

**ECONOMIC GROWTH IN A CROSS SECTION
OF NON-INDUSTRIAL COUNTRIES:
DOES COLONIAL HERITAGE MATTER FOR AFRICA?**

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ECONOMIC GROWTH IN A CROSS SECTION OF NON-INDUSTRIAL COUNTRIES: DOES COLONIAL HERITAGE MATTER FOR AFRICA?

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Abstract

This paper investigates the effects of Sub-Saharan African colonial heritage on economic growth in a sample of non-industrial countries. Parameter estimates from an augmented Solow growth model indicate that having a twentieth century colonial heritage matters for growth in Sub-Saharan Africa. The results suggest that directly, colonial heritage accounts for approximately 87 percent of the growth gap between the former colonies in Sub-Saharan Africa and other non-industrial countries. Even more dramatically, an illustrative growth decomposition suggests that colonial heritage indirectly accounts for approximately 97 percent of Sub-Saharan Africa's growth gap attributed to physical capital investment, trade policy, and tropical geography.

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1. Introduction

One of the more consistent findings in the empirical cross-country growth literature is the Africa effect: being a Sub-Saharan African country, in many instances even after controlling for numerous factors that plausibly govern economic growth, has an adverse impact on economic growth. Representative findings that report a negative and significant sign on a dummy variable for Sub-Saharan Africa in cross-country growth regressions include those of Grier and Tullock (1989), Barro (1991), Easterly and Levine (1997), and Collier and Gunning (1999). A negative and significant dummy variable for Sub-Saharan Africa could result from factors omitted from the cross-country growth specification that are unique and operative in Sub-Saharan Africa. In this context, the more recent analysis of Bloom and Sachs (1999) add variables to a cross-country growth model that capture the influence of geography and demography; and by doing so, find that a dummy for Sub-Saharan African is no longer significant. They conclude that by and large, geographical characteristics unique to Africa explain the poverty and miserable growth experience of Sub-Saharan African countries.

Other variables that have been found to either explain African growth, not necessarily in a cross-country growth regression framework, and/or render the Sub-Saharan dummy insignificant, include the extent of ethnic diversity (Easterly and Levine, 1997), the extent of openness in trade (Sachs and Warner, 1997), and colonial heritage (Bertocchi and Canova, 1991; Sala-i-Martin, 1997).¹ What is surprising, given the results of Sala-i-Martin (1997) and Ley and Steel (1999), that dummy variables for colonial heritage are important regressors

¹More generally, as reported in the survey of Temple (1999), variables that have been found to be important to cross-country growth include those that measure: (1) Investment in physical capital, (2) Investment in human capital, (3) Investment in research and development, (4) Population growth, (5) International trade, (6) Financial systems, (7) Macroeconomic policy, (8) Government size, (9) Infrastructure/Public capital, (10) Income/wealth inequality, and (11) Social and Political factors.

for explaining cross-country growth patterns in approximately two trillion different growth model specifications, is that, with the exception of Bertocchi and Canova (1997), very little effort has been made to determine the extent to which colonial heritage explains African growth in a cross-country growth framework.²

To the extent that colonial heritage is indeed important for growth in Africa, conclusions such as those made recently by Bloom and Sachs (1998) that approximately two thirds of the African growth shortfall is due to noneconomic factors such as geography, demography and public health may be an overstatement. If colonial heritage is important, and adversely affects growth in African countries, then the possible policy interventions that could enhance growth in Africa would have to consider the historical realities of colonialism, and not just, for example, the realities of geography, political institutions, demography, social capital, and the structure and scope of central government economic policy. Colonial heritage, if important for explaining growth in Africa, would shed light upon the extent to which Africa's growth problems are not just a function of internal factors alone, but also a function of external historical factors such as colonialism. Moreover, it could be the case that some of the internal factors that are important for explaining growth in Africa are not exclusively internal, but are a consequence of colonial heritage, thus exacerbating the effects of those internal factors found to adversely affect growth.³

²Salai-i-Martin's (1997) results are in response to the findings of Levine and Renelt (1992) regarding the robustness of regressors. Salai-i-Martin suggest that in a cross-country growth model, a regressor is important if, over all the possible specifications, its 90 percent confidence interval does not include zero. Ley and Steel (1999) extend this methodology to a Bayesian framework, and determine the importance of a regressor based upon the posterior probability of a regression model containing a particular regressor. For both Salai-i-Martin (1997) and Ley and Steel (1999), dummy variables for Spanish, French, and British colonial heritage turn out to be important explanatory variables for cross-country growth.

³Barro (1996) for example explores the extent to which colonial heritage determines the extent

In this paper, the central concern is to determine the extent to which colonial heritage can explain the growth experience of Sub-Saharan African countries in an explicit cross-country growth specification—the human capital augmented growth model of Solow (1956) proposed by Mankiw, Romer and Weil (1992).⁴ A sample of non-industrial countries which includes African countries, is utilized to estimate the parameters in cross-country growth model that includes variables considered by Mankiw, Romer and Weil (1992), plus variables that capture twentieth century colonial heritage, and various sociocultural, policy, and geography factors that could determine the level of technology. Given that most of the non-industrial countries have a twentieth century colonial heritage, exploiting this common characteristic in a sample is perhaps a useful way to determine how convergence in these countries is conditioned upon colonial heritage. In the case of African countries, this regression strategy will also permit a determination as to whether or not the Africa effect is explained by colonial heritage, and to what extent.

If it is indeed the case that "nothing that is true about the growth rate of advanced countries is true of the developing countries [Pritchett (1997), p. 14]", then a consideration of the growth experiences of just the non-industrial countries may be appropriate for examining the possible effects of colonial heritage on steady-state per capita output. The common characteristic of having a twentieth century colonial heritage may be a useful way to appropriately group and identify countries that belong on a common regression surface implied by an empirical cross-country growth model specification— one of the objections to cross-section empirical growth models addressed, and defended recently by Temple (1999).

of democracy, which in turn influences long run growth.

⁴The Mankiw, Romer and Weil (1992) human capital augmented growth model is an explicit theoretical specification in the sense that a common approach is to utilize more or less ad hoc specifications driven by variables found to be significant in previous studies. Temple (1999) calls these ad hoc specifications "Barro regressions" as they follow the approach initiated by Barro (1991).

The remainder of this paper is organized as follows. Section 2 considers the ways in which a country's colonial heritage could adversely affect economic growth. In section 3, the sample, data, and empirical growth model specification are provided. The results are reported in Section 4, and Section 5 concludes.

