenditure with specific reference to education expenditure in Africa. The empirical estimations are carried out using a public choice model on a panel of 15 selected African countries over the period 1995–2004. The results show that government expenditure on education is resilient to shocks and the education sector is not seriously affected by allocative changes that favour corruption. Expenditure on education in the countries included in the study generally complies with the guidelines set by the IMF in terms of their fiscal adjustment programmes.

JEL H52

1 Introduction

Investment in human capital through education has received much attention in the Millennium Development Goals (MDG) as a blueprint for building a better world in the 21st century. Education is seen as one of the main development challenges for especially African countries to sufficiently invest in their people in a sustainable fashion.

Most empirical studies focus on the determinants of military spending. This is not surprising, since the latter absorbs more than 5 per cent of world resources annually. However, there seems to be consensus that in developing countries, military expenditures mostly constrain economic growth and absorb resources that should have been spent on capacity building such as education (Hewitt, 1992). Thus lately, fiscal adjustment programmes in developing countries have been featured by less expenditure on military and more on socio-economic development including education and health (Davoodi et al., 2001; Chu, Ke-young et al., 1995; and IMF, 1997).

The relatively poor economic growth performance of most African economies over the past few decades raises the question whether this is not because of its lack of capacity and therefore educational inadequacies.

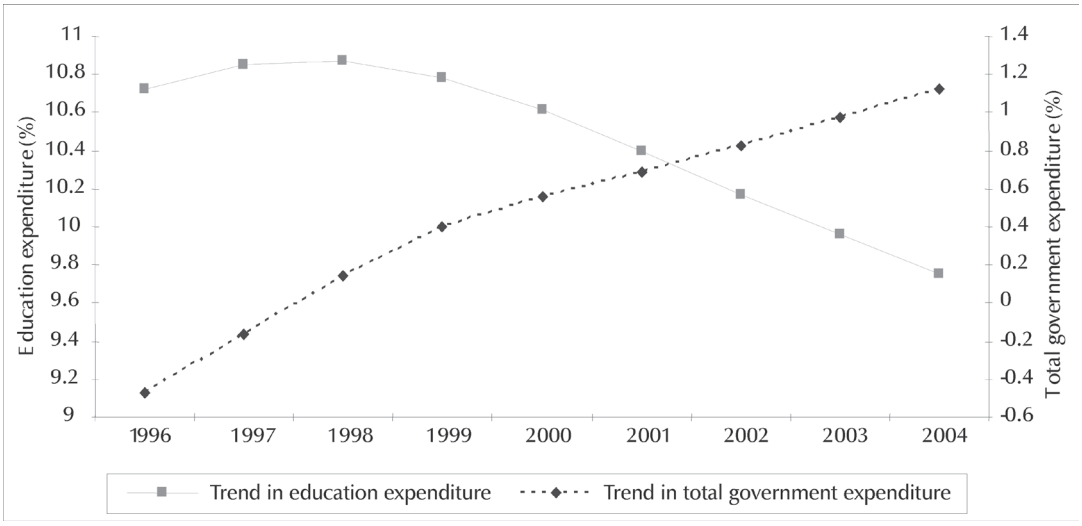
This paper aims to provide some answers to the posed question by looking at allocational expenditure priorities in a selected number of African countries with a specific focus on education expenditure. The hypothesis is, therefore, to investigate the drivers behind spending allocations with a specific focus on expenditure on education.

The rest of the paper is organised as follows; Section 2 outlines trends in education spending in some selected African countries. In Section 3 the theoretical framework and methodology used in the study is presented and Section 4 contains a description of the data used in the study. Section 5 contains an analysis of the results of the various estimations and diagnostic tests conducted and Section 6 concludes.

2
Trends in education spending

In most African countries a few basic trends have emerged over the past few years with regard to the patterns of education expenditure and total government expenditure as a share of Gross Domestic Product (GDP). Figure 1 shows the average growth rates of the ratios of education spending and total government expenditure as a share of GDP in some selected African countries. The figure shows that between 1998 and 2004, total government expenditure and education expenditure as a share of GDP have been moving in opposite directions.

