POLITICAL INSTITUTIONS AND ECONOMIC GROWTH IN AFRICA♦

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Abstract

The purposes of this paper include (a) a review of the literature on the so-called "African dummy;" (b) an explication of the system GMM method of estimation, by which Hoeffler (2002) shows the "Africa dummy" to be an artifact of the application of inappropriate estimation techniques; and (c) an effort to employ this technique to measure the impact of political variables – measures of stability, regime type, and violence – on economic growth in Africa.

♦ The paper has been written to support the African Economic Research Consortium's study of the determinants of economic growth in Africa and is designed to complement the 27 in depth country studies, many of which highlight the importance of politics to the performance of their respective national economies.

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1. Introduction

This paper revisits the empirical growth literature, with the main objective of highlighting the crucial importance of politics in explaining the growth process in Africa. It is part of a bigger comparative project on "Explaining Growth in Africa" directed by the African Economic Research Consortium (AERC). In consistency with the rest of the project, the paper adopts the System Generalized Method of Moments (SYS-GMM) as the preferred estimation procedure. This is in line with Hoeffler (2002), one of the benchmark papers used in the project. The paper aims to estimate an 'augmented' Solow model of growth, adding political variables to the standard economic variables of the Solow model.

Following Ndulu and O'Connell (2000), whether the addition of political variables improves the explanatory power of the Solow model is determined based on the comparison of the fits and residuals of the two models. In addition to econometric reasons, the choice of the sample and the estimation procedure are guided by the need to produce results that are comparable with the fits and residuals computed on the basis of Hoeffler (2002).

In the second section, the paper discusses briefly the theoretical and empirical literature on growth with a special focus on results relating to African economies. A brief background to the AERC project is also presented. From its preliminary results, the project has highlighted the crucial importance of politics in explaining economic growth. This is the subject of section 3. In section 4, a brief discussion of the System Generalised Method of Moments (SYS-GMM) is provided. Section 5 presents Hoeffler (2002) empirical model used as our benchmark. Section 6 discusses empirical results of the SYS-GMM model of growth and political institutions. Section 7 concludes.

2. Background

In his seminal work on growth, Solow (1956) developed the idea that economic growth is an outcome of capital accumulation. Countries that experience per capita growth have increasing capital-labour ratios, which in turn result from high enough rates of savings (capital accumulation) to compensate for the cost of capital depreciation and population growth. The concept of capital was later broadened to include human capital (Lucas, 1988; Barro and Sala-i-Martin, 1995). Based on the hypothesis of diminishing returns to capital, the Solow growth model predicted that growth in per capita income eventually ends in the long-run. This was in contradiction with empirical data on a number of countries that displayed positive growth rates for more than a century.

Given that long-term growth in the Solow growth model is determined by an exogenous rate of technological progress, the contradiction was later explained as being due to the absence of an endogenous process of technological innovation in the model. The theoretical foundations of technological change and its impact on growth were laid by Arrow (1962) and Sheshinski (1967). However, it is only in the late 1980s that Romer (1986; 1987) and Lucas (1988) developed a framework where sustained research and development (R&D) in a context of imperfect competition may lead to positive per capita GDP growth in the long-term. Determination of long-run growth within the growth model led to the so-called 'endogenous growth model'. It is in this context that Solow's model is sometimes referred to as an 'exogenous growth model', while the Romer and Lucas model is termed an 'endogenous growth model'.

Following these theoretical developments, most recent research on growth has been empirical. Generally, empirical results based on the Solow growth model are estimates of an equation of the rate of output growth on the following variables, entering individually or in combination:[1] (i) a measure of the initial level of output and the initial level of technology to capture the impact of initial conditions; (ii) the [exogenous] rate of technological change to account for productivity changes; (iii) the savings rate to capture capital accumulation; (iv) the growth rate of the work force; (v) the rate of depreciation of capital; (vi) the share of capital in output; and, (vii) the rate of convergence to the steady-state (Barro and Sala-i-Martin, 1995). This specification is directly derived from a production function.

A number of empirical studies have found that the Solow growth model fails to explain Africa's economic growth. An 'African dummy' has been found to be large and significant in cross-section studies, suggesting that Africa's growth responds to variables different from those explaining it elsewhere (Barro and Lee, 1993; Easterly and Levine, 1997). Other studies, as noted by Collier and Gunning (1999, p. 65), eliminated the dummy "though to an extent by transferring the puzzle elsewhere". This is the case with Sachs and Warner (1997) for example, who do not find a significant African dummy but instead find a significant 'tropics dummy'.

Both specification and estimation techniques could explain the significance of the African dummy. Most researchers have responded to the puzzle of the Africa dummy by re-specifying the growth model and adding variables thought to capture missing factors not explained by the textbook Solow model. First, some studies endogenize the savings variable by including in the model the policy variables influencing savings. These include the black market premium, the rate of inflation and the rate of the budget deficit.[2] Even sociological variables such as ethnic fractionalisation have been considered important in explaining the Africa's dummy (see Easterly and Levine, 1997). Sachs and Warner (1997) added geographical variables to the list and found a significant tropical dummy. More generally,

[1] Output is often but not always in units per worker.

some studies have also introduced political variables in growth models to explain better the growth process (see for instance Barro and Lee, 1993; Alesina et al., 1996; and Easterly and Levine, 1997).

