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# Does Africa grow differently?

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**Abstract**

This paper extends the analysis of African economic growth in two directions: first by challenging the assumption that growth effects of particular explanatory variables are the same in Africa as elsewhere; and second, by measuring indirect contributions to growth of initial conditions as they influence explanatory variables in a basic growth regression. Robust regression analysis shows that for Africa, being closed to trade is more costly to growth, natural resource abundance is more detrimental to institutional development, and several factors that reduce population growth and enhance institutional quality outside Africa fail to show such beneficial effects within Africa. © 2001 Elsevier Science B.V. All rights reserved.

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## 1. Introduction

Generating sustained growth in Sub-Saharan Africa is often cited as the most pressing challenge in global development; yet, in the voluminous empirical literature on economic growth, Sub-Saharan Africa exists primarily as a dummy variable in a single reduced-form growth regression. [1] This paper seeks to address that problem by examining in greater detail several mechanisms of economic

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[1] For the remainder of this paper, the term "Africa" is intended to refer specifically to Sub-Saharan Africa as defined in Appendix B.


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growth, asking in particular whether those mechanisms operate differently in Africa.

Several recent studies have explicitly asserted that Africa is not different from other regions with regard to the factors contributing to growth.[2] These studies explain Africa's slower growth entirely as a function of the region's different mean levels with respect to given explanatory variables, often assuming that the magnitude of the marginal impacts of those variables is the same in Africa as elsewhere. For present purposes, that approach is unsatisfactory for two reasons: (1) the forced equality between African and non-African slope coefficients, and (2) the lack of consideration of the channels of transmission through which the reduced form variables affect growth.

Regarding the first point, the present analysis does not take as given that the determinants of growth must have the same marginal impact in Africa as elsewhere. Rather, I take the novel approach of freeing not only the African intercept term, but each of the African slope terms as well in the specifications described below. This approach permits explicit testing of the common assumption that Africa's growth mechanisms operate no differently than those of other developing regions. Several critical slope terms are indeed different for Africa. Where differences exist they are typically such that if a variable is found to contribute positively to growth in the non-African countries, the benefits are less in Africa; if a variable is costly to growth in the non-African countries, it is often more costly to growth in Africa.

Regarding the second point, this study loosely follows Taylor (1998) and Temple (1998) in an attempt to uncover some of the relevant channels of growth transmission by first specifying a typical Barro-style growth equation, and then specifying several additional equations intended to explain the determinants of selected variables in the initial growth equation. This approach permits identification of indirect growth effects of more fundamental variables through their impact on variables directly specified in the initial growth regression.[3] However, the present study takes the application of this approach a step further by explicitly asking whether such channels of transmission function differently in Africa.

It is particularly interesting to ask even for those variables for which the marginal growth impacts are no different in Africa than elsewhere whether the determinants of those variables are the same in Africa as elsewhere. For instance, population growth rate is found in the initial growth regression to be negatively

[2] Easterly and Levine (1997), Sachs and Warner (1997), Rodrik (1997), and Bloom and Sachs (1998).

[3] What I refer to as the "initial growth regression" is more commonly referred to as a reduced form growth regression in the empirical growth literature (i.e., Barro, 1997). An anonymous referee correctly notes, however, that in the present setting, this term might be better applied to the set of auxiliary regressions with which I explain several variables in the initial growth regression. To avoid confusion, I will refer to the "initial growth regression" and the "auxiliary regressions", respectively.

associated with growth, though not differentially so in Africa. Yet, analysis of the determinants of population growth finds that Africa fails to benefit from particular variables that are associated with reduced population growth in the broader cross-section of countries. Such differences indirectly inhibit African growth even though the direct growth determinant (population growth in this case) has the same marginal impact in Africa as elsewhere. By limiting the analysis to a single "reduced form" equation, and by forcing growth rates in Africa and elsewhere to have the same sensitivity to given influences, previous studies have assumed away potentially important differences in the mechanisms of growth in Africa. Several of these differences can have important implications for policies designed to promote economic growth, and may help to explain the mixed results to date from policy reform efforts in Africa.

The discussion is organized as follows. Section 2 sets the context, providing a brief overview of descriptive statistics comparing African and non-African low- and middle-income countries. Section 3 outlines the empirical framework guiding the analysis and a robust estimation strategy. Section 4 presents the empirical results and assesses the practical magnitude of differences found in the mechanisms of growth in Africa. Section 5 concludes with policy implications.

## 2. Data: Africa versus other developing areas

A simple comparison of the African and non-African data on the variables used in this analysis highlights many of the challenges confronting African governments. Of course, there is substantial variation within Africa on each of these variables. Recognizing that variation, however, one can still distinguish the African experience from that of the rest of the world at a certain level of aggregation, which is the level addressed in this paper. The data set itself includes 89 countries (listed in Appendix A) with 1990 real GDP per capita less than US$15,000 (in 1985 international prices).[4] Of these 89 countries, 35 are located in Africa. The data set covers the period 1975–1995, and is structured as a panel with observations for each country consisting of 5-year averages. Each country thus has four observations—the averages for 1975–1979, 1980–1984, 1985–1989, and 1990–1995. This section provides an overview of descriptive statistics for Africa versus non-Africa during the period 1975–1995, which are summarized in Table 1.

The most basic (and striking) point is that the average growth in per capita income for Africa over this period was slightly negative (−0.23% per year), compared with an average growth rate of 1.6% per year in the non-African low- and middle-income countries. Variation in growth rates within Africa was also

[4] Data definitions and sources are presented in Appendix B.

Table 1
Descriptive statistics: Africa vs. non-Africa (1975/1979–1990/1995)
Source: see Appendix B.

| Variable | Africa | | | | Non-Africa | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean | S.D. | c.v. | *n* | Mean | S.D. | c.v. | *n* |
| GRGDP | −0.0023 | 0.0386 | 16.78 | 126 | 0.0158 | 0.038 | 2.41 | 198 |
| LGDP(0) | 6.824 | 0.643 | 0.09 | 126 | 7.84 | 0.673 | 0.09 | 198 |
| LLEB(0) | 3.88 | 0.134 | 0.03 | 134 | 4.14 | 0.125 | 0.03 | 195 |
| GPOP | 0.0288 | 0.0065 | 0.23 | 126 | 0.0206 | 0.0103 | 0.50 | 190 |
| TYR | 1.27 | 1.36 | 1.07 | 140 | 3.80 | 2.23 | 0.59 | 216 |
| ELF | 0.66 | 0.25 | 0.38 | 124 | 0.32 | 0.26 | 0.81 | 180 |
| INST | 0.48 | 0.12 | 0.25 | 108 | 0.53 | 0.14 | 0.26 | 204 |
| DEF | −4.675 | 5.49 | 1.17 | 104 | −4.212 | 5.03 | 1.19 | 181 |
| GRTOT | −0.00064 | 0.00378 | 5.91 | 140 | 0.0022 | 0.0034 | 1.55 | 212 |
| OPEN | 0.12 | 0.31 | 2.58 | 116 | 0.394 | 0.465 | 1.18 | 192 |
| WORKER | 0.454 | 0.060 | 1.32 | 140 | 0.392 | 0.071 | 0.18 | 212 |