Figure 1
Overall average growth rates of education and total government expenditure as a share of GDP in the selected African countries



Source: World Bank; African development indicators

Over the period 1996 to 2004, the average annual growth rate of the ratio of education expenditure as a share of GDP amounts to 10.3 per cent compared to the growth rate of the ratio of total government expenditure/GDP of only 0.45 per cent. The trend shows, however, that while the growth rate of the ratio of government expenditure to the GDP is rising, the growth rate of education expenditure as a percentage of total government expenditure has been declining[2].

One would *a priori* expect that increasing expenditure on education as a proportion of a developing country's budget would be an indicator of improved skills and thus higher levels of economic growth. Naturally, such spending should be properly administered to ensure good quality education. It is this aspect that is criticised most in the literature, especially given the relatively large amounts spent on education in developing countries in Africa. The fact is that according to the research findings of, for example, Lucas (1988) and Barro (1990) a positive correlation between human capital investment and growth and development is indisputable. The question then is what drives expenditure priorities and are there some common characteristics to be found in such expenditure allocation decisions in the panel of African countries included in this study? Naturally, it would be interesting to investigate the way in which spending patterns by governments actually reflect individual desires (public choice) but due to the lack of country data this is simply not possible. Instead, this study is limited to expenditure patterns only as reflected in education and total expenditure.

3 Theoretical framework

The framework used in this study follows a public choice approach similar to that used by Hewitt (1991, 1992, 1993) and Davoodi et al. (2001). However, instead of analysing military expenditures within the context of total government expenditures as in the models referred to, this paper focuses on the relationship between education spending and overall government spending. Using a similar model to analyse education expenditure within the context of total government expenditure could be questionable given the fact that the latter is normally seen as a mixed or even merit good (i.e provided both privately and by government) compared to military expenditure which is a purely a public good. The implication being that the drivers behind such expenditure could be different. However, given the nature of budget expenditure patterns of the 15 African countries under investigation, the authors are convinced that the spending fundamentals are not substantially different from those in a military/total spending context. Education in these countries is close to being purely a public good with extremely few alternative service providers, non-rival in consumption and from an ethical point of view, non-excludable. The model allows for the optimisation of government expenditure separate from total expenditure with an exposition of the drivers behind both education and total expenditures Thus, the determination of education spending is modelled as a government optimisation problem meaning that the decision of how much to spend on education as proportion of the size of a budget and other votes are being taken by the political leadership.

The welfare function of the government is assumed to be:

$$W = f(C, E, O, Z) \tag{1}$$

Where
C = private consumption;
E = education spending;
O = non-education government spending; and
Z = state variables (i.e corruption index, IMF programs, population index, etc.)

The government's choice of the level of education and overall government spending is affected by the state variables. Overall government spending is represented by:

$$G = \mathrm{E} + O \tag{2}$$

Abstracting from private investment and the external account, the budget constraint is determined by the available resources in the economy:

$$G = Y - C \tag{3}$$

Where Y represents the value of gross domestic product.

To get a simple analytical solution, a Cobb-Douglas specification for equation (1) is assumed, while abstracting from the presence of state variables. Thus,

$$W = C^{\alpha} E^{\beta} O^{\gamma} \tag{4}$$

Choices of E and G that maximise equation (4) subject to equations (2) and (3) will result in[3]:

$$\mathrm{E} = \frac{\beta}{\beta + \gamma} G \tag{5}$$

and

$$\mathrm{G} = \frac{\alpha}{\alpha + \gamma} E + \frac{\gamma}{\alpha + \gamma} (Y) \tag{6}$$

Equations (5) and (6) show the simultaneous relationship between education spending and overall government spending. Higher education spending will lead to higher overall spending and vice versa. Dividing both equations by Y and allowing for the state variables to enter the equations, results in:

$$\frac{E}{Y} = f_1\left(\frac{G}{Y}; Z\right) \tag{7}$$

And

$$\frac{G}{Y} = f_2\left(\frac{E}{Y}; Z\right) \tag{8}$$

Where $f1$ and $f2$ are functions. Equations (7) and (8) form a structural model.

Furthermore, the impact of IMF-supported adjustment programmes on education spending is assessed using a similar model by Davoodi et al. (2001) and others such as (De Masi & Lorie, 1989; Abed, George et al., 1998; Schiff, Gupta & Clements, 1998; and Gupta, Sanjeev, McDonald & Ruggiero, 1998). However, the

framework adopted in this study also allows for measuring the effects of corruption on education and overall government spending equations. Similar work has also been done by Mauro (1998) using cross sectional data and finding that corruption reduces government spending on education.