Anke Hoeffler (2002) is among the few who responded to the debate over the African dummy from an econometric perspective. In her methodologically detailed study, Hoeffler found that the significance of the African dummy was due to estimation problems. All the studies cited above used either cross section OLS or fixed effect panel approaches to estimate the growth model. However, it is simple to show that these methods are flawed when estimating dynamic panel data models (see the discussion below). Hoeffler presents five models using five different estimation techniques. She finds that when the appropriate method of estimation is used, the African dummy is no more significant even when the model is restricted to the basic Solow model without adding any more variables. She therefore concludes that growth in Africa is explained by the same fundamental production function factors used in the Solow model.

Underlying the controversy is the complexity of the growth process. Most studies claiming to have explained growth account for just a small proportion of the variation in the rate of growth. This cannot be otherwise because growth has its country or regional idiosyncratic determinants. Whether these are so important that they invalidate the main pattern given by the basic variables of the Solow model is an empirical question. An important but rarely adopted approach to explaining growth, probably due to its high cost, remains the 'case study' approach. It is only through case study analysis that the predictions of cross-country models can be confronted with country 'realities' to determine their robustness.

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[2] Note that policy variables are also used in 'endogenous' growth models.

The African Economic Research Consortium (AERC) has launched a project on case studies of economic growth in Africa. About 30 countries are being studied by African scholars, under general coordination by economists and political economists. The central objective of the project is to produce what has been termed a 're-writing of African economic history by Africans'. The plan is to have a collection of the project results published by Cambridge University Press in edited volumes under the general title "Cambridge Economic Survey of Africa".

This project is unique in many respects. First, it is an initiative of an African institution using highly qualified Africans to write about Africa. Secondly, the richness of its methodology matches the challenge posed by the complexity of the growth process. The analysis of growth blends macroeconomic accounting, political economy, microeconomic and institutional analyses. Thirdly, the project's relatively wide coverage—about 30 countries-- implies that the project will propose a growth profile that is truly African. In the process, researchers can address and perhaps resolve the question whether Africa's growth is explained by the factors generally included in the cross-country literature.

3. Political Factors and Economic Growth

The role of political variables in explaining economic growth has been acknowledged by many economists. For instance, Barro and Lee (1993) used the number of revolutions while Easterly and Levine (1997) used the number of assassinations to proxy for social disturbance as a determinant of growth. Alesina and Perotti (1996a) used a set of variables, namely the number of assassinations, deaths, coups and demonstrations to compute an index of political instability using the principal component method. Moreover, Alesina et al. (1996b) used dummy variables indicating regime change, both regular and irregular transfer of executive power, to proxy for political instability. They also included a dummy variable representing democratic institutions. Fosu (2001) based his measure of political instability on three variants of 'coup plots', namely successful, abortive and officially reported coups. Collier and Gunning (1999) used the number of months of war in a country to proxy for social disturbance.

Barro and Lee, Alesina and Perotti and Alesina et al. found negative and statistically significant coefficients, deducing that social disturbance or political instability has a significant negative impact on economic growth. The coefficients in Easterly and Levine, and Collier and Gunning are negative but not statistically significant. Fosu's coefficient on the instability variable is positive; he justifies the sign as meaning that a coup may signal a positive development if a government change is seen as necessary to help revitalize an economy. Although some coups may be perceived as welcome events when they depose dictators albeit through illegal means, it is hard to generalize that coups always bring good news for growth, especially when they target democratically elected governments. The positive relationship between political instability and growth in Fosu (2001) is probably due to the nature of the sample which is made of only 31 Sub-Saharan African countries. In a global sample, we should expect political instability to be negatively related to growth given the destructions and uncertainty it entails.

The conclusion that political instability has no impact on growth remains strikingly counter-intuitive as is the result that the relationship is positive. The result may be dependent on the quality of the proxies used to measure social disturbance. For instance, the use of the number of months of civil war focuses on the most extreme case of social disturbance which is, on average, a rather rare event, implying that there is not much variation in the variable. Based on the sample used by Hoeffler (2002) in her growth study, we have found that as many as 85 percent of the countries never experienced civil war. As a result, only 15 percent of the countries have nonzero values of the months of civil war for the sample which covers the period from 1960 to 1990. As we show in the next section, the methods of estimation may also contribute to biased estimates, affecting the conclusions drawn on the basis of such parameters.

In his chapter 7 on "Social Infrastructure and Long-Run Economic Performance" Jones (2002) discusses some of the reasons why politics matters for economic growth. The underlying argument is that growth results from investment and out of three factors determining the expected profitability of investment, two are related to political institutions. These are: (i) the extent to which the economy favours production instead of diversion, and (ii) the stability of the economic environment (p. 140). Diversion of resources is a consequence of practices such as corruption, theft, the payment of protection money, confiscatory taxation, the lobbying of government by special interests, etc. All these act like taxes on businesses, reducing their expected profitability. The government usually stands at the centre of this system of resource diversion, either as an active player or a passive one through the structure of incentives it puts in place (see Easterly, 2001). Economic instability is often the result of political instability and vice versa. As Jones (2002: 142) remarks, "Wars and revolutions in an economy are extreme forms of instability". Instability of the economic environment increases uncertainty and discourages investment, thereby affecting growth.