substantially greater, as measured by the coefficient of variation of 16.8 versus 2.4 for non-Africa. Africa's uniquely disappointing experience over this period has motivated a plethora of studies, the titles of which justifiably use words like "tragedy" and "crisis". Not only did average African incomes grow more slowly than elsewhere, but African countries began in the first period (1970–1974) with less than half the initial income per capita of the non-African countries: US$926 versus US$2184 (in 1985 international prices). While the most recent data indicate more robust growth in average African incomes (5% growth in 1996), Rodrik (1997) notes that roughly one-third of African countries today have real per capita incomes lower than they did in the early 1960s.

In many respects, the differences are not great; yet, in most of the instances where there are substantial differences in means, the comparison is unfavorable to Africa. Cases in point include such social indicators as life expectancy at birth, the stock of education, and ethnolinguistic fragmentation. There are also large differences between the African and non-African sub-samples in certain policy-related indicators, such as degree of openness to trade and fiscal deficits.

The broad picture of Africa that emerges in comparison to other low- to middle-income areas is of a poorer set of countries with lower investment, the economies of which slowly shrank while other economies grew. Institutional development tended to be lower, population growth higher, human capital less available, and policy distortions more severe. Exogenous factors added disproportionately to the challenges of African development, as well.[5]

[5] *T*-tests comparing the means of the African and non-African observations reject with *P*-values uniformly less than 0.001 the null hypothesis of equality of means. The sole failure to reject a difference is in the case of fiscal deficits as a share of GDP ($P = 0.25$).

## 3. Empirical framework and estimation strategy

### *3.1. Empirical framework*

The empirical framework adopted in this paper is loosely based on Taylor (1998) and Temple (1998). Taylor argues that the standard growth regressions alone are incapable of identifying the mechanisms through which the explanatory variables affect growth. To address this problem, Taylor constructs a theoretical framework, which relates the growth of output to a system of equations which, in addition to the Barro-style reduced-form regression, includes additional equations specified to explain the determinants of the explanatory variables in the initial growth regression.

Temple (1998) takes a broadly similar approach in his analysis of the roles of initial conditions and social capital in African growth. Temple reviews the direct growth effects of initial conditions, policy variables, and other exogenous factors in the growth of a broad cross-section of developing countries. Finding that policy variables are statistically associated with growth outcomes, Temple then proceeds to regress the relevant policy variables on a set of plausibly exogenous initial conditions. This permits him to draw conclusions about the mechanisms through which initial conditions might affect growth through the channel of policy variables in the initial growth regression. The present analysis lies in this recent tradition of going beyond Barro-style reduced form growth regressions in an effort to uncover some of the mechanisms through which particular variables affect growth; yet extends that tradition by allowing for the effects to differ in Africa.

To address the question of whether Africa grows differently, each of the equations is estimated in two forms: "partially unrestricted", and "fully unrestricted". In the generic case, the fully unrestricted regression takes the form:

$$Y = \beta_0 + \gamma_0 \times \mathbf{d} + \mathbf{X}\beta + (\mathbf{d} \times \mathbf{X})\gamma + \varepsilon \tag{1}$$

where $\boldsymbol{d}$ is a vector of dummy variables equal to 1 for observations from Africa and the columns of the $\mathbf{X}$ matrix are particular explanatory variables. The fully unrestricted specification is equivalent to running a separate regression for Africa, though the single equation facilitates hypothesis testing of African differences.[6] The partially unrestricted regression frees only the Africa intercept, imposing the constrain $\gamma = 0$. Thus, a finding that the Africa-specific intercept term is significant in the partially unrestricted specification indicates that the model fails to account for African differences. A finding that the Africa-specific intercept disappears in the fully unrestricted specification indicates that freeing the African slope coefficients provides a better description of the data. Chow tests permit testing of whether the African regression surface (or particular dimensions of it)

[6] The validity of this pooled regression requires that $E[\varepsilon^2 \mid \boldsymbol{d}=0] = E[\varepsilon^2 \mid \boldsymbol{d}=1]\sigma^2$.

differ from the non-African regression surface. In the initial growth regression, this approach reveals that two policy-related variables (openness and fiscal deficits) do have marginal impacts on growth that differ between the African and non-African observations.

Ideally, one could explain in separate regressions the policy outcomes that appear in the initial growth regression. Yet, many of the plausible explanatory variables may themselves be policy choices, and the resulting problems of endogeneity are substantial. One alternative would be to follow Temple (1998) in associating policy outcomes with selected initial conditions. Temple thus establishes useful stylized facts about policy outcomes. Rather than attempting to replicate Temple's results, the approach taken here, after analyzing the fully unrestricted initial growth regression, is to specify equations to explain two of the initial explanatory variables for which the African slope terms are not statistically different from the rest of the sample.

In these cases (institutional quality and population growth), Africa's direct growth penalty comes not from different marginal impacts, but from simply having lower quality institutions and more rapid population growth. These variables are neither direct policy outcomes nor exogenous initial conditions. It is thus interesting and plausible to examine their determinants, which are specified as initial conditions or exogenous variables whenever possible. Doing so reveals that even though these factors do not differentially affect African growth in the initial growth equation, Africa fails to benefit from several factors that indirectly promote growth in other regions by contributing to reduced rates of population growth or improved institutional quality.

### *3.2. Estimation strategy*

It is widely asserted (Temple, 1999) that growth regressions are fraught with robustness issues, particularly with regard to outliers, specification, and endogeneity of regressors. Outliers are of special concern in the present context, as a differential slope coefficient for Africa may be particularly sensitive to outliers (of which Botswana and Mauritius are notorious examples).

To address the potential problem of outliers driving the findings, this study avoids OLS in favor of the semi-parametric technique of median regression (a special case of quantile regression). Median regression differs from OLS principally in fitting the median of the dependent variable to a linear function of covariates, as opposed to centering the variance around its mean as in OLS. Rather than minimizing the squared deviation from the mean, median regression minimizes the absolute deviation around the median of the distribution of the dependent variable, solving

$$\min_{\beta} \sum_{t} | y_t - x_t' \beta |$$

The resulting estimator is also known as the least absolute deviations (LAD) estimator.