2. Why Colonial Heritage Could Matter For Economic Growth

There are at least two ways in which colonial heritage can have an adverse impact upon the long-run growth rate of a country: directly and indirectly. In typical cross-country growth specifications of the Solow growth model, the level of technology is unspecified, but assumed to be constant across countries. But, as Sachs and Warner (1997) note, the omitted variable bias introduced by unspecified the level of technology can be diminished, if not eliminated by introducing variables that are determinants of the level of technology. One plausible determinant of the level of technology available to a country is colonial heritage. The effect could be direct, in the sense that it is a strict determinant of total factor productivity, or it could manifest itself indirectly through other determinants of total factor productivity.

Bertocchi and Canova (1999) have provided a model of economic growth where a country's colonization experience, and presumably its legacy, indirectly compromises long-run growth as a result of the economic and institutional distortions resulting from colonialism. The intensity of the distortions that result from colonial heritage are captured by a parameter measuring the loss of total output due to the distortions in an optimal growth framework. They also offer a model of growth where a country's initial colonial experience is characterized by a rapid infusion of colonialist physical capital, which creates an imbalance between physical and human capital.⁵ If the technological scale parameter on the produc-

⁵Alam (1994), argues for example, that the foreign capital influx associated with colonization

tion is proportional to the ratio of human to physical capital, the effect of colonization is reduced growth, that can persist even after independence. This effect of colonial heritage on an economy can be viewed as an extension of the theory of threshold externalities in human capital accumulation developed by Azariadis and Drazen (1990). To the extent that a country's tenure under colonial rule inhibits a high ratio of human capital to per capita income, a threshold externality where human capital has increasing returns is not realized, reducing the rate of growth of income per capita.⁶

To conjecture that a country's colonial heritage affects growth through institutional distortions, is perhaps most compelling, since in the standard neoclassical growth model, growth is function of the level of technology, which is plausibly a function of many institutional factors that capture for example, culture, political structure, and historical factors. Collier and Gunning (1999) suggest that the manner in which colonial powers geographically divided up Africa into small countries may have hindered growth prospects in Africa. In general, if government, and presumably the capacity to provide those public goods crucial for growth, has some fixed cost, it may be difficult for small countries to perform at minimum and efficient cost. Barro (1996), in his analysis of the effects of democracy on growth, notes that the indirect effects of a country's colonial heritage on the determinants of growth merit consideration, given its negative, but insignificant affect on democracy—which Barro finds to enhance growth at low levels of political freedom. Thus, to the extent that colonial heritage impacts upon those institutional factors that indirectly impact the level of technology, colonial heritage could matter for economic growth.

In a context similar to Barro (1996), Bertocchi and Canova (1999) suggest that the

was deployed mainly in primary production activities, which are not technology intensive. In this context, a country's colonial heritage is associated with a reduced capability to absorb and utilize new technologies that enhance growth.

⁶Other theoretical analyses underscoring the importance of human capital accumulation for economic growth include Lucas (1988), Becker, Murphy, and Tamura (1990) and Romer (1990).

high degree of political instability and ethnic conflict in Africa, both of which have been found to be inversely correlated with growth, may be a result of the former colonizers total disregard for the geographical borders that delimited territories prior to colonization. The plausibility of colonial heritage having an adverse impact on growth indirectly has also been argued by David Laibson, in his response to the analysis of Bloom and Sachs (1999). Laibson argues, for example, that the hierarchical religions associated with colonizers were negatively correlated with public good provision and hence, economic growth.⁷ To the extent that the hierarchical religion of colonialist powers crowds-out local, and presumably non-hierarchical indigenous religions, and is associated negatively with public good provision, the adverse effects of a colonial heritage could persist long after independence.

Below, a cross-country growth specification is provided that will accommodate the effects that colonial heritage can have on a country indirectly through those social, cultural, and political factors that have been found to adversely affect growth. This strategy is based upon the notion that if colonial heritage matters, it is plausible that it manifests itself through the level of technology. A reasonable way to empirically determine this is through the explicit neoclassical growth framework of Mankiw, Romer, and Weil (1992), as it is amenable, in a non ad-hoc way, to adding variables that measure a country's colonial heritage.

3. Sample, Data, And Cross-Country Growth Specification

Table 1 reports the sample of countries under consideration. The countries are a subset of those classified by Temple (1998) as non-industrial, which are a subsample of countries initially considered by by Mankiw, Romer and Weil (1992), extracted from the Penn World

⁷See p. 287 of Bloom and Sachs (1998).

Table Data of Summers and Heston (1988, 1991).⁸ This sample selection criterion seems appropriate given Temple's (1998) finding that the explanatory power of the augmented Solow growth model of Mankiw, Romer and Weil (1992) is high when countries are grouped according to a common characteristic. Given that all of the countries with a twentieth century colonial heritage are non-industrial countries, a sample of just non-industrial countries, some of which do not have a colonial heritage, may allow the measurement of the relevant growth dynamics associated with colonial heritage that are otherwise obscured in samples which include industrial countries without a colonial heritage.

To estimate the effects of Sub-Saharan African colonial heritage on economic growth, the explicit human capital augmented Solow growth framework of Mankiw, Romer, and Weil (1992) is followed. At time t , output for a particular country is determined by a Cobb-Douglas production function with physical capital, human capital, labor, and technical efficiency as arguments:

$$Q_t = K(t)^\alpha H(t)^\beta (A(t)L(t))^{1-\alpha-\beta}$$

where $K(t)$ is physical capital, $H(t)$ is human capital, $L(t)$ is labor supply, and $A(t)$ is an index of technical efficiency. It is assumed that investment rates in physical and human capital are constant at s_k and s_h , and have a common depreciation rate of δ . The supply of labor is assumed to grow at a rate, perhaps different among countries, of n .

Instead of having the level of technology completely unspecified, it is hypothesized following the approach of Ghura and Hadjimichael (1996), that the level of technology A at time t is:

$$A = A_0 \exp\left(gt + C_i + \sum \Phi_i X_i\right)$$

⁸Temple's data are publicly available from the *Journal of Applied Econometrics* Program and Data archive at: <http://qed.econ.queensu.ca/jae/>.

where g is the exogenous growth rate of technical efficiency, C_i is a dichotomous variable indicating whether or not a country has a colonial heritage, the X_i are country-specific sociocultural, policy, and geography variables, and the Φ_i are their coefficients.