What role does politics play in Africa's economic growth? Information from the AERC Growth Project shows clearly how politics overrides economics in policy making in most countries.[3] In Burundi for instance, Nkurunziza and Ngaruko (2002) show that most of the investment is dominated by the public sector. Between the late 1970s and early 1980s, more than 100 state firms were created and put in the hands of political appointees close or members of the political elite. Most of these firms have never been profitable. Instead, they are bailed out each year using taxpayers' money. Investment in human capital through the allocation of education and health infrastructure has favoured Bujumbura, the capital city, and the South of the country, the cradle of the political elite. Rent sharing rather than economic and social efficiency of these projects seems to have been the overarching objective of the investments.

Burundi is not an exception in Africa. The similarity of political problems confronting many countries in Africa is striking. In many countries the similarities regarding regionalization of politics and economic policymaking is surprising. There is often tension between those favoured, namely those directly or indirectly identifying with the political leadership, and those at the other end of the spectrum. This distinction may take an ethnic, regional or even religious form. When violence erupts, economic infrastructure is usually the target of those opposing the leadership as they perceive infrastructure as a symbol of their exploitation. In Sudan where a predominantly Arab and Muslim North has been fighting a long war with a predominantly Christian and Animist South, oil installations in the South are often sabotaged by the Southern rebels who do not gain benefits from oil exports.

In Nigeria populations from the Southern Delta region that produces most of the country's oil have engaged in acts of sabotage to disrupt the flow of oil from their region. The current war in Cote d'Ivoire is often referred to as a political war between the predominantly Muslim North and the Christian South for equality of political rights. The rebels have targeted cocoa producing regions, which has already resulted in an increased pressure on cocoa prices in the international market. In the Central African Republic (CAR),

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[3] This tendency is not particular to Africa but it is more pronounced where there are no effective 'agencies of

the regional political divide is similar to that in Burundi. The recent coup d'état in CAR was a replica of the 1993 coup in Burundi (see Ngaruko and Nkurunziza, 2000). As in Burundi, the country's political elite and the army have been traditionally dominated by people from the South. The North-South political divide is also observed in Chad and Togo, among others. One way or the other, most of the 30-country studies in the AERC Growth Project have argued for a close negative relationship between political instability and economic performance.

4. The System Generalised Method of Moments (SYS-GMM) and Growth Equations

A number of influential studies in the empirical growth literature have estimated growth equations using cross-section averages over twenty to thirty years.[4] Although there may be some theoretical support for using cross-sectional averages in panel data analysis, especially when one is interested in an 'average' slope coefficient, the most interesting cases of growth analysis show that a cross-sectional model has a number of shortcomings. First, averaging data over such long periods wastes valuable information on the dynamics of the phenomenon under analysis. This is particularly the case with the analysis of growth, which is dynamic by definition. Secondly, estimates from a cross-section equation will more likely suffer from an omitted variable bias due to heterogeneity. Thirdly, some variables explaining growth, especially the investment variable, will more likely be endogenous so they need to be instrumented for. It should be noted, though, that the problem of endogeneity is not particular to dynamic panel models.

restraint' (Collier, 1991).

[4] See for instance Barro (1991), Sala-i-Martin (1997) and Levine and Renelt (1992).

Step by step, we show why the SYS-GMM is our preferred estimation approach.[5] The SYS-GMM method addresses the problems of omitted variable bias, endogeneity, and unit root effects in the choice of instruments (see Blundell and Bond, 1998).

We start with a cross-section model of the form:

$$g_i = \alpha + \beta y_i + \gamma x_i + \varepsilon_i \tag{1}$$

where the i subscripts refer to country, with $i = 1, 2, ...N$. Variable g_i is country i^{th} average of real per capita (or per worker) GDP growth rate over the sample period, y_i represents initial output level while x_i is a vector of other explanatory variables, and ε_i is the error term. α, β and γ are the parameters to be estimated. If the sample is, say, from 1960 to 1990 with half decadal data, there are NT data points available, where $T = 6$ (in a balanced panel). However, equation (1) uses only N data points, referring to the point made earlier regarding the waste of information associated with the estimation of a cross-section equation. The other disadvantage of equation (1) is that if the vector x_i contains one or more endogenous variables (this is especially the case with the investment variable), the estimates will be biased. Lastly, the equation does not take into account the problem of heterogeneity among countries, which introduces an omitted variable bias.