4 Methodology and data

A panel data econometric technique is used in estimating the required models with 15 cross-sectional data points of selected African countries over the period 1995–2004[4]. The econometric models are specified in natural logarithms form based on equations (7) and (8) which are presented below:

$$\ln(educ_{it}) = \alpha + \alpha_1 \ln(ypc_{it})\, \alpha_2 \ln(gov_{it}) + \alpha_3\, imf_{it} + \alpha_4 \ln(pop14_{it}) + \alpha_5 \ln(ur_{it}) + \alpha_6\, cor_{it} + u_{it} \quad (9)$$

$$\ln(gov_{it}) = \beta + \beta_1 \ln(ypc_{it})\, \beta_2 \ln(educ_{it}) + \beta_3\, imf_{it} + \beta_4 \ln(ur_{it}) + \beta_5\, cor_{it} + \beta_6 \ln(pop65_{it}) + v_{it} \quad (10)$$

Where
educ = ratio of education spending to GDP,
ypc = real per capita GDP,
gov = ratio of overall government spending to GDP,
*pop*14 = population 14 years and under,
cor = corruption index,
imf = existence of IMF supported adjustment program (Dummy variable),
ur = urbanization ratio,
*pop*65 = population above 65 years,

and u_{it} and v_{it} are error terms. The subscript (*it*) refers to country and time period respectively. The state variables in the specified equations (9) and (10) include an IMF dummy variable, real per capita GDP, population under 14 years, corruption index, urbanisation ratio, and population above 65 years. These variables are assumed to influence the parameters of education and government expenditures similar to the approach followed by Davoodi et al. (2001), Hewitt and van Rijckeghem (1995), Mauro (1998) and Heller, Peter and Diamond (1990).

The specification of the models reveals a possible simultaneity problem between education spending and overall government spending and this has rendered the use of Ordinary Least Square (OLS) to be inappropriate in the estimations. In order to derive robust estimates of the parameters in equation (9 & 10) a Two Stage Least Square (TSLS) estimation method is adopted and the lag values of all the independent variables are used as instruments to remove the simultaneity problem that exists between education and government spending.

As discussed earlier, the estimations were carried out using a full panel data set of 15 African countries for the period 1995–2004. Due to the lack of available data over a long period of time, for some of the variables in specific countries, our analysis is restricted to a 10-year period for which a full data set could be obtained. Initially, about 28 African countries were included in the estimations based on the data set available, but the number of cross-sections was restricted to only fifteen. The reason for excluding some of these countries from the estimations is because they tend to produce unexpected and implausible signs for some core coefficients that are at odds with similar studies found in the literature.

Countries included in our analysis were selected on the basis of their homogenous features relating to expenditure patterns. Countries that spend less than 5 per cent on education as a share of GDP were excluded from the data set with the remaining countries all showing higher levels of expenditure on health as a share of GDP, the idea being that those would be countries with their budget priorities

more focused on the quality of life of its citizens[5]. Omitted variables include school enrolment ratios, adult literacy rates and educational attainment which may have captured the determinants of education spending in these countries, but the non-availability of such data restricted the analysis to the variables specified in equations (9 & 10).

The relationship that exists between total government expenditure and education expenditure is found to be ambiguous. One would expect that an increase in total government expenditure results in a corresponding rise in education expenditure but such a rise in overall government expenditure may also lead to a reprioritisation of votes on the budget. In contrast, an increase in education expenditure is expected to result in an increase in total government expenditure if not being compensated for by the reprioritisation of other votes on the budget.

The GDP per capita which serves as a measure of welfare or development is expected to show evidence in favour of Wagner's law. This means that a higher level of welfare is accompanied by an increased share of government expenditure to GDP. However, in the literature, evidence in favor of this phenomenon is mixed (Easterly & Rebelo, 1993; Rodrik & Dana, 1996; and Commander et al., 1997).

Considering the two population age groups that are being used in this paper, it is expected that the size of the age group below 14 years should correlate positively with education expenditure. The reason being that the highest share of government expenditure on education goes to primary and secondary education, with a large number of pupils falling in the age group younger than 14 years. Also, the age group above 65 years is expected to correlate positively with overall government expenditure since an increase in the number of the aged also results in an increase in government spending on social welfare and pensions. However, it is also known that in many African countries little or no pension provision is available. Evidence from Hewitt (1992) shows that increases in the population and corresponding urbanisation will also lead to increased overall government spending that affects the level of education expenditure.