Let q_o and q^* be actual/initial and steady-state income per effective worker respectively, then by approximating about the steady-state, where $d\ln q(t)/dt = \lambda[\ln(q^*) - \ln(q_o)]$, an explicit regression specification for economic growth that can accommodate the effects of colonial heritage is:

$$\begin{aligned} \ln(q^*) - \ln(q_o) &= \theta a - \theta \ln q_o - \theta \left(\frac{\alpha + \beta}{1 - \vartheta} \right) \ln(n + g + \mu) + \theta \left(\frac{\alpha}{1 - \vartheta} \right) \ln(s_k) \\ &+ \theta \left(\frac{\beta}{1 - \vartheta} \right) \ln(s_h) + C_i + \theta \sum \Phi_i X_i + \varepsilon \end{aligned} \quad (1)$$

where $a = gt$, s_k is the share of income invested in physical capital, s_h is the share of income invested in human capital, $\theta = 1 - \exp(-\lambda t)$, $\lambda = (n + g + \mu)(1 - \alpha - \beta)$ is the rate at which a country converges to its steady state income per capita, $\vartheta = \alpha + \beta$, and ε is a stochastic error term.

To estimate the cross-country growth specification above, data were obtained from several sources. The first three variables are from Mankiw, Romer and Weil (1992), and are measured over the 1960 - 1985 period. The dependent variable is measured as the difference between the log of real GDP per member of the working age population in 1985 ($\ln q_{85}$) and the log of GDP per member of the working age population in 1960 ($\ln q_{60}$). Following Mankiw, Romer, and Weil (1992), it is also assumed that $g + \mu = .05$, and n is measured by the average growth rate of the working age population (POP_N).⁹ The variable s_k is the average share of real investment in real GDP (PKAP). The human capital variable, s_h , is initially measured by the percentage of the population aged 12 - 17 enrolled in secondary

⁹The assumption that $g + \mu = .05$ is invoked by Mankiw, Romer and Weil (1992) on the basis of its correspondance with data from a sample of U.S and non-U.S countries.

school multiplied by the percentage of the population age 15 - 19 (HKAP1). To the extent that school enrollment rates may be a poor proxy of human capital (Temple, 1999), perhaps as a result of obscuring the level and accumulation effects of human capital (Gemmell, 1996), a second specification of the model is also considered where the human capital variable is from Barro and Lee (1993). The alternative human capital variable is measured as the log of the difference between average years of total schooling of the total population in 1985 and 1960 (HKAP2).¹⁰

An additional six variables are used to further augment the by specifying the initial level of technology given by $C_i + \sum \Phi_i X_i$. This strategy, other than mitigating or eliminating the omitted variable bias that can result from not specifying the determinants of the initial level of technology, will also permit a determination on the extent to colonial status and other social, cultural, policy, and geographical factors matter for economic growth in nonindustrial countries in general, and Sub-Saharan Africa in particular.

The C_i term is measured by a dichotomous dummy variable (COLONY) which equals one if the country has a twentieth century colonial heritage. A dichotomous dummy variable (AFRICA), which equals one if the country is located in Sub-Saharan Africa is also included among the X_i . Given the previous findings in the cross-country growth literature about the effects of being a former colony, and being located in Sub-Saharan Africa, the a priori expectation is that both of these dummy variables will have negative coefficients.

Three of the variables included among the X_i are from Sachs and Warner (1997).¹¹ ACCESS is a dummy variable that indicates whether or not a country is completely landlocked. The variable TROPIC measures the approximate fraction of a country's land area that is subject to a tropical climate. OPEN is a variable that measures the proportion of

¹⁰The data is available on-line at: www.worldbank.org/research/growth/ddbarlee.htm

¹¹These data are available via the Internet at: www.nuff.ox.ac.uk/Economics/Growth/datasets/sachs/sachs.csv

years between 1965 and 1990 in which the country is rated as an open economy. In tandem, ACCESS and TROPIC are geographical variables. To the extent that adverse geographical conditions are deleterious to growth, the a priori expectation is that ACCESS and TROPIC will have negative coefficients. OPEN is a policy variable measuring the extent to which a country's macroeconomic policies promote and encourage free trade. To the extent that free trade engenders greater efficiency in the allocation of resources, and thereby increasing economy-wide total factor productivity, the a priori expectation is that OPEN will have a positive coefficient.

The last two variables included among the X_i attempt to measure the impact of sociocultural factors on the initial level of technology. The variable DIFREL measures the difference between the percentage of a country's population that practices Christianity and Indigenous religions. This variable is constructed on the basis of data reported in the CIA World Factbook (1999). AVELF is a variable that measures the extent of ethno-linguistic diversity in a country, and is based upon an average of five linguistic diversity measures utilized in Easterly and Levine (1997).¹² To the extent that societies are polarized among ethnic lines that results in competitive rent-seeking by ethnic groups in conflict, ethnic diversity may inhibit growth enhancing public good provision, and create noncompetitive rents for ethnic groups in power. In this context, ethnic diversity is growth retarding as it reduces total factor productivity. If ethno-linguistic diversity is an adequate measure of the extent to which ethnic rivalry results in the successful capture of rents, and/or leads to the adoption of growth-retarding economic policies, the a priori expectation is that AVELF

¹²As constructed by Easterly and Levine (1997), AVELF is the average of five measures of ethno-linguistic diversity: (1) Two measures of the probability of two individuals speaking different languages, (2) Percent of the population not speaking the country's official language, (3) Percent of the population not speaking the country's most widely used language, and (4) The probability that two randomly selected individuals from a given country will not belong to the same ethno-linguistic group. The data are available on-line at www.worldbank.org/research/growth/ddeale.htm

will have a negative coefficient.

Assuming that indigenous religious beliefs are less hierarchical than Christianity, the a priori expectation regarding the coefficient of DIFREL is not unambiguous, as the extent of adherence to Christian religious beliefs can have two plausible effects. If the conjecture of Laibson is correct, that adherence to a hierarchical religion results in reduced public good provision, then DIFREL would have a negative coefficient. On the other hand, if the perspective of Max Weber (1905) is correct, that adherence to Christian beliefs promotes a work ethic that, that presumably results in higher effort levels regarding saving, investing, and labor supply, then the extent of adherence to Christian beliefs relative to indigenous beliefs can have a positive effect on total factor productivity. In this context, the coefficient of DIFREL will be positive.

4. Results

Table 1 reports a list of the countries considered for inclusion in the sample along with their colonial heritage, the metropolitan European country they were colonized by, and the date of independence. Table 2 reports the period average and standard deviation of the variables utilized to estimate empirical growth specifications based on equation (1). The pattern of the averages conditioned on the colonial heritage and geographical region of non-industrial countries is suggestive of how different Sub-Saharan African countries are from other non-industrial countries. In general, the growth rate of GDP per capita given by $\ln(q^*) - \ln(q_0)$, is higher for non-industrial countries without a colonial heritage, and for those countries not in Sub-Saharan Africa. Moreover, Sub-Saharan African countries without a colonial heritage grew at a rate that higher than Sub-Saharan African countries with a colonial heritage. Relative to all non-industrial countries in the sample, Sub-Saharan African countries, both those with and without a colonial heritage, are more landlocked,

more subject to a tropical climate, less open to trade, and have higher levels of ethnolinguistic diversity.