Buchinsky (1998) notes that this objective function gives rise to an important advantage for present purposes, namely that the LAD estimator is not sensitive to outlier observations on the dependent variable. Buchinsky also notes that this estimator may be more efficient than least squares when the error term is non-normal. LAD regression, however, provides no protection against remaining threats to robustness, such as endogeneity of the regressors, exclusion of unobserved (and time-invariant) country effects, as well as sensitivity to specification.

The potential endogeneity of covariates in growth regressions, though often noted, is rarely treated. While the obvious choice is to employ instrumental variables, Temple (1999) notes that few useful and valid instruments present themselves.[7] As such, the only prudent interpretation of non-IV growth regressions (including those presented here) is that they reflect associations between the dependent and independent variables, yet fall short of implying causation. Mankiw (1995) affirms the value of such associations in that they permit the rejection of theories for which such associations are not implied.

One might also be concerned about parameter heterogeneity resulting from unobserved time-invariant characteristics of each country in the sample. The standard approach is to address this problem by specifying fixed effects. This solution is inappropriate in the present study for two reasons. The first, more general, reason is that many of the explanatory variables in the models are relatively persistent over time. Fixed effects models are known to perform poorly under such circumstances, as they wipe out the majority of the identifying variation, which exists in the cross-section dimension of the data. This would clearly be of concern in the present case. Yet, a more case-specific reason for eschewing fixed effects is that a key parameter of the models estimated here is the Africa intercept term, which is time-invariant and thus falls out of fixed effects estimation. Random effects may also be problematic, as the maintained assumption that the unobserved country effects are uncorrelated with included regressors is difficult to accept in the present application.

A final concern for robustness pertains to model uncertainty. If particular parameter estimates are only statistically significant in the presence of other particular independent variables, the robustness of the finding is in question, as Levine and Renelt (1992) clearly demonstrate. The approach taken here, less formal than the extreme bounds tests applied by Levine and Renelt, is simply to

[7] Efforts to address the potential endogeneity of regressor in this paper included both a search for useful and valid "outside" instruments for use in 2SLS, and estimation of the equations by the Generalized Method of Moments using the "internal" instruments of lagged values of the regressors. Tests of overidentifying restrictions in too many cases of both 2SLS and GMM led to rejection of the validity of the instruments.

note and to report any change in either the sign or the significance of explanatory variables as they are combined in a step-wise manner (given the models as specified). In addition, I apply the RESET test for omitted variables, though this test may be better interpreted as a test for non-linearities in the specification (Kennedy, 1993). As Temple (1999, p. 128) asserts, "...the robustness study which simultaneously addresses fixed effects, measurement error, endogeneity, outliers and model uncertainty, is yet to be written, and one suspects that his will remain the case for some time". For present purposes, the greatest practical concern is that the Africa-specific slope coefficients could be driven by outliers, and the LAD regression approach adopted here is particularly robust to that possibility.

## 4. Results

The results presented here implement the empirical framework outlined above by first specifying an initial growth regression (representative of the relevant literature) and comparing estimates of the partially and fully unrestricted specifications. Additional specifications then examine the determinants of institutional quality and population growth, also with a view to revealing African differences. Indeed, the clearest differences in Africa's growth mechanisms lie in the channel regressions rather than in the reduced form (though several important African differences are also apparent in the initial specification).

### *4.1. Initial growth regression*

The initial growth equation is estimated as in Eq. (1), where growth in GDP per capita is a function of: initial income, initial life expectancy at birth, institutional quality, openness, fiscal deficit, and population growth. This reduced-form specification is broadly representative of the recent growth literature. Each of the independent variables in this specification, for instance, appear in the basic growth regressions of either Sachs and Warner (1997) or Temple (1998) to cite two among many examples.

Columns (1) and (2) of Table 2 present the partially restricted and fully unrestricted specifications of the initial growth regression estimated by LAD regression. With the exception of initial life expectancy at birth, all coefficient estimates in the partially unrestricted model (column (1)) are of the expected sign and are statistically significant at the 5% level. Ramsey's RESET test also fails to reject the null hypothesis of no omitted variables.

For present purposes, primary interest in the partially unrestricted specification lies in the Africa-specific intercept term. Table 2, column (1), indicates that the

Table 2
Initial growth regression LAD estimation results. dependent variable: GRGDP[a]

| | (1) | (2) | (3)[b] |
|---|---|---|---|
| Constant | 0.283* (0.095) | 0.112 (0.147) | 0.020* (0.004) |
| LGDP(0) | −0.028* (0.006) | −0.038* (0.008) | −0.028* (0.006) |
| LLEB(0) | −0.057 (0.060) | 0.086 (0.010) | 0.006 (0.007) |
| INST | 0.138* (0.024) | 0.139* (0.028) | 0.018* (0.004) |
| OPEN | 0.021* (0.007) | 0.011 (0.008) | 0.005 (0.003) |
| DEF | 0.002* (0.0004) | 0.003* (0.0006) | 0.016* (0.003) |
| GRPOP | −0.733* (0.354) | −0.781** (0.434) | −0.006** (0.004) |
| SSA | −0.038* (0.008) | 0.062 (0.193) | −0.026* (0.009) |
| LGDP(0)×SSA | | 0.015 (0.011) | 0.011* (0.009) |
| LLEB(0)×SSA | | −0.118 (0.129) | −0.009 (0.010) |
| INST×SSA | | −0.021 (0.054) | −0.003 (0.007) |
| OPEN×SSA | | 0.030** (0.016) | 0.013** (0.007) |
| DEF×SSA | | −0.004* (0.001) | −0.019* (0.005) |
| GRPOP×SSA | | −0.095 (0.857) | −0.0008 (0.007) |
| Pseudo-$R^2$ | 0.23 | 0.26 | 0.26 |
| $n$ | 200 | 200 | 200 |
| RESET[c] | 0.66 | | |
| Chow Test[d] $H_0$: $\gamma_0 = \gamma = 0$ | | 0.000 | |
| Chow Test $H_0$: $\gamma = 0$ | | 0.008 | |

[a]Coefficients are estimated for the period 1975/1979–1990/1995.
[b]Independent variables in standardized form. Coefficients indicate effect of a one standard deviation change on the dependent variable.
[c]Ramsey RESET test, $P$-value for $H_0$: no omitted variables (based on OLS estimation).
[d]$P$-vaue of stated null hypothesis.
* Standard errors in parentheses = 0.05-level of significance.
** Standard errors in parentheses = 0.10-level of significance.

model in which Africa's slope coefficients are constrained to equal those of non-African countries fails to account for Africa's slower growth. With the controls as specified, African countries grow more slowly by 3.8 percentage points per year. The failure of cross-country growth regressions to account for African differences is common in recent literature.[8] The present specification is sufficient, however, to eliminate the African intercept term when all slope terms are freed to differ for Africa, as in the fully unrestricted specification reported in Table 2, column (2).