Corruption which can be regarded as a symptom of bad management of the resources of a country also affects expenditure priorities. A rise in the level of public expenditure and lower revenue as a result of corrupt systems may lead to adverse budgetary implications with poor infrastructure and public services. Corruption is difficult to quantify though, but in this study the corruption control index is used with higher numerical numbers indicating less corrupt governance[6]. It is expected that a more corrupt government will spend less on education than on other components of expenditure where corrupt expenditures are less visible. This is because it may be easier to collect substantial bribes on large infrastructural projects such as defence expenditures than on textbooks or teachers' salaries (Mauro, 1997). Also, overall government expenditure will rise as the government becomes more corrupt. The composition of government expenditure may be distorted as corrupt government officials choose to direct expenditures to sectors such as defence or transport that tend to favour bribery.

The IMF dummy reflects those countries that embrace the IMF supported programmes and those that do not. It is expected that the former countries will spend more on education but reduce their total expenditures which is what most IMF programmes prescribe (IMF, 2002).

The data used were obtained from the World Bank data base except the IMF dummy variable which was taken from the IMF country reports. The real per capita GDP, size of the population under the age of 14, urbanisation ratio, population above 65 years, total population, real GDP, education expenditure, and total government expenditure series were obtained from the World Bank: African Development Indicators. The corruption control index was sourced from the Worldwide Governance Indicators.

5
Estimation results

As discussed earlier, the structural models of equations (9) and (10) are estimated using a two-stage least squares (2SLS) procedure. A fixed effect (both country and time specific effects)

estimation technique is adopted based on the assumption that these countries are not poolable since they may not be similar in many other aspects. The advantage of estimating the structural model with the lagged values of the independent variables as instruments is that it provides point estimates of the response of education spending to exogenous changes in government spending and the response of government spending to exogenous changes in education spending.

The results shown in Table 1 are encouraging with R-square coefficients of 0.97 and 0.99 in equations (9) and (10), respectively. This result represents the 15 countries that are included in the estimations[7].

5.1 Total government expenditure

The significance of the coefficient of the ratio of government spending to GDP corresponds to *a priori* expectations. It shows that an increase of 1 percent in total government spending as a share of GDP will lead to an increase of about 0.54 per cent in education expenditure as a share of GDP. This is an indication that these countries devote a substantial part of their additional budget resources to education rather than shifting them to other votes on the budget.

5.2 Education expenditures

The indirect influence of exogenous variables on education spending can be seen through the total government spending equation. Since education expenditure is a component of total government expenditure it is expected that a higher level of spending on education will result in a higher level of total government spending. This is confirmed by the estimation. Total government expenditure as a share of GDP rises by about 0.32 per cent if education spending as a share of GDP increases by one per cent. The statistical significance of this coefficient shows that education expenditure still comprises a small share of total government expenditure in these countries.

Table 1

Results of education and government expenditure equations

Dependent variables		
Independent variables	**Ratio of education spending to GDP**	**Ratio of government spending to GDP**
Real per capita GDP	0.84*** (3.87)	–0.29** (2.23)
Ratio of government spending to GDP	0.54*** (2.03)	
Ratio of education spending to GDP		0.32*** (6.92)
Urbanization ratio	2.41*** (2.69)	0.5 (0.88)
Population below 14	3.31*** (4.13)	
Population above 65		
IMF dummy	0.08 (0.64)	0.1 (0.94)
Corruption control index	0.15** (2.17)	–0.05* (–1.95)
Number of observation	135	135
R-square	0.97	0.99

Note: *** Significant at 1% level; ** significant at 5% level; * significant at 10% level

Source: Authors calculation and analysis of data

5.3 Real per capita GDP

The significance of real per capita GDP in the education expenditure equation shows that the higher the welfare level of a country, the more that country spends on education. The coefficient shows that a one per cent increase in real per capita income will lead to a 0.84 per cent increase in education spending as a share of GDP. However, in the case of the total government expenditure equation, an increase in the per capita income by one per cent results in the overall government spending to GDP ratio to fall by about 0.3 per cent.