Tables 3 and 4 report Ordinary Least Squares (OLS) parameter estimates of various specifications of the augmented Solow growth model. The results in Table 3 utilize the Mankiw, Romer and Weil (1992), human capital variable, whereas the results reported in Table 4 utilize a human capital variable constructed from data compiled by Barro and Lee (1993). To insure valid inferences on parameters given the possibility of heteroscedastic errors in cross section data, all reported standard errors are heteroscedastic consistent. The human capital augmented Solow growth model also has an adding up restriction, that is useful for assessing the adequacy of the model in a particular cross-section of data. The model predicts that the annual rate of convergence (λ) is .02, and the sum of the coefficients on $\ln(s_k)$, $\ln(n + g + \mu)$, and $\ln(s_h)$, is zero. Given a predicted λ of .02, the predicted coefficient of $\ln(q_o)$ is -.3935, and this should equal the sum of the coefficients on all four variables.¹³ Each specification reported in Tables 3 and 4 test for this parameter restriction, and report the F-tests for the coefficient restrictions. The implied rate of λ , based upon the unrestricted coefficient of $\ln(q_o)$, is also reported.

For the estimated specifications reported in columns (2) - (7) of Table 3, the adding-up restriction could not be rejected, suggesting the adequacy of the augmented Solow growth model—and augmented further to include technology determinants, for the cross-section of non-industrial countries in the sample. Column (1) of Table 3 reports the results of a test for unconditional convergence. Both the constant and the coefficient on the GDP per capita in 1960 are insignificant, implying that among non-industrial countries, there is no tendency, unconditionally, for poorer countries to grow faster than richer countries.¹⁴ The

¹³If θ = the coefficient on $\ln(q_o) = \exp(-\lambda t) - 1$, then for $\lambda = .02$, and $t = 25$, solving for θ gives the implied coefficient on $\ln(q_o)$ of $-.3935 = \theta$.

¹⁴Mankiw, Romer, and Weil (1992) note that what the Solow model predicts is "conditional convergence"—countries converge in growth rates only after controlling for the determinants of

OLS parameter estimates reported in column (2) are the Mankiw, Romer, and Weil (1992) specification. With the exception of the insignificant sign on the growth rate of the working age population, all other coefficients are significant, and have the expected sign.

The OLS parameter estimates reported in columns (3) and (4) of Table 3 specify the level of technology by including dummies for being a Sub-Saharan African country and having a twentieth century colonial heritage. In column (3), the AFRICA dummy is negative and significant, and reveals the so-called "Africa effect" among non-industrial countries: being a Sub-Saharan African country is associated with a lower growth rate. Note however, that the inclusion of the AFRICA dummy alters the coefficient on the growth rate of the working age population, and the human capital variable is insignificant. The specification in column (4) adds a dummy for twentieth century colonial heritage. While colonial heritage has a negative effect, it is insignificant, and the AFRICA dummy remains negative and significant. The human capital and population variable also remain positive and insignificant.

Column (5) of Table 3 reports the OLS parameter estimates after adding the geography, religion, and ethno-linguistic diversity variables to the technology specification. Only OPEN and TROPIC are significant and have the expected sign. Apparently, for the non-industrial countries in the sample, landlockedness, the extent of Christian religious beliefs, and ethno-linguistic diversity do not matter for economic growth, whereas openness to trade and tropical climate do. Even after the inclusion of these determinants of the level of technology, the AFRICA dummy is still negative and significant. The coefficient on the COLONY is now positive, but insignificant. Moreover, similar to the specifications in columns (2), (3), and (4), the coefficients on the population and human capital variable are insignificant.

The significance of the AFRICA dummy for the specifications in columns (3) - (5) of Table 3 suggests that among the non-industrial countries in the sample, the "Africa

steady-state GDP per capita. Murthy and Ukpolo (1999) report similar evidence of conditional convergence in the case of African countries.

effect” is important, whereas having a twentieth century colonial heritage is not important, for explaining economic growth. In particular, the significance of the AFRICA dummy indicates that in Sub-Saharan African countries, there are some determinants of growth not captured in the specification. The OLS parameter estimates reported in columns (6) and (7) of Table 3 add two variables to the technology specification that address the central concern of this paper—whether or not colonial heritage matters for economic growth in Africa.

The first variable added to the specification of the technology, INTER1, is an interaction of the COLONY and AFRICA dummies. This interaction term will permit a determination as to whether or not a colonial heritage for non-industrial Sub-Saharan African countries matters for economic growth. The second interaction variable, INTER2, is the cross product of COLONY, AFRICA, AVELF, and OPEN. Two considerations motivate the second interaction term. First, to the extent that colonial policy in Africa resulted in colonies with geographical frontiers that incorporated more tribal and ethnic diversity than precolonial geographical frontiers, the geography imposed by the former colonizers may be responsible for the high degree of political instability and ethnic conflict in the post-colonial era which compromised economic growth (Bertocchi and Canova, 1999). Finally, if as Easterly and Levine (1997) argue, that ethnic diversity promotes social conflict that results in policy interventions that create rents for ethnic groups in power, ethnic diversity in Sub-Saharan African countries with a twentieth century colonial heritage may retard growth. Thus, INTER2 is a variable that captures the effect of ethnic diversity in former African colonies, the effect it has on trade policy, and its subsequent effect on economic growth.

In column (6) of Table 3, the coefficient on INTER1 is negative and significant. Moreover, the inclusion of INTER1 renders the AFRICA dummy insignificant, implying that it is the colonial heritage of Sub-Saharan African that explains the ”Africa effect”. Column (7) of Table 3 adds INTER2 to the specification of column (6). With the inclusion of IN-

TER2 the AFRICA dummy is still insignificant, and the large and negative coefficient on INTER2 suggests that among former colonies in Sub-Saharan Africa, high levels of ethnic diversity interact with colonial heritage in a way that retards growth. Given that OPEN measures the extent to which trade policy facilitates free trade, an implication is that in former Sub-Saharan African Colonies, high levels of ethnic diversity lead to the adoption of growth retarding economic policy.