[8] This is the case in Easterly and Levine (1997), Barro and Lee (1994) and Schmidt-Hebbel (1996). Sachs and Warner (1997) and Barro (1997) are alone in eliminating the African dummy from a standard growth regression. Collier and Gunning's (1999) Africa intercept disappears in the presence of several Africa slope interaction terms of the type employed here.

The fully unrestricted specification reveals that the African slope terms differ along two dimensions among the eight independent variables in the initial growth regression: openness, and fiscal deficits.[9]

The slope coefficient for openness (as defined by Sachs and Warner, 1995) differs between Africa and the rest of the sample. The interpretation in this case is that while openness increases per capita growth in the general sample by 1.1% annually, the increase for Africa is 4.1% annually. This finding raises the question of why openness should have such an extraordinarily stronger effect on African growth. Collier and Gunning (1999) report a similar finding based on the black market premium, which they find (for a given level) to be half again as damaging to growth in Africa as elsewhere. Their explanation for why the effect is more intense in Africa is the combination of more severe trade restrictions and smaller economies. A given level of trade restriction, they argue, should be expected to be more damaging in a smaller economy. Wang and Winters (1998) make a similar claim about Africa.

The finding that being closed to trade harms growth in Africa more than elsewhere, derived from a LAD regression, is not driven by African outliers. Yet, one must still be concerned with its robustness to changes in the model specification. This concern is warranted in the case of openness. Reconstituting the current specification in a step-wise manner demonstrates that the significance of Africa's openness slope term is sensitive to changes in the other conditioning variables. In this regard, Temple (1999, p. 128) argues that "Finding that a result is fragile to a particular conditioning variable could in itself be valuable information... If one treats individual variables as symptoms of underlying problems, finding that some are 'fragile' in the Levine–Renelt sense does not tell us much about their potential usefulness". Given the construction of the Sachs–Warner openness index as a composite of five underlying and somewhat general problems, its interpretation as being broadly symptomatic of a set of problems is appropriate. Nonetheless, caution in its interpretation here is warranted.

An alternative approach to investigating the effect of openness on African growth is to substitute the trade share of GDP for the Sachs–Warner dummy variable in the present specification. This eliminates any of the problems associated with the Sachs–Warner openness indicator (summarized by Rodriguez and Rodrik (2000)) particularly as it may apply to Africa, though Frankel and Romer (1999) note the likely endogeneity of the trade share.[10] Nonetheless, when the

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[9] In column (2) of Table 2, the net slope term for Africa is the sum of the slope for non-Africa and the slope of the Africa interaction term.

[10] Frankel and Romer (1999) create a gravity-based instrument to solve the endogeneity problem of the trade share of GDP. Using their instrument in the present initial growth specification and estimating by 2SLS yields the same pattern in which trade share is insignificant for the non-African countries but significantly positive ($P = 0.056$) for the African countries.

trade share of GDP replaces the Sachs–Warner openness dummy, it is statistically insignificant for the non-African countries, but positive and statistically significant for African countries. The slope on the trade share of GDP in Africa is significantly different both from the slope for trade share in non-African countries ($P = 0.04$) and from zero ($P = 0.03$). This alternative specification thus lends credence to the notion that being closed to trade hurts African countries more that non-African countries. In a more constructive light, it also suggests that opening trade in Africa should be a particular priority of reform programs.

Results of the initial growth regression also suggest that African growth is less responsive to changes in fiscal deficits than is the case outside Africa. A 1 percentage point reduction in deficits, which increases economic growth by 0.3 percentage points outside Africa, has no impact on growth in Africa. The difference in the African slope term (from the non-African slope) is highly statistically significant, and an $F$-test fails to reject ($P = 0.41$) the null hypothesis that the net African slope term equals zero.[11] This result is highly robust to changes in specification.

This result has both pessimistic and optimistic interpretations. On the one hand, Africa could be said to fail to reap the same growth benefit from deficit reduction that one might expect elsewhere—a serious concern given the central role of deficit reduction in typical reform programs. It may be most reasonable to conclude that deficit reduction is a necessary but insufficient component of reform programs in Africa. On the other hand, this finding may be taken as good news, given that Africa tends to have higher deficits than non-African developing countries and may not pay the same growth penalty. Work by Schmidt-Hebbel (1996), however, casts doubt on such an optimistic interpretation.

Schmidt-Hebbel (1996) finds that lower public deficits contribute to growth in a broad cross-section of countries indirectly through their contribution to macroeconomic stability. In particular, he suggests that the long-term effects of fiscal adjustment can contribute to growth either through the resource contribution to higher domestic investment or through the reduction in financial and monetary market distortions and macroeconomic instability. He finds empirical support in the broader cross-section only for the latter of these potential channels in a broad cross-section of countries, yet his model fails to account for African differences (which remain in a significant African intercept dummy in his results). Allowing for an African slope interaction with fiscal deficit shows more precisely that African growth does not directly benefit from deficit reduction. In terms of

[11] Strictly speaking, a negative result such as this does not rule out any growth effect from deficit reduction in Africa (given 95% confidence intervals around the estimates). It does, however, suggest that a sizeable African effect is relatively unlikely, as it would jointly require a high draw from the distribution around the estimate for non-Africa and a low draw from the distribution around the estimate for Africa.

Schmidt-Hebbel's analysis, this result may be interpreted as indicating that African distortions and macroeconomic instability derive from sources that are additional to (or impervious to) changes in the fiscal deficit. Fiscal deficits (and macroeconomic instability generally) in Africa, for instance, may be particularly sensitive to terms of trade shocks, given Africa's disproportionate dependence on primary exports and the volatility of commodity markets.[12]

In short, most of the direct determinants of growth in this initial growth specification do not differentially affect African growth on the margin. Yet, it is worth noting that the African slope terms and intercept are jointly significantly different. An $F$-test strongly rejects the null hypothesis that the African slope terms and intercept are jointly equal to the non-African slope terms ($F(7,186) = 4.64$, $P = 0.0001$); raising the bar for rejection by excluding the intercept term still results in rejection of the null hypothesis that the African slope terms are jointly significantly different from the non-African slopes ($F(6,186) = 3.01$, $P = 0.008$).[13] Yet, while one can conclude that African observations in the initial growth regression may not lie in all dimensions on the same regression surface as non-African countries, the magnitude of the differences can be further clarified.