Most but not all of these shortcomings are solved by using a dynamic panel data model.[6] Using the time dimension not only increases the data points to NT but it also allows

[5] See Hoeffler (2002) for a detailed discussion

us to solve the problem of heterogeneity. Assume that instead of the specification (1) our model is in the following panel form:

$$g_{i,t} = \alpha + \beta y_{i,t-1} + \gamma x_{i,t} + \varepsilon_{i,t} \tag{2}$$

where the t subscripts refer to time. If the panel has some time invariant effects, we account for them by decomposing the error component in equation (2) into a time invariant and a time variant components such that:

$$\varepsilon_{i,t} = \mu_i + \nu_{i,t} \tag{3}$$

where μ_i is the time invariant and $\nu_{i,t}$ the time variant error components. Substituting equation (3) into equation (2) we have:

$$g_{i,t} = \alpha + \beta y_{i,t-1} + \gamma x_{i,t} + \mu_i + \nu_{i,t} \tag{4}$$

Equation (4) is equivalent to:

$$y_{i,t} - y_{i,t-1} = \beta y_{i,t-1} + \gamma x_{i,t} + \mu_i + \nu_{i,t} \tag{5}$$

which can be re-written as:

[6] It should be acknowledged that if the slope coefficients differ across countries, dynamic panel data models cannot produce consistent estimates even when the number of cross-sectional observations and time points are large.

$$y_{i,t} = \beta^* y_{i,t-1} + \gamma x_{i,t} + \mu_i + \nu_{i,t} \tag{6}$$

where $\beta^* = (\beta + 1)$. By writing equation (6) in first differences, we have:

$$\Delta y_{i,t} = \beta^* \Delta y_{i,t-1} + \gamma \Delta x_{i,t} + \Delta \nu_{i,t} \tag{7}$$

given that $\mu_{i,t} - \mu_{i,t-1} = 0$. This transformation solves the problem of heterogeneity (omitted variable bias) by sweeping μ_i out of equation (6). However, while doing so, the method introduces the problem of endogeneity. By inspection, we see that $y_{i,t-1}$ is endogenous to the error term through $\nu_{i,t-1}$. The relationship between $y_{i,t-1}$ and $\nu_{i,t-1}$ in equation (7) is the same as the relationship between the dependent variable and the error term in equation (6) but only lagged once. Hence:

$$if \;\; y_{i,t} = f(\nu_{i,t}) \;\Rightarrow y_{i,t-1} = f(\nu_{i,t-1}) \tag{8}$$

Therefore, estimating equation (7) by OLS produces biased estimates of β. Nickell (1981) identifies three characteristics of the bias: (i) it is negative for positive values of β; (ii) it increases with β; and, (iii) it (slowly) decreases in T. The second characteristic implies that regressions using inappropriate estimation methods may wrongly suggest the presence of rapid economic convergence.

In order to solve the problem of endogeneity, Anderson and Hsiao (1982) propose the use of an instrumental variable that instruments for $\Delta y_{i,t-1}$ in equation (7). Following the standard arguments on the use of instrumental variables, Anderson and Hsiao suggest using $\Delta y_{i,t-2}$ as a good instrument (but in a latter paper they suggested $y_{i,t-2}$) along with the other exogenous variables at the right-hand side of equation (7). Therefore, Anderson and Hsiao's vector of instrument is $Z = [y_{i,t-2}, \Delta x_{i,t}]$ assuming that all variables in $\Delta x_{i,t}$ are exogenous, which is not the case as we discuss below.

Building on Anderson and Hsiao's result that $y_{i,t-2}$ is a good instrument, Arellano and Bond (1991) argue that if that is the case, then $y_{i,t-3}, y_{i,t-4} ..., y_{i,t-k}$ are also good instruments, leading to the following moment restrictions[7]:

$$E(y_{i,t-j} \Delta v_{i,t}) = 0 \;\; for \; j = 2,3,....,(T-1) \tag{9}$$

and:

$$E(x_{i,t-k} \Delta v_{i,t}) = 0 \;\; for \; k = 1,2,3,....,(T-1) \tag{10}$$

Equations (9) and (10) show clearly that there are more valid instruments than endogenous variables. In order to combine the instruments in an efficient way, Arellano and Bond propose the use of Hansen (1982) Generalised Method of Moment (GMM) estimator. It is computed in two steps. First all the instruments are put in a single vector:

$$Z^* = [y_{t-2}, y_{t-3}, ..., \Delta x_t, \Delta x_{t-1}, \Delta x_{t-2}, ...] \tag{11}$$

Secondly, the inverse of the variance-covariance matrix of the instruments denoted A_H, is computed to combine the instruments efficiently and then used to derive the GMM estimator:

$$\hat{\delta}_{GMM} = (X'Z^* A_H Z^{*'} X)^{-1} X'Z^* A_H Z^{*'} y \tag{12}$$

The main advantage of the GMM over the Anderson Hsiao instrumental variable (IV) estimator is that it is more efficient and consistent (albeit asymptotically) as it uses more moment restrictions than the latter. In addition, if any of the variables in $x_{i,t}$ is endogenous, appropriate instruments can be easily found using pre-determined and exogenous variables within the system. This is typically the case with the investment variable in growth regressions. The fact that internal instruments are available to help solve the problem of endogenous explanatory variables makes GMM an appealing estimation method.