5.4 Corruption control index

The response of education spending to the corruption index shows that as the government becomes less corrupt its spending on education rises. An improvement in the corruption index by one unit, results in an increase in education expenditure as a share of GDP of about 0.2 percentage points. This is not surprising since the education sector is not an attractive sector for politicians attempting to seek their own personal gain. Similar results were found in Mauro (1997), who nevertheless cautions readers not to interpret expenditure on education as being free of corruption. However, the results seem to indicate that the incidence of corrupt practices in the education sector is much lower than in other sectors.

The response of total government expenditure to less corrupt governance is also in line with expectations. The statistical significance of the corruption index shows that as the corruption index declines (more corrupt) by one unit, total government expenditures as a share of GDP tend to rise by about 0.1 percentage points. In other words, a more corrupt government will tend to increase its expenditure by either inflating its projects or choosing those that will be easier to levy bribes on. This is contrary to what is found in the case of education spending and could reflect the self-interest of politicians and bureaucrats.

5.5 IMF dummy

Given the strict fiscal rules and conditions for the implementation of IMF supported programmes one would expect that expenditure on education would increase while total expenditure is constrained. Despite a statistically insignificant relationship between the IMF dummy variable and education spending as a share of GDP, the results tend to suggest that the IMF supported programmes can be associated with increased spending on education. However, in the case of total expenditure as a share of GDP the results indicate that IMF supported programmes contribute to increased levels of expenditure. This result is, however, not compatible with the findings of Davoodi et al. (2001) in which two measures of international tension and an interaction term are included.

5.6 Population and urbanisation

The age and the urbanisation ratios included in the estimations are in line with *a priori* expectations as far as expenditure on education is concerned but the general lack of socio-networks causes the results for the number of aged people and total expenditure to be distorted.

The results reveal that a one per cent increase in the size of the population under 14 years will increase spending on education as a share of GDP by about 0.05 per cent. Similar results have been found in Mauro (1998) where he included the share of the population aged between 5 and 20 in order to raise the magnitude of the coefficient on corruption. As indicated the model failed to find any particular relationship between age and government expenditure, probably because of the lack of data on social programmes for the elderly in the African countries included in the model.

The urbanisation ratios have a positive impact on education spending as a share of GDP as well as total government spending as a share of GDP. However, the results are not statistically significant in the total government expenditure equation. The results show that an increase in the urbanisation ratio by one per cent will lead to an increase of about 2.4 and 0.5 per cent in education expenditure as a share of GDP and total government expenditure as a share of GDP, respectively. The reason for the statistical significance of the urbanisation ratio in the education equation may be based on the

fact that most of the educational institutions are located in urban areas. In contrast, the statistically insignificance of the urbanisation ratio in the total government equation may be related to the fact that much of government expenditure in Africa is not really directed at urban infrastructural development.

6 Conclusion

This study investigates the impact of a number of selected variables on government expenditure on education and total public expenditure in 15 selected African countries. The estimations performed (after corrections to the various statistical problems encountered) portray a robust estimate of the parameters in the models. The impact of total government expenditure on education spending shows the expected results, namely, that the share of education spending to total government spending increases when fiscal policy is expansionary. This means that government expenditure on education is resilient to shocks in total government spending and total government expenditure on the other hand is found to be resilient to shocks in education spending. In other words, expansionary fiscal policy in these countries results in a dedicated part of the expansion automatically being directed to the education sector.

The positive, significant and robust relationship found between corruption and education spending as a share of GDP also shows that the education sector is not affected by corruption as much as other components of government expenditure. Similar results were reported by Mauro (1998) who ascribed this relationship to the fact that most corrupt governments find it easier to collect bribes on non-educational expenditures such as infrastructure spending and the military.

Although not statistically significant, the results show that IMF supported programmes have contributed to increased spending on education in the countries included in this study. It is interesting to note though, that increased use and implementation of IMF programmes have actually led to increased levels of public spending in general. One would assume that the increased expenditure was made possible by funds invested by the IMF but that does not seem to constrain total government expenditures.

While the results indicate that expenditure on education receives its fair share with a rise in total expenditure, there seems to be a tendency for expenditures on other votes on the budget to grow while the growth in the share of education is gradually declining. This is a concern given the need for skills and human capacity building in general in developing countries. Also, from a good governance point of view, the fact that expenditure on education is less affected by negative factors like corruption indicates that fiscal prudence can be promoted by increasing this sector's share of total expenditure.