Statistically significant differences are not necessarily quantitatively important in explaining Africa's slower growth. How important are the differences revealed above? Table 2 column (3) re-estimates the fully unrestricted specification of the initial growth regression with the independent variables in standardized form (based on the standard deviation of each variable across the full sample).[14] In this form, the estimated coefficients describe the impact on growth resulting from a one standard deviation change in each explanatory variable. For instance, a one standard deviation reduction in the fiscal deficit increases growth outside Africa by 1.6 percentage points per year, but has essentially no effect on growth in Africa. Similarly, a one standard deviation increase in openness increases growth in non-Africa by 0.5 percentage points, but increases growth in Africa by 1.8 percentage points per year (with the caveats described above). Over time, these effects are large and imply substantial differences in welfare.

Most of the explanatory variables in the initial growth regression are no different in their marginal impact on African growth. The African interaction

[12] Another possible (though speculative) explanation for this divergence may be that the negative consequences of fiscal deficits in general derive from the fact that most government debt (outside Africa) is financed through the sale of domestic bonds, the owners of which may choose to increase consumption (and thus reduce savings). This lowers the steady-state capital stock, slowing transitional growth. Since African governments face more limited opportunities to finance debt domestically, deficit reduction in Africa would not have as pronounced an effect on domestic consumption and savings decisions, thus minimizing its effect on steady-state capital stock and transitional growth.

[13] Raising the bar for rejection still further, by excluding openness and fiscal deficits (the two arguments that were individually significant) does cause an $F$-test to fail to reject the joint difference of the remaining African parameters ($P = 0.79$).

[14] Thanks are due to an anonymous reviewer for suggesting this presentation of the results.

terms for initial income, initial life expectancy at birth, institutional quality, and population growth are neither singly nor jointly significantly different from the non-African slopes. Yet, in each of these cases (with the exception of initial income), African differences undermine growth: in the full sample Africa has lower quality institutions and faster population growth. (*T*-tests confirm that differences in the means between Africa and non-Africa are statistically significant in each case.) Stopping the analysis there (as previous studies have nearly uniformly done), however, ignores the interesting question of why Africa is different in its levels of these direct growth determinants. The following discussion extends the analytical framework developed in Section 3 to address whether the determinants of institutional quality and population growth themselves operate differently in Africa.

### *4.2. Determinants of institutional quality*

Institutional quality is specified as a function of initial ethnolinguistic fragmentation, initial total years of schooling of the over 25 population, and the share of raw materials in total exports.[15] Ethnolinguistic fragmentation is a potential indicator of a country's social cohesion. Several recent political economy models argue that an inability of social groups to resolve conflict or to agree on the allocation of costs and resources can undermine economic performance (Drazen and Alesina (1991), Rodrik (1999)). This is likely to be particularly important in Africa, where civil wars have been endemic. To a large extent, these failures can be seen as institutional failures. Thus, if a high degree of ethnolinguistic fragmentation reduces social cohesion, it follows that the quality of institutions required to resolve conflicts and to promote development will also suffer. Conversely, one expects that a more educated society—one with a greater stock of human capital—will be better equipped to evolve a strong set of social institutions. The inclusion of raw materials as an explanatory variable for institutional quality draws on the enhanced potential for rent-seeking behavior, such as suggested by Lane and Tornell (1996). The opportunity and possibly greater ease of capturing the rents from raw materials exports may be conducive to corruption, and should thus enter negatively in this equation.

The results of LAD estimation of the partially restricted specification of this regression presented in Table 3 (column (1)) confirm two of these three hypotheses. Higher initial levels of total years schooling and greater initial ethnolinguistic

[15] It is noteworthy that the ICRG indicator of institutional quality employed here is subjective and based on surveys of international businessmen dealing with various countries. As such, one cannot eliminate the possibility that the measure is biased, though it is not clear why any such bias would be systematic or differentiated by region. Indeed, this indicator has been widely used in recent growth literature, including Barro (1997), and Rodrik (1999).

Table 3
Determinants of institutional quality—LAD regression results[a]

| | (1) | (2) | (3)[b] |
|---|---|---|---|
| Constant | 0.452* (0.021) | 0.453* (0.025) | 0.472* (0.011) |
| ELF | −0.120* (0.028) | −0.143* (0.034) | −0.045* (0.011) |
| TYR | 0.026* (0.004) | 0.026* (0.005) | 0.054* (0.010) |
| RAW | −0.0001 (0.0002) | 0.0002 (0.0003) | 0.005 (0.009) |
| SSA | 0.063* (0.022) | 0.035 (0.053) | 0.035 (0.053) |
| ELF × SSA | | 0.167* (0.076) | 0.060* (0.027) |
| TYR × SSA | | −0.023* (0.012) | −0.024* (0.012) |
| RAW × SSA | | −0.001* (0.0005) | −0.032* (0.012) |
| Pseudo-$R^2$ | 0.09 | 0.10 | 0.10 |
| RESET[c] | 0.41 | | |
| $n$ | 242 | 242 | 242 |
| Chow Test[d] $H_0$: $\gamma_0 = \gamma = 0$ | | 0.000 | |
| Chow Test $H_0$: $\gamma = 0$ | | 0.008 | |

[a]Coefficients are estimated for the period 1975/1979–1990/1995.
[b]Independent variables in standardized form. Coefficients indicate effect of a one standard deviation change on the dependent variable.
[c]Ramsey RESET test, $P$-value for $H_0$: no omitted variables (based on OLS estimation).
[d]$P$-value of stated null hypothesis.
* Standard errors in parentheses = 0.05-level of significance.
* * Standard errors in parentheses = 0.10-level of significance.

fragmentation both have the expected statistically significant effects on institutional quality. Note, in particular, that the partially restricted specification fails to eliminate the African intercept ($P = 0.004$). Specific interpretation of the magnitudes of the estimated effects is less informative given the arbitrary seven-point scale of the dependent variable (though the relative magnitudes of the coefficient estimates are compared below).

Table 3 (column (2)) presents results for the fully unrestricted specification. Note, first, that freeing the African slope terms eliminates the African intercept. The fully unrestricted specification further reveals that the marginal impacts of all three explanatory variables differ at the 5% level in African relative to non-African observations. While ethnolinguistic fragmentation hurts and total years of education helps institutional quality in the non-African baseline, the African slopes in both cases do not differ significantly from zero. An $F$-test fails to reject the null hypothesis that the net impact of ethnolinguistic fragmentation on institutional quality in Africa is zero ($P = 0.73$), and similarly fails to reject the null of a zero effect of education ($P = 0.83$).