The insignificance of DIFREL and AVELF in the specifications reported in columns (5) - (7) of Table 3 is also instructive. Apparently, for non-industrial countries in general, neither the extent of Christianity relative to indigenous religions matters for growth, nor does the extent of ethnic diversity. An implication is that the Weberian protestant work ethic is not necessarily manifested through Christianity, nor does a hierarchical religion such as Christianity necessarily crowd-out growth enhancing public investments. The positive, but insignificant sign of AVELF suggests that ethnic diversity can possibly be conducive for growth.¹⁵

In tandem, the large and negative coefficients on INTER1 and INTER2 suggest that having a twentieth century colonial heritage matters for Sub-Saharan African countries. Quantitatively, the OLS specifications reported in columns (6) and (7) of Table 3 suggest that the effects of colonial heritage are substantial. The actual log difference of the growth differential between the former Sub-Saharan African colonies and all other non-industrial countries in the sample is .3630 percentage points. The coefficient on INTER1 suggests that colonial heritage reduced the growth rate of GDP per capita by .2810 percentage points, which is 77 percent of the actual growth gap between Sub-Saharan African countries and

¹⁵The effects of ethnic diversity on economic growth are not unambiguous. In contrast to the findings of Easterly and Levine (1997), Collier (1998) finds that the relationship between ethnic diversity and growth is non-monotonic, as the deleterious growth effects of ethnic diversity can be offset by sufficiently democratic institutions.

the other non-industrial countries in the sample.

The coefficient on INTER2 suggests that in Sub-Saharan Africa, colonial heritage interacts with high levels of ethnic diversity in such a way that leads to the adoption of growth retarding trade policies. Thus, while ethnic diversity does not appear to matter for non-industrial countries in general, it does appear to matter for Sub-Saharan African countries. The coefficient on INTER2 presumably measures the impact of former colonizers total disregard for pre-colonial geographical and ethnic borders during the colonization process. This effect reduced the growth rate of GDP per capita by .0342 percentage points, which is approximately 9 percent of the actual growth gap between Sub-Saharan African countries and the other non-industrial countries in the sample.¹⁶

The adjusted R^2 's for the specifications in columns (2) - (7) of Table 3 range in value from .363 to .473. While seemingly low, the magnitudes of the adjusted R^2 's suggest that the non-industrial countries in the sample, even after the growth model specification accounts for several determinants of steady state income per capita, are far from their steady states. Distance from the steady state also implies that population growth and capital accumulation, both physical and human, have not had their full impact on GDP per capita over the sample period (Mankiw, Romer, and Weil, 1992). Nonetheless, the failure to reject the Solow model's adding-up restriction suggests that the Solow model is indeed an appropriate framework for explaining the growth of GDP per capita among non-industrial countries.

Table 4 reports on the same specifications of Table 3, with the Mankiw-Romer-Weil human capital variable replaced with a human capital variable based on the school com-

¹⁶The calculation of the growth differential attributed to INTER2 follows from subtracting the Sub-Saharan African average value of the explanatory variables (AVELF and OPEN) from the average value of the explanatory variables for all the other countries in the sample, and multiplying it by the coefficient on INTER2.

pletion data of Barro and Lee (1993). Across the seven specifications reported, the results are similar to the results in Table 3. For the estimated specifications in columns (2) - (7), the adding-up restrictions on the parameters could not be rejected, suggesting again the adequacy of the Solow growth specification for the data. Apparently, for the non-industrial countries in the sample, the parameter estimates of the model are not sensitive to alternative measures of human capital. Moreover, the magnitudes of the parameter coefficients are not appreciably different when the Barro-Lee human capital variable is used.

A useful context for the results is to consider the extent to which the growth differential between former colonies in Sub-Saharan Africa and the other non-industrial countries can be explained by colonial heritage, including the extent to which the significant growth determinants are indirectly explained by colonial heritage. The indirect effect may be important if the INTER1 and INTER2 variables alone do not account for all of the structure responsible for the implementation of growth policies among former colonies in Sub-Saharan African countries. It is plausible that, other than INTER1 and INTER2, the other variables found to be significant in columns (7) in both Tables 3 and 4, could be conditioned, to some extent, on the colonial heritage of Sub-Saharan African countries in the sample. To examine this possibility, a growth decomposition similar to that of Easterly and Levine (1997) is useful.

For illustrative purposes, and since the estimates are apparently not sensitive to the measurement of human capital, the results utilizing the Mankiw-Romer-Weil human capital variable reported in column (7) of Table 3 are decomposed. The first consideration, is to examine the extent to which the significant colonial heritage variables influence, or condition the other significant variables. Table 5 reports heteroscedastic consistent OLS parameter estimates for a simple linear relationship between the significant growth determinants and the colonial heritage variables. The results show that the significant determinants of growth are indeed correlated with, or conditioned by, at least one measure of colonial

heritage. Investment in physical capital, as measured by $\ln PKAP$, is negatively influenced by colonial heritage in Sub-Saharan Africa. The negative correlation between Tropic and colonial heritage suggests that the tropicality of Sub-Saharan countries is influenced, to some extent by the geographical boundaries established by their former colonizers. The significance of the negative correlation between OPEN and colonial heritage suggests that the propensity to enact growth enhancing trade policy is inhibited as a result of being a former colony in Sub-Saharan Africa. Initial income also appears to be adversely affected by colonial heritage.

Table 6 reports the growth decomposition in three parts: (I.) The total effect through the significant determinants of growth, (II.) The total effect through the colonial heritage variables, and (III.), The joint effect through the the significant growth determinants plus the colonial heritage variables. In each panel, column (1) reports the growth differential accounted for the the variable alone.¹⁷ The bold figures in panels I., II., and III. are simply the sum of each variable's contribution to the growth differential. Column (3) of each panel reports the growth differential implicitly explained by colonial heritage through the variable.¹⁸ Column (2) of table 6 is simply column III. divided by column I., and it measures the the extent to which colonial heritage in Sub-Saharan Africa indirectly accounts for the growth differential between Sub-Saharan African countries, and the other countries in the sample, through the relevant variable.

¹⁷The calculation proceeds by subtracting the Sub-Saharan African average value of the explanatory variable from the average value for the other countries in the sample, and multiplying it by the relevant coefficient in column (7) of Table 3.

¹⁸The calculation proceeds by substituting in the predicted values for each variable from Table 5 in the relevant coefficient estimate from column (7) of Table 3. In cases where the amount of the growth differential implicitly explained by colonial heritage exceeded the amount directly explained in column (1) of Table 6, the amount implicitly explained was constrained to the value in column (1).