The $\hat{\delta}_{GMM}$ estimator in (12) is called "differenced GMM" estimator as it is based on the differenced equation in (7). However, Blundell and Bond (1998) show that lagged levels of the variables in the system may not be good instruments of current differences if the series is close to a random walk. Instead, they propose a GMM estimator derived from the estimation of a simultaneous system of two equations, the first being the differenced equation in (7) and the second being the levels equation in (6). Suitably lagged levels of $y_{i,t}$ and $x_{i,t}$ are used as instruments in the differenced equation while $\Delta y_{i,t-1}$ and Δx_{it},

[7] See Hoeffler (2002) on a detailed discussion of the determination of valid instruments.

provided x_{it} is strictly exogenous, are used as instruments in the levels equation. The validity of these instruments is established using a Sargan test of overidentifying restrictions (see Arellano and Bond, 1991). A Difference Sargan test allows to compare first-differenced and system GMM estimators. The gain in efficiency from the system GMM is remarkable, as the series tend to be random walks.

To recap, econometric developments in terms of the analysis of panel data over the last twenty years and estimation of empirical models of economic growth have demonstrated the need for 'instrumenting' for one or more of the explanatory variables. More and more studies are using the Generalised Method of Moments given its ability to provide internal instruments in an efficient combination.

5. Hoeffler's Augmented Solow Empirical Model

Hoeffler estimates five models which are compared to determine which one explains growth best. These are OLS, fixed effects, instrumental variables, difference GMM and system GMM. On the basis of the discussion in section 3, we focus on and employ Hoeffler's (2002) SYS-GMM estimates as our benchmark. Table 1 presents Hoeffler's results.

The results in Table 1 show that the key variables of the Solow model are significant with the expected signs. The first variable, $ln(GDP_{t-1})$ is the log of GDP per capita lagged one period to proxy for initial conditions. When it is significant and negative, it indicates conditional convergence. Variable *ln(investment)* is the log of the ratio of investment to GDP. As expected, it is positive and highly significant.

Table 1: SYS-GMM Estimates of the Augmented Solow Model (Hoeffler, 2002)

Dependent variable is growth rate of log of per capita GDP

	Coefficients	Std. errors	T-statistics
$\ln(GDP_{t-1})$	-0.151	0.053	-2.849
$\ln(investment)$	0.249	0.039	6.385
$\ln(n+g+d)$	-0.419	0.144	-2.910
$\ln(schooling)$	0.011	0.037	0.297
Number of *countries*			85
Number of observations			404
m_1 = first-order correl.			0.00
m_2 = second-order correl.			0.94
*S*argan test			0.44

The results reported for m_1 and m_2 as well as those for the Sargan test are *p-values* of the null hypotheses of no autocorrelation and appropriate set of instruments, respectively. Computed standard errors are heteroskedasticity consistent. The programme used to estimate the model is Arellano and Bond DPD98 for GAUSS.

The composite variable *ln(n+g+d)* is a linear combination of the rate of population growth, technological progress and the rate of capital depreciation. As is conventional, it is assumed that the rates of technological progress and capital depreciation are constant across countries and sum to 0.05. Therefore, *ln(n+g+d)* is the log of country population growth augmented by 0.05. The last variable is *ln(schooling)*. It is the log of the period average of years of schooling and provides a proxy for the level of human capital. As in most growth models, this variable is not significant, probably because the number of years of schooling is poorly measured.

The second part of the table shows three diagnostic tests of the appropriateness of the instruments used. The first two are tests of first and second-order serial correlation in the first-differenced residuals. The statistics reported are *p-values* giving the probability of correctly rejecting the null hypothesis of no autocorrelation. The third test is a Sargan test of identifying restrictions under the null hypothesis of the validity of the instruments (Arellano and Bond, 1991; 1998). As required, the test for first-order autocorrelation rejects the null while the test for second-order autocorrelation fails to reject the null hypothesis of no autocorrelation. First-differencing introduces MA(1) serial correlation when the time-varying component of the error term in levels is serially uncorrelated (Arellano and Bond, 1991; 1998). Therefore, GMM estimator is consistent only when second-order correlation is not significant although first-order correlation need not be zero. With respect to the Sargan test of overidentifying restrictions, the high *p-value* suggests that we cannot reject the null hypothesis that the set of instruments is appropriate. Therefore, both m_1, m_2 and the Sargan test support the validity of the GMM estimator of Table 1.

It should be noted that investment in the model above is taken as endogenous. It is instrumented for by using its lagged levels and first differences (see the discussions above).[8]

Hoeffler's (2002) main objective is to refute the significance of the 'Africa dummy' in growth regressions by arguing that all the studies that have found a significant dummy are based on a flawed estimation methodology. To this effect, Hoeffler estimates a simple Solow growth model and proceeds in two steps. The first step is the estimation of the SYS-GMM estimator discussed above (see Table 1). The second consists in running a regression of the residuals from step 1 on the African dummy.[9] If significant, the results would signify that there is a systematic component in the residuals not explained by the standard variables of

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[8] See Arellano and Bond (1991) for details.

[9] Arellano and Bond's GMM estimator is computed using DPD98 programme which produces one-step and two-step estimators. Monte Carlo simulations have shown that inference based on the one-step estimator is more reliable especially when the levels error term is heteroskedastic. Therefore, the practice is to report the

the Solow growth model. Hoeffler finds that the Africa dummy is not significant. She concludes that the apparent significance of the Africa dummy found in all the studies she surveyed is due to inappropriate estimation methods. Africa's slow growth is not due to some unexplained phenomena but rather to the low levels of investment and high population growth. Therefore, attention should be focused on the reasons why investment is so low and population growth high instead of concentrating research efforts on a spurious Africa dummy.