It is counter-intuitive that ethnolinguistic fragmentation should not undermine institutional quality in Africa, while it does so in the non-African countries. One possible explanation may lie in poor measurement of institutional quality, particularly in Africa. Yet, a more subtle explanation may lie precisely in Africa's unusually high degree of ethnolinguistic fragmentation (Africa's median level is 0.73 versus 0.21 in included non-African countries). Collier and Hoeffler (1998) examine ethnolinguistic fragmentation in relation to the causes of civil war, finding a non-monotonic relationship such that highly fractionalized societies have no greater risk of civil war than homogenous ones. It is, in turn, reasonable to expect a high (negative) correlation between institutional quality and civil conflict (as argued by Rodrik, 1999). Thus, Collier and Hoeffler's finding may also explain the lack of a negative association between ethnolinguistic fragmentation and institutional quality in Africa.[16] This is the only instance in this paper in which Africa's difference works in its favor, though Africa's indirect growth penalty returns in the case of education's effect on institutional quality.

Initial total years of education fails to contribute to institutional quality in Africa, despite its highly significant effect in the non-African countries. The African slope term is statistically significantly different from the non-African slope, but their sum (the net slope for Africa) is not significantly different from zero. One can only speculate as to why the positive impact of total years of education on institutional quality in Africa is muted, though the possibility of lower quality of education in Africa relative to non-Africa is a viable explanation. This stands as another instance in which a positive direct determinants of growth (i.e., institutional quality) is more difficult to obtain in Africa (and, again, the explanation lies in an initial condition).[17]

The fully unrestricted specification is also revealing with respect to the effect of raw material abundance on institutional quality. This variable was insignificant in the partially restricted specification, and remains so in the fully unrestricted specification for the non-African observations. Yet, Table 3 column (2) shows that in Africa raw material abundance is negatively associated with institutional quality.[18] This finding is statistically significantly different from both non-Africa ($P = 0.008$) and from zero ($P = 0.003$). The differentially negative impact of raw materials abundance on institutional quality is particularly bad news for Africa, as it also has a substantially higher median share of raw materials in total exports

[16] Indeed, appropriate quadratic terms added to the present specification suggest a statistically significant inverted-U relationship between ethnolinguistic fragmentation and institutional quality in Africa.

[17] Here, too (as in the case of fiscal deficits), a more optimistic interpretation is plausible: if educational attainment does not contribute to institutional quality in Africa, then Africa's institutional quality may not be penalized by its lower level of educational attainment.

[18] Table 3 column (3) re-scales the results described above to indicate the effect on institutional quality of a one standard deviation change in the independent variables. A change of 0.14 is equivalent to a one-level change in the underlying scale of institutional quality. Thus, for instance, while a one standard deviation increase in the raw materials share of exports has no significant effect on institutional quality in the non-African countries, that same increase in Africa reduces institutional quality by approximately one-fifth of a level.

than non-Africa (0.23 versus 0.14). Again, one can only speculate as to why the marginal impact of raw materials abundance may be more harmful to institutional quality in Africa, but Africa's relative lack of constraints to rent-seeking behavior may illustrate Lane and Tornell's (1996) model. Forcing African and non-African observations onto a common regression surface may explain the negative but statistically insignificant estimate for raw materials in the partially restricted specification (column (1)).

While a country's raw materials endowment is clearly exogenous to institutional quality, its share of raw materials in total exports might be argued to be a result of poor institutions rather than a cause. One potential proxy for raw materials endowment is total land area (Wood and Berge, 1997). Substituting total arable land for raw materials export share in the present specification reinforces the findings presented in Table 3. Indeed, the negative African difference is even more pronounced in that case.

### *4.3. Determinants of population growth*

Population growth is modeled here as a function of initial income, initial life expectancy at birth, initial total years of schooling in the over 25 population, and the ratio of total labor force to total population. A large theoretical and empirical literature specifically addresses fertility decisions and the endogeneity of population growth. The proposed specification draws broadly on this literature without claiming to capture its depth and detail. For instance, higher life expectancy generally reflects lower infant and child mortality. Based on Becker (1991), one expects a negative association between initial life expectancy at birth and population growth. Similarly, greater educational attainment and employment prospects increase the opportunity cost of time spent on child rearing, and should thus reduce population growth. The same reasoning leads to the expectation of a negative association between working age share of the population and population growth. Such results have been widely reported.

Table 4 presents the results of LAD regressions of the partially restricted and fully unrestricted versions of a quadratic specification for population growth.[19] The partially unrestricted specification (column (1)), as in the previous cases, fails to account for African differences as reflected in the intercept dummy, which indicates that ceteris paribus Africa's population grows faster than non-Africa's by 0.46 percentage points per year. For initial life expectancy at birth, both the first-order and second-order terms are significant, leading to a U-shaped function

[19] A Ramsey RESET test rejects the null hypothesis of no omitted variables from this basic specification ($P = 0.0000$). This problem is resolved by allowing for non-linearity in the effect of initial life expectancy at birth and working age share of the population (including these two quadratic terms causes the RESET test to fail to reject with $P = 0.77$).

Table 4
Determinants of population growth—LAD regression results

| | (1) | (2) | (3)[c] |
|---|---|---|---|
| Constant | −0.1.05 (0.231) | −0.324 (0.627) | 0.065* (0.316) |
| LGDP(0) | 0.0004 (0.001) | 0.0005 (0.001) | 0.0004 (0.001) |
| LLEB(0) | 1.32* (0.266) | 0.488 (0.704) | 0.038 (0.055) |
| WORKER | −0.187* (0.063) | −0.232* (0.086) | −0.017* (0.006) |
| TYR | −0.0007** (0.0004) | −0.001* (0.0006) | −0.003* (0.001) |
| $LLEB(0)^2$ | −0.386* (0.078) | −0.147 (0.200) | −0.040 (0.054) |
| $WORKER^2$ | 0.180* (0.073) | 0.227* (0.102) | 0.014* (0.006) |
| SSA | 0.005* (0.001) | −1.54* (0.780) | −1.54* (0.774) |
| LGDP(0)×SSA | | −0.0002 (0.002) | −0.0008 (0.007) |
| LLEB(0)×SSA | | 1.70** (0.895) | 1.42** (0.740) |
| WORKER×SSA | | 0.431* (0.201) | 0.097* (0.045) |
| $(LLEB(0)\times SSA)^2$ | | −0.502* (0.260) | −0.709* (0.363) |
| $(WORKER\times SSA)^2$ | | −0.448* (0.222) | −0.048* (0.024) |
| TYR×SSA | | 0.002* (0.0009) | 0.002* (0.001) |
| pseudo-$R^2$ | 0.29 | 0.34 | 0.34 |
| RESET[b] | 0.77 | | |
| $n$ | 281 | 281 | 281 |
| Chow Test[d] $H_0$: $\gamma_0=\gamma=\gamma=0$ | | 0.000 | |
| Chow Test $H_0$: $\gamma=0$ | | 0.013 | |