Future research should attempt to correct some of the shortcomings of this study such as the lack of available data which resulted in a number of countries being excluded and some relevant variables not being included in the estimations.

Endnotes

1 We are thankful to Dr E Nyamongo for his assistance in obtaining data for this study and also his constructive suggestions and comments.
2 Note: Figure 1 depicts the trend of the two variables and is calculated using a Hodrick–Prescott Filter.
3 The solution for the optimal choice of E and G is shown in Appendix 1.
4 List of the countries included in the estimations is shown in Appendix 2.
5 List of countries excluded from the estimations is also shown in Appendix 2.
6 Most corrupt (–2.5) and Least corrupt (+2.5)
7 Appendix 3 present the results of the countries that are excluded from the sample.

References

ABED, G. & OTHERS, 1998. Fiscal reforms in low-income countries: experience under IMF-supported programs. Washington: International Monetary Fund.

ANON. Not dated. United Nation Development Programme (UNDP): *Millennium development goals*. [Online] Available from: http://www.undp.org/mdg/basics.shtml [Accessed: 2007-2-20].

BARRO, R.J. 1991. Economic growth in a cross section of countries. *Quarterly Journal of Economics*, 106(2): 407–43.

CHU, KE-YOUNG & OTHERS, 1995. Unproductive public expenditures: a pragmatic approach to policy analysis. *IMF Pamphlet Series*, No. 48. Washington: International Monetary Fund.

COMMANDER, S., DAVOODI, H.R. & LEE, U.J. 1997. The causes of government and the consequences for growth and well-being. *Policy Discussion Paper*, No. 1785. Washington: World Bank.

DAVOODI, H., CLEMENTS, B., SCHIFF J. & DEBAERE, P. 2001. Military spending, peace dividend, and fiscal adjustment. *IMF Staff Papers*, 48(2): 290–316.

DE MASI, P. & LORIE, H. 1989. How resilient are military expenditures? *IMF Staff Papers*, 36(3): 130–65.

EASTERLY, W. & REBELO, S. 1993. Fiscal policy and economic growth: an empirical investigation. *Journal of Monetary Economics*, 32(3): 417–58.

GUPTA, S., MCDONALD, C. & RUGGIERO, E. 1998. Worldwide military expenditures appears to have leveled off. *IMF Survey*, May: 149–50.

HEELER, P.S. 2005. Understanding fiscal space. *IMF Policy Discussion Paper*, 05/4.

HELLER, P.S. & DIAMOND, J. 1990. International comparisons of government expenditure revisited: the developing countries. 1975–86. Washington: International Monetary Fund.

HEWITT, D.P. 1991. Military expenditure: econometric testing of economic and political influences. *IMF Working Paper*, WP/91/53 (Washington: International Monetary Fund).

_____ 1992. Military expenditure worldwide: determinants and trends *Journal of Public Policy.* 12(2): 105–52.

_____ 1993. Military expenditure 1972–1990: the reasons behind the post-1985 fall in world military spending. *IMF Working Paper*, WP/93/18. Washington: International Monetary Fund.

HEWITT, D.P. & VAN RIJCKEGHEM, C. 1995. Wage expenditures of central governments. *IMF Working Paper*. WP/95/11. Washington: International Monetary Fund.

INTERNATIONAL MONETARY FUND. 2007. Regional economic outlook: sub-Saharan Africa. Washington D.C.

INTERNATIONAL MONETARY FUND. 2002. Fiscal adjustment in IMF-supported programs. *Draft Issues Paper*, March 28.

INTERNATIONAL MONETARY FUND. 1997. Reducing unproductive expenditures is important for fiscal adjustment. IMF Survey, February 24, pp.49-51.

LUCAS, R.E. 1988. On the mechanics of economic development, *Journal of Monetary Economics*, 22: 3-42.

MAURO, P. 1998. Corruption and the composition of government expenditure. *Journal of Public Economics,* 69: 263–79.

MAURO, P. 1997. Why worry about corruption? *International Monetary Fund*. [Online] Available from: http://www.imf.org/external/pubs/ft/issues6/index.htm.