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one-step parameters with the accompanying serial correlation tests, and the second-step Sargan test which is heteroskedasticity-consistent. The results of this second step are reported in Hoeffler (2002).

6. Growth and Political Institutions in Africa

Whereas Hoeffler's main objective was to show the irrelevance of the debate on the significance of the Africa dummy, ours is to explore the importance of politics as a determinant of economic growth. Although, as discussed in section 2, some authors have estimated growth regressions that include political variables, their results may have been affected by the same estimation problems discussed in section 3. Using Hoeffler (2002) as a benchmark, we seek to determine if the inclusion of political variables reduces the residuals of her model and, if so, to what degree. We seek to improve the explanatory power of her estimates by including measures of political instability, regime type, and violence. To facilitate the comparison of our results with Hoeffler's "a-political" growth model, we constrain our sample to the one used by Hoeffler. We then compare the performance of the alternative models to Hoeffler's in terms of the size of the residuals. If the models that take into account the impact of politics outperform the benchmark model, their residuals should be smaller.

We first concentrate on the impact of political stability (regime duration) and regime type. To proxy for stability, we employ the measure *time in office*, which is defined as the number of years an incumbent leader has been in office; the data are from Bueno de Mesquita et al. (2002). We draw the measure of regime type from the standard *Polity* scores (see Gurr and Marshal, 2000). The Polity survey computes for each country and each year an index that varies from 0 to 10, with high numbers meaning high autocracy and democracy, respectively. As is conventional, we combine the two scores. To avoid negative values (more autocratic regimes would have negative values), we re-scale the index by adding 10 to each value. The variable Polity therefore varies between 0 and 20.

In general, political stability should be conducive to economic growth. However, the question that arises is whether political stability in a dictatorship (for example Zaire under Mobutu or Togo under Eyadema) and stability under democracy have the same effect. To measure the impact of stability on growth while also exploring its possibly different effect, we introduce an interaction term in the model.

Table 2: SYS-GMM Estimates of the Model of Growth and Political Institutions

Dependent variable is growth rate of log of per capita GDP

Variables	Benchmark Model		Politically Augmented Model	
	Coefficient	Std. Error	Coefficient	Std. Error
Constant	-0.417	0.379	-0.577	0.332
$\ln(GDP_{t-1})$	-0.193	0.068***	-0.171	0.044***
$\ln(investment)$	0.293	0.052***	0.275	0.039***
$\ln(n+g+d)$	-0.472	0.179***	-0.485	0.157***
$\ln(schooling)$	0.006	0.048	0.014	0.037
ln(time in office)			0.087	0.026***
ln(polity)			0.061	0.029**
ln(polity and time office)			-0.073	0.026***
Dummy Period 75	-0.032	0.019*	-0.040	0.018**
Dummy Period 80	-0.015	0.020	-0.024	0.018
Dummy Period 85	-0.090	0.027***	-0.102	0.023***
Dummy Period 90	-0.013	0.031	-0.024	0.025
Number of *countries*		78		78
Number of *observations*		288		288
Wald test of joint signif.		0.000		0.000
Wald-jt sig. time dummies		0.000		0.000
m_1 = first-order correl.		0.000		0.000
m_2 = second-order correl.		0.898		0.640
Sargan test		0.168		0.997

The results reported for the different tests are *p-values* of the null hypotheses of no autocorrelation and appropriate set of instruments, respectively. Computed standard errors are heteroskedasticity consistent. The programme used to estimate the model is Arellano and Bond DPD98 for GAUSS.

The tests for serial correlation, the Sargan test, the Wald tests of joint significance of the variables, and the time dummies all suggest that the GMM estimator in Table 2 is appropriate.

Note that the introduction of two new variables in the benchmark sample, namely *time in office* and *polity*, led to the loss of degrees of freedom due to the lack of data on those variables. The number of countries declined from 85 to 78 and the number of observations from 404 to 288.[10] The bulk of the lost observations come from the 1960s; hence, the time dummy variable starts from the period 1970-75, yielding four dummies instead of six

The inclusion of new variables and the reduction in the degrees of freedom have slightly changed the original coefficients of Hoeffler (2002) model shown in Table 1. The change is the greatest for the coefficient on the lagged dependent variable (which changes from -0.15 to -0.19). As suggested by the size of the coefficients, the impact of political variables is weaker than that of economic variables. The coefficients of the original model and those of the new variables are all significant.

The sign and significance of the coefficients imply that democracy and political stability are good for economic growth. This result is intuitive and does not call for elaboration. More problematic is the coefficient of the interaction term. The result suggests that the impact of tenure on growth varies with the level of democracy. Long term authoritarians appear to be better for growth than democratically elected politicians who succeed in prolonging their term of office (see Bueno de Mesquita et al. 2003).