[a]Coefficients are estimated for the period 1975/1979–1990/1995.
[b]Ramsey RESET test, $P$-value for $H_0$: no omitted variables (based on OLS estimation).
[c]Independent variables in standardized form. Coefficients indicate effect of a one standard deviation change on the dependent variable.
[d]$P$-value of stated null hypothesis.
* Standard errors in parentheses = 0.05-level of significance.
** Standard errors in parentheses = 0.10-level of significance.

with slope evaluated at the sample median of −0.041 (an $F$-test strongly rejects the null hypothesis of equality with zero ($P=0.003$)). The working age share of the population also produces a statistically significant U-shaped function for the full sample, with slope at the sample median of −0.039 (for which an $F$-test also strongly rejects the null hypothesis of equality with zero ($P=0.0000$)). Table 4, column (1) further indicates that total years of education is also significantly (at the 10% level) negatively associated with population growth in the full sample. These results confirm each of the expectations for this specification.

Table 4, column (2), presents the fully unrestricted version of this specification. Freeing the African slope terms in the case of population growth does not eliminate the African intercept term. Yet, the fully unrestricted specification still reveals that Africa fails to benefit from any of the specified conditions that lead to reduced population growth (and thus to faster income growth) elsewhere. With respect to the working age share of the population, African terms are both significantly different from the non-African terms; yet, $F$-tests fail to reject the null hypothesis that the net African first-order and second-order slope terms are equal to zero ($P = 0.28$ and $P = 0.26$ for the first-order and second-order terms, respectively). At respective sample medians, the slope for working age share of the population is $-0.004$ for Africa (which is not significantly different from zero ($P = 0.74$)) and $-0.59$ for non-Africa, which highly statistically significantly different both from zero ($P = 0.000$) and from the African slope term ($P = 0.004$). Thus, having a higher proportion of the population of working age decreases population growth outside Africa, but has no impact (or, at least is too imprecisely measured to justify a similar claim) within Africa.[20]

The evidence of an indirect African growth penalty is more suggestive in the case of initial life expectancy at birth as a determinant of population growth rates.[21] For Africa, both terms are significantly different from the non-African terms, and both the first-order and the second-order terms for Africa are significantly different from zero. Evaluated at the medians, the slope for non-Africa is $-0.044$, while the African slope for initial life expectancy at birth is 0.008. $F$-tests strongly fail to reject the null hypothesis that the African slope (at the sample median) equals zero ($P = 0.65$), but only narrowly fails to reject the same null in the non-African case ($P = 0.116$).[22] This constitutes suggestive evidence that higher initial life expectancy at birth has a greater negative association with population growth outside Africa than inside, suggesting once again that Africa may fail to benefit from an indirect channel through which improved initial conditions enhance growth.

In the case of total years of schooling for the over 25 population, each additional year of schooling in the non-African countries reduced population growth by 0.13 percentage points. The African slope term for total schooling is significantly different from the non-African slope ($P = 0.05$), but not significantly different from zero ($P = 0.54$).[23] This, too, suggests that Africa may fail to benefit

[20] One possible explanation may lie in the link between workforce share of the population and family income levels. As an increasing proportion of the population can work, family incomes will tend to rise. Assuming that children are a normal good, increased income leads to increased demand for children through the income effect. This interpretation is consistent with a theoretical model by Galor and Weil (2000), which demonstrates that at low levels of income, an income effect may dominate substitution of quality for quantity in the demand for children. This could indirectly hurt African economic growth, which is seen in the initial growth regression to be negatively associated with population growth.

[21] This specification is sensitive to the presence of the quadratic term on working age population share, the exclusion of which causes initial life expectancy at birth not to differ for Africa. With that exception, however, the estimates in this equation are highly robust to piecewise elimination of other explanatory variables.

[22] Similarly, an additional $F$-test only narrowly fails to reject the equality of the African and non-African slopes ($P = 0.115$).

[23] As in the case of institutional quality, one might surmise that the lack of an education effect on population growth in Africa reflects lower quality education. Yet, here too, a dominant income effect may also be at play if increased educational attainment is associated with increased income.

from a factor that reduces population growth elsewhere, adding indirectly to Africa's growth penalty.[24]

In each case, the specified variables contribute to reduced population growth in non-Africa, but do not measurably do so in Africa. As in previous cases, an inverse and more optimistic interpretation is possible—for instance, that Africa's lower degree of educational attainment may not indirectly harm growth by increasing population growth. Yet, if the goal is to increase African growth then it is surely not good news that these indirect means found to be effective outside Africa may not have the same beneficial impact inside Africa.

## 5. Summary and policy implications for African development

The most important policy implication of these results is also the most general: one-size-fits-all economic adjustment programs are less likely to succeed in Africa and greater scrutiny must be trained on underlying assumptions about the channels of transmission of growth effects if future adjustment programs are to be more successful in Africa than past programs.

The common assumption (and occasional assertion) of recent literature has been that the mechanisms of growth operate just the same in Africa as elsewhere. On the surface, this appears more or less true: most of the determinants of growth identified in the initial growth regression affect growth similarly in sub-samples of African and non-African countries. Yet, most analyses have stopped there, usually with a large and significant Africa dummy variable. This study attempts to advance the discussion in two respects. First, this study tests rather than assumes the equality of estimated parameters inside and outside of Africa, finding several critical differences in variables' impact on African growth. Second, this study follows a small strand of the growth literature in specifying additional equations to estimate the indirect contributions to growth of various initial conditions and exogenous factors as they influence explanatory variables in the initial growth regression.

Doing so reveals that several variables in the initial growth regression do indeed have different marginal effects on African growth, and moreover, most of the differences in Africa's growth mechanisms arise not in the initial regression, but rather in the indirect effects on growth that operate through those direct determinants. There are important ways in which Africa does grow differently,

[24] An anonymous referee suggests that one might also consider modeling the fertility rate rather than the population growth rate. Indeed, doing so with the same specification described here produces virtually identical results with respect to African differences, and doubles the pseudo-$R^2$ statistic. (Yet, in the initial growth regression, fertility (in place of population growth) has the expected sign but is imprecisely measured.)

usually failing to reap the indirect growth benefits of several positive influences and paying a harsher penalty for several negative influences on growth.