The growth decomposition computations reported in Table 6 are quite dramatic. Column (2) of panel I. reveals that almost all the Sub-Saharan African disadvantages regarding physical capital, trade policy, and tropical geography are explained by colonial heritage. Approximately 97 percent of the total growth differential attributed to the variables $\ln PKAP$, $OPEN$, and $Tropic$ is implicitly explained by colonial heritage. The actual growth differential between the former Sub-Saharan African colonies and the other countries in the sample is .3630 percentage points. Summing up appropriately down column (1) of panels I., II., and III., the result is that the significant growth determinants and Sub-Saharan colonial heritage account for .3061 percentage points or 84 percent of the actual growth differential between former Sub-Saharan African countries and the other countries in the sample after the convergence effect is accounted for.¹⁹ Indirectly, through the variables $\ln PKAP$, $OPEN$, and $TROPIC$, the effects of colonial heritage account for .2964 percentage points of the Sub-Saharan African growth differential. This is approximately 82 percent of the actual growth differential between the former colonies in Sub-Saharan Africa and the other non-industrial countries in the sample.

5. Conclusions

The central concern of this paper was to determine if colonial heritage has explanatory power for the growth experience of Sub-Saharan African countries. Given plausible mechanisms through which a colonial heritage can influence total factor productivity, the augmented Solow growth model of Mankiw Romer and Weil (1992) provides a natural cross-country growth framework to evaluate the effects of colonial heritage on long-run economic growth. The results reported here suggest that among the class of non-industrial countries, colonial heritage does matter for former colonies in Sub-Saharan Africa.

¹⁹The convergence effect is determined by the coefficient on $\ln q60$ from column (7) of Table 3.

Parameter estimates from an augmented Solow growth model—augmented further to specify the initial technology as a function of colonial heritage, show that the Sub-Saharan growth experience has been dramatically compromised by its colonial past. Illustrative growth decompositions suggest that approximately 84 percent of the growth gap between Sub-Saharan Africa and other non-industrial countries is indirectly related to its colonial past. Moreover, the growth decompositions suggest Sub-Saharan Africa's colonial legacy hampered growth through three mechanisms: A lower propensity for investment in physical capital; a lower propensity for open trade policies; and a higher incidence of having a tropical geography.

The results reported here are also at odds with recent "geography as destiny" (Sachs and Bloom, 1998) and "ethnic diversity as destiny" (Easterly and Levine, 1997) interpretations of the Sub-Saharan African growth experience. This results reported in this paper suggest that, to a large extent, Sub-Saharan Africa's "colonial past is destiny". At least over the 1960 - 1985 time period, Sub-Saharan Africa's growth path was determined by its colonial past. The reported growth decomposition certainly permits this interpretation, as the variables measuring colonial heritage indirectly and implicitly account for almost of the growth differential attributed to the significant determinants of growth.

There are possible limitations of both the methodology and growth decomposition. In general, the econometric specification upon which the parameter estimates were based, could suffer from specification error, endogeneity problems, and data measurement errors.²⁰ The growth decomposition, as derived in this paper, is based upon a simple linear relationship, that need not be the actual structure determining the relationship between a country's colonial heritage and the other determinants of long-run growth.

Notwithstanding the limitations, the augmented Solow growth model fit the sample

²⁰Temple (1999), provides a good overview of these and others problems that can occur when estimating cross-country growth models with cross section data.

data fairly well—the adding up restrictions of the model could not be rejected, and the parameter estimates were stable with respect to two different human capital measures.²¹ In this context, the growth decomposition that suggests a dramatic effect of colonial heritage on long-run growth in Sub-Saharan Africa, is illustrative. Even without the illustrative growth decomposition, the parameter estimates from the growth specifications suggest that the colonial heritage of Sub-Saharan Africa accounts directly for approximately 86 percent of the 1960 - 1985 growth gap between Sub-Saharan African countries and the other non-industrial countries in the sample.

June, 2000
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²¹Hoeffler (2000), and Murthy and Ukpolo (1999) also find that the augmented Solow growth model can account for the growth experience of Sub-Saharan Africa.

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Table 1
Colonial Heritage Of Non-Industrial Countries

<u>Country</u>	<u>Colonial Heritage</u>	<u>Metropolitan Country</u>	<u>Date of Independence</u>
<i>Afghanistan</i>	<i>No</i>		
<i>Algeria</i>	<i>Yes</i>	<i>France</i>	<i>1962</i>
<i>Angola</i>	<i>Yes</i>	<i>Portugal</i>	<i>1962</i>
<i>Argentina</i>	No		
<i>Bahrain</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1971</i>
<i>Bangladesh</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1971</i>
<i>Barbados</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1966</i>
<i>Benin</i>	<i>Yes</i>	<i>France</i>	<i>1960</i>
<i>Bolivia</i>	No		
<i>Botswana</i>	No		
<i>Brazil</i>	No		
<i>Burkina Faso</i>	<i>Yes</i>	<i>France</i>	<i>1960</i>
<i>Burindi</i>	<i>Yes</i>	<i>Belgium</i>	<i>1962</i>
<i>Cameroon</i>	<i>Yes</i>	<i>France</i>	<i>1960</i>
<i>Central African Republic</i>	<i>Yes</i>	<i>France</i>	<i>1960</i>
<i>Chad</i>	<i>Yes</i>	<i>France</i>	<i>1960</i>
<i>Chile</i>	No		
<i>Columbia</i>	No		
<i>Congo</i>	<i>Yes</i>	<i>France</i>	<i>1960</i>
<i>Costa Rica</i>	No		
<i>Cyprus</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1960</i>
<i>Dominican Republic</i>	<i>No</i>		
<i>Ecuador</i>	No		
<i>Egypt</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1922</i>
<i>El Salvador</i>	No		
<i>Ethiopia</i>	No		
<i>Fiji</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1970</i>
<i>Gabon</i>	<i>Yes</i>	<i>France</i>	<i>1960</i>
<i>Gambia</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1965</i>
<i>Guatemala</i>	No		
<i>Guinea</i>	<i>Yes</i>	<i>France</i>	<i>1958</i>
<i>Guyana</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1966</i>
<i>Haiti</i>	No		
<i>Honduras</i>	No		
<i>HongKong</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1985</i>
<i>Iceland</i>	<i>Yes</i>	<i>Denmark</i>	<i>1918</i>
<i>India</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1947</i>
<i>Indonesia</i>	<i>Yes</i>	<i>Netherlands</i>	<i>1949</i>
<i>Iran</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1906</i>
<i>Iraq</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1932</i>
<i>Ivory Coast</i>	<i>Yes</i>	<i>France</i>	<i>1960</i>
<i>Jamaica</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1962</i>
<i>Jordan</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1946</i>
<i>Kenya</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1963</i>
<i>Korea</i>	<i>Yes</i>	<i>Japan</i>	<i>1945</i>
<i>Kuwait</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1961</i>
<i>Lesotho</i>	No		
<i>Liberia</i>	No		
<i>Luxembourg</i>	No		