Perhaps an autocrat, not needing to face electoral challenges or organized opposition, need not to pay so high a price in order to retain power as would a democrat. Although engaging in redistribution, he may need redistribute less, conferring benefits on a narrow political elite, rather than upon a mass electorate. Incumbents who serve long terms

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[10] GAUSS software used for the estimations is data constraining. For instance, it requires that observations be consecutive, implying that it does not run if there are missing observations 'inside' a country unit in the data matrix.

may, therefore, produce more economic damage in democratic than in authoritarian political systems.

Whatever the interpretation, the results suggest that for a given level of democracy, there is an optimal period of tenure beyond which the incumbent leader harms economic growth. The optimal tenure period is largely influenced by the strength of the direct impact of political stability on growth.

Table 3: SYS-GMM Estimates of the Model of Growth and Violence (mean incidents)

Dependent variable is growth rate of log of per capita GDP

Variables	Benchmark Model		Model with Violence (Average)	
	Coefficient	Std. Error	Coefficient	Std. Error
Constant	-0.406	0.284	-0.413	0.271
$\ln(GDP_{t-1})$	-0.210	0.052***	-0.217	0.049***
$\ln(investment)$	0.271	0.038***	0.270	0.037***
$\ln(n+g+d)$	-0.522	0.141***	-0.546	0.132***
$\ln(schooling)$	0.038	0.039	0.050	0.038
Violence (mean incidents)			-0.006	0.003**
Dummy Period 70	0.012	0.013	0.019	0.013
Dummy Period 75	-0.021	0.018	-0.018	0.018
Dummy Period 80	-0.008	0.024	-0.004	0.023
Dummy Period 85	-0.089	0.025	-0.086	0.025***
Dummy Period 90	-0.013	0.029	-0.012	0.029
Number of *countries*		83		83
Number of *observations*		375		375
Wald test of joint signif.		0.000		0.000
Wald-jt sig. time dummies		0.000		0.000
m_1 = first-order correl.		0.000		0.000
m_2 = second-order correl.		0.663		0.759
Sargan test		0.469		0.948

The results reported for the different tests are *p-values* of the null hypotheses of no autocorrelation and appropriate set of instruments, respectively. Computed standard errors are heteroskedasticity consistent. The programme used to estimate the model is Arellano and Bond DPD98 for GAUSS.

In Tables 3 and 4, we explore the impact of violence. The violence variable in Table 3 is the yearly average of violent political incidents that occurred in the five years covered by the half-decadal data. These incidents are assassinations, strikes, guerillas, purges, riots, revolutions and demonstrations. Since adding up these variables may be considered arbitrary, we run a different model where the violence variable is an index constructed using factor score analysis.[11] Only the first factor is retained since all the remaining factors possess eigenvalues that are less than 1. Based on these values, the index of violence named *violence1* is computed and used in the growth model. The results are in the following equation and in Table 4.

$$violence1 = 0.109 * assassinations + 0.163 * strikes + 0.152 * guerillas + 0.083 * purges$$
$$+ 0.373 * riots + 0.102 * revolutions + 0.333 * demonstrations$$

[11] See STATA 7 Reference Manual for a discussion of factor score methodology.

Table 4: SYS-GMM Estimates of the Model of Growth and Violence (factor score)
Dependent variable is growth rate of log of per capita GDP

Variables	Benchmark Model		Model with Violence (Factor Score)	
	Coefficient	Std. Error	Coefficient	Std. Error
Constant	-0.406	0.284	-0.422	0.275
$\ln(GDP_{t-1})$	-0.210	0.052***	-0.216	0.049***
$\ln(investment)$	0.271	0.038***	0.269	0.037***
$\ln(n+g+d)$	-0.522	0.141***	-0.547	0.132***
$\ln(schooling)$	0.038	0.039	0.050	0.038
Violence (mean incidents)			-0.004	0.002**
Dummy Period 70	0.012	0.013	0.019	0.013
Dummy Period 75	-0.021	0.018	-0.018	0.018
Dummy Period 80	-0.008	0.024	-0.004	0.023
Dummy Period 85	-0.089	0.025	-0.086	0.025***
Dummy Period 90	-0.013	0.029	-0.012	0.029
Number of *countries*		83		83
Number of *observations*		375		375
Wald test of joint signif.		0.000		0.000
Wald-jt sig. time dummies		0.000		0.000
m_1 = first-order correl.		0.000		0.000
m_2 = second-order correl.		0.663		0.796
Sargan test		0.469		0.956

The results reported for the different tests are *p-values* of the null hypotheses of no autocorrelation and appropriate set of instruments, respectively. Computed standard errors are heteroskedasticity consistent. The programme used to estimate the model is Arellano and Bond DPD98 for GAUSS.

The two sets of results closely resemble each other. The Wald tests of the joint significance of the variables as well as the tests for autocorrelation and the Sargan test confirm that the GMM estimator estimated in both tables is appropriate. All the coefficients except that on education are significant and with the expected signs. The variable violence is negative and significant in both tables, implying that political violence has a negative -albeit low- impact on economic growth given the size of the coefficient. Inclusion of the violence variable has also changed the coefficients of the original model.

Another way of assessing the impact of politics on growth is by comparing the residuals of the benchmark models with those that include the political variables. Given that our central concern is with Africa, we report this comparison in Table 5, which includes the residuals for the African nations included in the Hoeffler (2002) sample.