Even at the surface, there is evidence from the initial growth equation that several direct growth determinants have different marginal impacts in Africa. For instance, there is strongly suggestive evidence that being closed to international trade is more costly in terms of growth forgone in Africa than in other low- and middle-income areas. This is of particular concern as an example where African growth is doubly penalized: any closed country grows more slowly and Africa (on average) is more closed than other regions; yet, the negative marginal impact is exaggerated in Africa beyond the effect found elsewhere. One implication of these findings is that trade reform is particularly crucial for Africa. Similarly, deficit reduction may be necessary for accelerated African growth but the results presented here suggest that (in contrast to other regions) it may be insufficient.

Consideration of several channels of transmission provides a more detailed picture of Africa's growth differences. The study considers the determinants of both population growth and institutional quality—both variables from the initial growth regression for which the marginal effects in Africa are not different.

Higher population growth reduces economic growth in the broad sample. While this effect is not differentially severe in Africa, Africa's faster population growth makes this a serious concern. Yet, the explanation for population growth itself differentially magnifies the challenge of successful development in Africa: additional schooling, a higher work force share of the population, and higher initial life expectancy at birth all contribute to reduced population growth outside Africa, but in each case any effect in Africa is either zero or too imprecisely measured to conclude otherwise. The case of institutional quality provides further evidence of Africa's indirect growth penalty. The direct growth benefits of institutional quality are the same in Africa as elsewhere; yet, examination of the determinants of institutional quality highlight Africa's challenges. Increased stock of education improves institutional quality outside Africa, but has no such effect in Africa; abundance of raw materials does not effect institutional quality outside Africa, but reduces institutional quality in Africa. These findings, too, are troubling: the former implies that other means must be found to improve the quality African institutions; the latter is an exogenous factor about which little can be done. Only in the case of ethnolinguistic fragmentation does Africa's difference in marginal impacts work in its favor; yet, the difference in marginal effects is swamped by Africa's higher median level of ethnolinguistic fragmentation (shown by Easterly and Levine, 1997 to undermine growth).

The pattern to emerge is that some conditions leading to lower population growth or better institutions (and thus faster income growth) in the non-African countries apparently fail to yield these indirect growth benefits in Africa. In other cases, African differences result in indirect growth penalties. The absence of a positive effect in Africa might be optimistically interpreted as indicating that Africa does not pay a penalty for lacking in an area that indirectly contributes to growth elsewhere. Yet, given the goal of accelerating African growth, such negative results increase Africa's challenge by showing that reforms that have been effective elsewhere may be less so there. The problems of African growth may indeed be more complex, increasing the difficulty of designing effective responses with available tools. These findings thus reinforce the idea that more country or regional sensitivity needs to be incorporated into the design of structural adjustment programs.

The recognition that there are important differences in the mechanisms of economic growth in Africa raises more questions than it answers. Other differences undoubtedly exist as well. Making use of this information to derive more pointed policy implications, however, first requires a deeper understanding of why certain channels of influence on growth operate differently in Africa. This study has contributed to identifying African differences, but only begins to explain them. This opens up a potentially important avenue of research on growth. Such explanations will be essential if future efforts to promote economic growth in Africa are to be more successful than past efforts.

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## Appendix A. List of countries

Botswana
Burkina Faso
Burundi
Cameroon
Cape Verde Is.
Chad
Egypt
Ethiopia
Gabon
Gambia
Ghana
Guinea-Bissau
Ivory Coast
Jamaica
Mexico
Nicaragua
Panama
Puerto Rico
Trinidad and Tobago
Argentina
Bolivia
Brazil
Chile
Colombia
Equador
Guyana

Kenya
Lesotho
Liberia
Madagascar
Malawi
Mauritania
Mauritius
Morocco
Mozambique
Nambia
Niger
Nigeria
Rwanda
Senegal
Sierra Leone
South Africa
Sudan
Swaziland
Tanzania
Togo
Tunisia
Uganda
Zaire
Zambia
Zimbabwe
Barbados
Costa Rica
Dominican Rep.
El Salvador
Guatemala
Haiti
Honduras
Paraguay
Peru
Suriname
Uruguay
Venezuela
Bahrain
Bangladesh
China
Hong Kong
India
Indonesia
Iran
Jordan
Korea, Rep.
Malaysia
Myanmar
Nepal
Oman
Pakistan
Philippines
Singapore
Sri Lanka
Syria
Thailand
Yemen
Greece
Hungary
Portugal
Romania
Turkey
Papua N. Guinea

## Appendix B. Data definitions and sources

| Code | Description | Source |
|---|---|---|
| GRGDP | Annual percentage growth rate of GDP at market prices based on constant 1987 local currency. Aggregates are based on constant 1987 US dollars. | World Bank (1997) |
| LGDP(0) | Log of real per capita GDP measured at the start of each 5-year period. | Penn World Tables, 5.6 |

| | | |
|---|---|---|
| LLEB(0) | Log of life expectancy at birth measured in the initial year of each 5-year period. Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. | World Bank (1997) |
| GPOP | Growth rate of POP. | PWT, 5.6 |
| TYR | Average schooling years in the total population over age 25, measured at the start of each 5-year period. | BL (1993) |
| ELF | Index of ethnolinguistic fractionalization, 1960. Measures probability that two randomly selected people from a given country will not belong to the same ethnolinguistic group. | Easterly and Levine (1997) |
| INST | Computed from International Country Risk Guide Data (1982–1995). Unweighted average of subjective indices of: government repudiation of contracts, risk of expropriation, corruption, rule of law, and bureaucratic quality. Re-scaled to [0,1], averaged over entire period. | Political Risk Services |
| DEF | Overall budget deficit, including grants (% of GDP). Overall budget deficit is current and capital revenue and official grants received, less total expenditure and lending minus repayments. | World Bank (1997) |
| GRTOT | Growth rate of net barter terms of trade (1987 = 100). Net barter terms of trade are the ratio of the 1987 (base year) export price index to the corresponding import price index. | World Bank (1997) |
| OPEN | Portion of years in each 5-year period that is country is“open” as defined by Sachs and Warner (1995). | Sachs and Warner (1995) |
| WORKER | Ratio of total labor force to total population. Total labor force comprises people who meet the ILO definition of the economically active population: all people who supply labor for the production of goods and services during a specified period. It includes both the employed and unemployed. While national practices vary in the treatment of such groups as the armed forces and seasonal or part-time workers, in general the labor force includes the other unpaid caregivers and workers in the information sector. | World Bank (1997) |

| | | |
|---|---|---|
| Africa | Dummy variable for Africa, includes: Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Chad, Ethiopia, Gabon, Gambia, Ghana, Guinea-Bissau, Ivory Coast, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zaire, Zamb-ia, Zimbabwe. | BL |

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