Table 1 (continued)
Colonial Heritage Of Non-Industrial Countries

<u>Country</u>	<u>Colonial Heritage</u>	<u>Metropolitan Country</u>	<u>Date of Independence</u>
<i>Madagascar</i>	<i>Yes</i>	<i>France</i>	<i>1960</i>
<i>Malawi</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1964</i>
<i>Malaysia</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1957</i>
<i>Mali</i>	<i>Yes</i>	<i>France</i>	<i>1959</i>
<i>Malta</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1964</i>
<i>Mauritania</i>	<i>Yes</i>	<i>France</i>	<i>1960</i>
<i>Mauritius</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1968</i>
<i>Mexico</i>	No		
<i>Morocco</i>	No		
<i>Mozambique</i>	<i>Yes</i>	<i>Portugal</i>	<i>1975</i>
<i>Myanmar</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1948</i>
<i>Nepal</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1959</i>
<i>Nicaragua</i>	No		
<i>Niger</i>	<i>Yes</i>	<i>France</i>	<i>1960</i>
<i>Nigeria</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1960</i>
<i>Oman</i>	No		
<i>Pakistan</i>	No		
<i>Panama</i>	No		
<i>Papua New Guinea</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1975</i>
<i>Paraguay</i>	No		
<i>Peru</i>	No		
<i>Philippines</i>	<i>Yes</i>	<i>United States</i>	<i>1946</i>
<i>Rwanda</i>	<i>Yes</i>	<i>Belgium</i>	<i>1962</i>
<i>Saudi Arabia</i>	No		
<i>Senegal</i>	<i>Yes</i>	<i>France</i>	<i>1959</i>
<i>Sierra Leone</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1961</i>
<i>Singapore</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1957</i>
<i>Somalia</i>	<i>Yes</i>	<i>Italy</i>	<i>1960</i>
<i>South Africa</i>	No		
<i>Sri Lanka</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1948</i>
<i>Sudan</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1956</i>
<i>Surinam</i>	<i>Yes</i>	<i>Netherlands</i>	<i>1975</i>
<i>Swaziland</i>	No		
<i>Syria</i>	<i>Yes</i>	<i>France</i>	<i>1941</i>
<i>Taiwan</i>	No		
<i>Tanzania</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1964</i>
<i>Thailand</i>	No		
<i>Togo</i>	<i>Yes</i>	<i>France</i>	<i>1960</i>
<i>Trinidad</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1962</i>
<i>Tunisia</i>	<i>Yes</i>	<i>France</i>	<i>1956</i>
<i>Uganda</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1962</i>
<i>United Arab Emirates</i>	No		
<i>Uruguay</i>	No		
<i>Venezuela</i>	No		
<i>Yemen</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1967</i>
<i>Zaire</i>	<i>Yes</i>	<i>Belgium</i>	<i>1960</i>
<i>Zambia</i>	<i>Yes</i>	<i>United Kingdom</i>	<i>1964</i>
<i>Zimbabwe</i>	No		

Source: Bertocchi and Canova (1999), Collier's and Britannica Encyclopedia

Table 2
Period Average and Standard Deviation Of Variables*

Variable	All Countries	Former Colonies	African Countries	African Colonies
<i>lnq85 - lnq60</i>	.397 (.482)	.395 (.527)	.233 (.476)	.169 (.457)
<i>lnq60</i>	7.31 (.725)	7.09 (.615)	6.83 (.488)	6.78 (.409)
<i>lnPOPN</i>	2.002 (.107)	1.987 (.099)	2.008 (.082)	2.01 (.084)
<i>lnPKAP</i>	2.64 (.498)	2.60 (.522)	2.49 (.549)	2.43 (.525)
<i>lnHKAP1</i>	1.17 (.907)	1.01 (1.03)	.457 (.822)	.362 (.831)
<i>lnHKAP2</i>	1.13 (.651)	.967 (.725)	.699 (.655)	.573 (.645)
ACCESS	.256 (.439)	.269 (.448)	.412 (.499)	.379 (.494)
OPEN	.209 (.345)	.208 (.360)	.095 (.246)	.097 (.258)
TROPIC	.763 (.394)	.815 (.364)	.906 (.256)	.975 (.083)
AVELF	.427 (.312)	.507 (.313)	.648 (.258)	.674 (.242)
DIFREL	.333 (.364)	.186 (.253)	.175 (.211)	.174 (.219)
<i>N</i>	78	52	34	29

Notes:

* Standard deviations are in parentheses.

N = number of countries. Relative to the 97 non-industrial countries reported in Table 1, the summary statistics reported here, as well as the subsequent parameter estimates, are for only those countries for which observations are available for every exogenous variable in the growth specification.

Table 3
Parameter Estimates Of The Human Capital Augmented Solow Model
(Mankiw-Romer-Weil Human Capital Variable)

Regressand: $\ln q_{85} - \ln q_{60}$ (Log difference of GDP per working-age person 1960 - 1985)

Specification:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Regressors:							
Constant	.32 (.505)	1.18 (1.01)	1.53 (.928) ^c	1.59 (1.03)	1.83 (.992) ^a	1.60 (.970) ^c	1.70 (.948) ^c
$\ln q_{60}$	.009 (.069)	-.309 (.064) ^a	-.362 (.060) ^a	-.366 (.065) ^a	-.348 (.062) ^a	-.331 (.062) ^a	-.345 (.062) ^a
$\ln \text{POP}_N$	-	-.059 (.374)	.032 (.374)	.018 (.383)	-.007 (.405)	.044 (.396)	.039 (.392)
$\ln \text{PKAP}$	-	.519 (.116) ^a	.570 (.107) ^a	.571 (.106) ^a	.532 (.101) ^a	.511 (.099) ^a	.492 (.098) ^a
$\ln \text{HKAP}_1$	-	.194 (.067) ^a	.075 (.069)	.077 (.069)	.034 (.073)	.005 (.077)	.019 (.079)
<i>AFRICA</i>	-	-	-.346 (.101) ^a	-.342 (.107) ^a	-.321 (.102) ^a	-.087 (.128)	-.049 (.113)
<i>COLONY</i>	-	-	-	-.013 (.095)	-.083 (.088)	.043 (.114)	.032 (.116)
<i>ACCESS</i>	-	-	-	-	-.002 (.111)	-.037 (.104)	-.065 (.110)
<i>OPEN</i>	-	-	-	-	.278 (.139) ^b	.312 (.138) ^b	.403 (.143) ^a
<i>TROPIC</i>	-	-	-	-	-.196 (.112) ^b	-.174 (.110)	-.182 (.111) ^c
<i>AVELF</i>	-	-	-	-	.036 (.156)	.037 (.153)	.048 (.155)
<i>DIFREL</i>	-	-	-	-	-.160 (.152)	-.073 (.146)	-.053 (.148)
<i>INTER1</i>	-	-	-	-	-	-.332 (.167) ^b	-.281 (.170) ^c
<i>INTER2</i>	-	-	-	-	-	-	-.568 (.331) ^c
<i>Restriction : $F_{1,n-k}$</i>	-	2.88	2.93	2.51	1.89	1.96	1.89
R^2	.0002	.396	.457	.457	.537	.549	.562
\bar{R}^2	-.013	.363	.419	.411	.467	.460	.473
<i>Implied λ</i>	-.0004	.011	.012	.012	.012	.011	.012
<i>Sample Size</i>	78	78	78	78	78	78	78

Notes:

Heteroscedastic consistent standard errors in parentheses.