Table 5: Residuals from the Growth Model with and without Political Variables

Countries	Political Variables		Violence (average)		Violence (Factor score)	
	Benchmark	Duration and Democracy	Benchmark	Violence	Benchmark	Violence
Benin	-0.637	-0.499	-0.113	-0.149	-0.113	-0.107
Botswana	1.162	1.935	0.914	1.256	0.914	1.324
Cameroon	0.614	0.510	0.462	0.130	0.462	0.173
C.A.R.	-1.955	-1.696	-1.821	-1.986	-1.821	-1.960
Ghana	0.358	0.580	0.028	-0.242	0.028	-0.254
Kenya	-4.034	-3.560	-3.901	-3.404	-3.901	-3.355
Liberia	-2.491	-2.282	-2.026	-2.125	-2.026	-2.095
Malawi	-3.980	-3.988	-4.011	-4.674	-4.011	-4.611
Mali	-2.602	-2.267	-2.253	-2.333	-2.253	-2.296
Mauritius	3.228	3.000	2.860	2.551	2.860	2.576
Mozambique	4.770	4.562	5.821	4.830	5.821	4.741
Niger	-2.746	-2.222	-1.806	-1.745	-1.806	-1.699
Rwanda	4.067	4.147	3.892	3.669	3.892	3.698
Senegal	2.685	2.503	2.490	2.254	2.490	2.283
Sierra Leone	8.114	7.619	7.555	7.400	7.555	7.398
Sudan	-4.544	-4.007	-3.942	-3.746	-3.942	-3.783
Tanzania	-4.055	-3.762	-4.485	-5.305	-4.485	-5.245
Togo	-4.945	-4.400	-4.391	-4.532	-4.391	-4.478
Uganda	4.364	4.700	3.864	3.587	3.864	3.493
Zambia	-6.838	-6.776	-6.792	-7.320	-6.792	-7.263
Zimbabwe	-2.815	-2.229	-3.188	-2.546	-3.188	-2.555
Zaire			1.029	0.964	1.029	0.924
Average	-0.585	-0.387	-0.446	-0.612	-0.446	-0.595

Source: Computed based on the coefficients of the models in Tables 2, 3 and 4. These figures are averages of all the sample periods for each country.

The residuals are calculated as the difference between the actual rate of growth and the fitted values generated using the coefficients in Tables 2, 3 and 4. The growth variable used by Hoeffler (2002) is a half-decadal observation. To transform her measure into an annual growth rate, we multiplied it by 100 and divided it by five. Therefore, the fits are also rescaled by multiplying them by 20 (see Ndulu and O'Connell, 2000).

The columns labeled "Benchmark" report the results of the estimation of Hoeffler's Augmented Solow model; in each instance, the next column gives the coefficients of that model when political variables are added. For instance for Benin, adding a measure of political stability and regime type (plus their interaction) reduced the residuals of the Solow model from -0.637 to -0.499.[12] The violence model using the mean of the number of violent incidents increased the residuals from -0.113 to -0.149; when the variable is measured as a factor score, it reduces the residual from -0.113 to 0.107. Negative residuals imply that the model over-predicts growth[13] while positive residuals mean that growth is under-predicted.

Note that adding duration and regime type to the Benchmark model yields smaller residuals. Sixteen out of 21 countries have lower residuals when these variables are added to the basic model. In the "violence models," however, only twelve out of 22 countries have smaller residuals when violence is measured as the average number of incidents; the number increases slightly to 13 if violence is measured as a factor score.

7. Conclusion

The country case studies produced for the AERC's *General Economic Survey of Africa* repeatedly emphasize the importance of politics for the performance of Africa's economies. The purpose of this paper has been to measure the magnitude and to assess the significance of that impact.

Employing Hoeffler's (2002) system-GMM estimates of an augmented Solow model, we have found that political stability and regime type significantly affect economic growth; for the African sample, their inclusion reduces the variance left unexplained by the Hoeffler equation.

[12] As we consider individual residuals to be the distance between the regression line and the observation, we are interested in absolute values.

[13] This is because the mean estimated value (regression line) is over the actual growth rate.

Less impressive are the results derived from equations including measures of political violence. While statistically significant and of the "right" sign, the coefficients are small in size. And their addition to the Benchmark regression adds to rather than reduces the magnitude of the residuals.

These results suggest several possible directions for future research. The most obvious is to re-assess the impact of political violence. The case studies emphasize its significance. But that assessment fails to find confirmation in the cross national regressions. One reason for the difference is that the number of instances of violence is relatively small; we may therefore wish to adopt techniques better adapted to the study of rare events. Another is that expectations of violence may be as important as its actual occurrence, thus muting the relationship between objective measures of violence and economic responses to it. Lastly, violence is entered into these equations along with investment. But it surely affects growth rates in Africa through its impact on investment (see, for example, Gyimah-Brempong and Corley, 2002). A portion of its impact may therefore be captured by the low level of investment in Africa, and so already incorporated in the Benchmark equations. Insofar as this is true, the differences in the residuals reported above would surely underestimate the impact of violence upon the growth of Africa's economies.

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