RODRIK & DANI. 1996. Why do more open economies have bigger government? *NBER Working Paper*, No. 5537, Cambridge, Massachusetts: National Bureau of Economic Research.

SCHIFF, J., GUPTA, S. & CLEMENTS, B. 1998. Worldwide military spending 1990–95. *Defense and Peace Economics*, 9(3): 237–81.

APPENDICES

Appendix 1

Forming a Langragian from (4) subject to (2) and (3).

$L = C^{\alpha} E^{\beta} O^{\gamma} + \lambda (Y - C - E - O)$

Since; $E + O = Y - C$

F.O.C

$L_c = \alpha C^{\alpha-1} E^{\beta} O^{\gamma} - \lambda = 0$ (1)

$L_E = \beta C^{\alpha} E^{\beta-1} O^{\gamma} - \lambda = 0$ (2)

$L_O = \gamma C^{\alpha} E^{\beta} O^{\gamma-1} - \lambda = 0$ (3)

$L_k = Y - C - E - O = 0$ (4)

Equating (2) and (3)

$\beta O = E\gamma$

$$O = \frac{\gamma}{\beta} E \quad (5)$$

Substituting (5) into (4)

$$Y - C - E - \frac{\gamma}{\beta} E = 0$$

But $Y - C = G$

$$G - \left(1 + \frac{\gamma}{\beta}\right) E = 0$$

$$E = \frac{\beta}{\beta + \gamma} G \quad (6)$$

Also, equating (1) and (3)

$\alpha O = \gamma C$

$$C = \frac{\alpha}{\gamma} O \quad (7)$$

Substituting (7) into (4)

$$Y - \frac{\alpha}{\gamma} O - G = 0 \qquad \text{for } G = E + O$$

$$Y - \frac{\alpha}{\gamma} (G - E) - G = 0$$

$$Y + \frac{\alpha}{\gamma} E = \left(1 + \frac{\alpha}{\gamma}\right) G$$

$$G = \frac{\alpha}{\alpha + \gamma} E + \frac{\gamma}{\alpha + \gamma} Y$$

Appendix 2

List of Countries

Countries included	Countries excluded
Botswana	Angola
Ivory Coast	Burundi
Djibouti	Cameroon
Ethiopia	Eritrea
Ghana	Gambia
Kenya	Guinea Bissau
Lesotho	Mali
Mauritius	Malawi
Morocco	Madagascar
Namibia	Niger
Rwanda	Nigeria
Sierra Leone	Senegal
Tunisia	Swaziland
Uganda	
South Africa	

Appendix 3

Results for countries excluded from the estimations

Dependent variable: Ratio of education spending to GDP				
Total pool (balanced) observations: 117				
Instrument list: c ln_gov?(–1) imf?(–1) cor?(–1) ln_ypc?(–1) ln_pop14?(–1) ln_ur?(–1)				
Variable	**Coefficient**	**Std. error**	**t-Statistic**	**Prob.**
C	2.289275	3.301217	0.693464	0.4897
Ratio of government spending to GDP	0.617170	2.520862	0.244825	0.8071
Real GDP per capita	0.344243	1.019042	0.337811	0.7362
IMF dummy	0.016969	0.268633	0.063169	0.9498
Corruption control index	0.000876	0.128534	0.006812	0.9946
Population below 14	–0.037749	0.259084	–0.145701	0.8845
Urbanisation ratio	6.059133	1.468762	4.125334	0.0001
R-squared	0.928747			

Dependent Variable: Ratio of government spending to GDP				
Total pool (balanced) observations: 117				
Instrument list: c ln_gov?(–1) imf?(–1) cor?(–1) ln_ypc?(–1) ln_pop14?(–1) ln_ur?(–1)				
Variable	**Coefficient**	**Std. error**	**t-statistic**	**Prob.**
C	–3.261680	32.15533	–0.101435	0.9194
Ratio of government spending to GDP	–0.058431	1.303423	–0.044829	0.9643
Real GDP per capita	0.233750	1.779611	0.131349	0.8958
IMF dummy	–0.067811	0.374417	–0.181112	0.8567
Corruption control index	–0.054173	0.038008	–1.425304	0.1572
Population below 14	0.783598	5.000243	0.156712	0.8758
Urbanisation ratio	0.088003	16.20648	0.005430	0.9957
R-squared	0.996545			