$\text{INTER1} = \text{AFRICA} * \text{COLONY}$

$\text{INTER2} = \text{AFRICA} * \text{COLONY} * \text{AVELF} * \text{OPEN}$

$\lambda = (n + g + \mu)(1 - \alpha - \beta)$ = rate of convergence to steady state GDP per capita.

^a Significant at the .01 level

^b Significant at the .05 level

^c Significant at the .10 level

Table 4
Parameter Estimates Of The Human Capital Augmented Solow Model
(Barro-Lee Human Capital Variable)

Regressand: $\ln q_{85} - \ln q_{60}$ (Log difference of GDP per working-age person 1960 - 1985)

Specification:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Regressors:							
Constant	.32 (.505)	.506 (.897)	1.51 (.788) ^c	1.56 (.904) ^c	1.82 (.899) ^a	1.76 (.872) ^b	1.78 (.849) ^b
$\ln q_{60}$	.009 (.069)	-.236 (.069) ^a	-.368 (.059) ^a	-.371 (.064) ^a	-.335 (.057) ^a	-.341 (.053) ^a	-.344 (.053) ^a
$\ln \text{POP}_N$	-	-.007 (.383)	.071 (.368)	.057 (.381)	-.032 (.413)	.014 (.401)	.009 (.398)
$\ln \text{PKAP}$	-	.603 (.117) ^a	.600 (.109) ^a	.602 (.107) ^a	.551 (.104) ^a	.522 (.103) ^a	.508 (.102) ^a
$\ln \text{HKAP}_2$	-	.172 (.093) ^a	.090 (.092)	.090 (.092)	.004 (.084)	.001 (.077)	.003 (.083)
<i>AFRICA</i>	-	-	-.398 (.109) ^a	-.395 (.114) ^a	-.335 (.120) ^a	-.069 (.124)	-.028 (.129)
<i>COLONY</i>	-	-	-	-.014 (.099)	-.112 (.084)	.006 (.108)	-.002 (.107)
<i>ACCESS</i>	-	-	-	-	.005 (.112)	-.019 (.106)	-.056 (.112)
<i>OPEN</i>	-	-	-	-	.322 (.145) ^b	.339 (.141) ^b	.447 (.153) ^a
<i>TROPIC</i>	-	-	-	-	-.203 (.124) ^b	-.182 (.120)	-.195 (.115) ^c
<i>AVELF</i>	-	-	-	-	.017 (.160)	.004 (.156)	.019 (.159)
<i>DIFREL</i>	-	-	-	-	-.179 (.158)	-.109 (.153)	-.072 (.155)
<i>INTER1</i>	-	-	-	-	-	-.329 (.153) ^b	-.297 (.160) ^c
<i>INTER2</i>	-	-	-	-	-	-	-.599 (.331) ^c
Restriction : $F_{1,n-k}$	-	3.53	3.39	2.95	1.71	1.78	1.70
R^2	.0001	.373	.470	.471	.556	.569	.582
\bar{R}^2	-.012	.338	.434	.426	.482	.489	.497
Implied λ	-.0004	.008	.012	.013	.012	.012	.012
Sample Size	78	78	78	78	78	78	78

Notes:

Heteroscedastic consistent standard errors in parentheses.

$\text{INTER1} = \text{AFRICA} * \text{COLONY}$

$\text{INTER2} = \text{AFRICA} * \text{COLONY} * \text{AVELF} * \text{OPEN}$

$\lambda = (n + g + \mu)(1 - \alpha - \beta)$ = rate of convergence to steady state GDP per capita.

^a Significant at the .01 level

^b Significant at the .05 level

^c Significant at the .10 level

Table 5
Effects Of Sub-Saharan African Colonial Heritage
On The Determinants Of Growth For Non-industrial Countries

<i>Dependent Variable</i>	<i>Constant</i>	<i>INTER1</i>	<i>INTER2</i>	<i>R²</i>	<i>Average Value of Dependent Variable For Countries without a Sub-Saharan African Colonial Heritage</i>
lnPKAP	2.74 (.069) ^a	-.377 (.107) ^a	.191 (.191)	.117	2.76
TROPIC	.591 (.068) ^a	.265 (.059) ^a	.333 (.097) ^a	.227	.637
OPEN	.276 (.056) ^a	-.176 (.077) ^a	-.009 (.115)	.063	.255
lnq60	7.60 (.108) ^a	-.855 (.119) ^a	.098 (.204)	.314	7.64
N = 78					

Notes:

Heteroscedastic consistent standard errors in parentheses.

^a Significant at the .01 level

^b Significant at the .05 level

^c Significant at the .10 level

Table 6
Decomposition Of Growth Differential Between
Former Sub-Saharan African Colonies And Non-Industrial Countries

Variable	<i>Sub-Saharan African growth differential accounted for by variable</i>	<i>Percentage of difference in variable explained by Colonial heritage</i>	<i>Growth differential implicitly explained by Colonial heritage through variable</i>
	<i>(1)</i>	<i>(2)</i>	<i>(3)</i>
I.			
<i>lnPKAP</i>	.1624	1.0	.1624
<i>OPEN</i>	.0637	1.0	.0637
<i>TROPIC</i>	.0615	.84	.0518
<i>Total effect through significant growth determinants:</i>	.2876	.97	.2779
II.			
<i>INTER1</i>	.2810	1.0	.2810
<i>INTER2</i>	.0342	1.0	.0342
<i>Total effect through Colonial heritage:</i>	.3152	1.0	.3152
III.			
<i>Convergence effect:</i>	- .2967	1.0	-.2967
<i>Joint effect through significant growth determinants and Colonial heritage:</i>	.3061	.97	.2964