DSGD DISCUSSION PAPER NO. 8

CROSS-COUNTRY TYPOLOGIES AND DEVELOPMENT STRATEGIES TO END HUNGER IN AFRICA

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ABSTRACT

A key motivation behind this study is to explore the many patterns of interactions between economic and non-economic factors in sub-Saharan Africa (hereafter referred to as Africa) in order to map out a typology of different types of country situations and thus, corresponding future options to develop strategies to end hunger and poverty in the region. The study builds on the earlier work of Irma Adelman and Cynthia Morris who argued that economic development is a dynamic, multi-faceted, nonlinear, and malleable process, a process explained by the many complex interactions between social, economic, political and institutional changes.

As in Adelman and Morris, we use factor analysis to reduce a large number of variables into a manageable set of key factors. Next, using the newly developed classification and regression tree technique (CART), we link the outcome variables, such as per capital GDP and the prevalence of child malnutrition, with this smaller set of factors. This overcomes the limitations of Adelman and Morris' work that mixed the outcome and explanatory variables in their analysis. The analysis helps identify the most important factors for each outcome indicator, which provides guidance for defining the development of a typology and exploring future strategy options associated with each country type.

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I. INTRODUCTION

Designing viable strategies to stimulate economic growth and development in sub-Saharan Africa (hereafter Africa) continues to employ considerable debate and analysis among development theorists and practitioners, donors, and African policy makers. Of considerable concern is the challenge of designing strategies that will achieve the Millennium Development Goals (MDGs) of halving poverty and hunger by 2015 on the continent. Already, African governments have been recommitting themselves to designing future strategies targeted at achieving these or other similar goals through the New Partnership for African Development (NEPAD), the Poverty Reduction Strategy Papers (PRSPs), and other initiatives. Donors too are making difficult choices about how to better allocate their aid resources across and within countries in Africa in order to help Africa achieve these goals. Therefore, there currently exists both a growing and practical need for an analytical framework that explores cross-country typologies to inform the design of development strategies. The need is particularly great for Africa, which is not only extremely diverse but also considered the region furthest from attaining the MDGs (UNDP 2003).

The primary objective of this study is to distinguish the many patterns of interactions between economic and non-economic factors in sub-Saharan Africa. These factors can be used to map out a country typology and help determine corresponding development strategies by type of country to end hunger and poverty in the region.

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Motivated by both lessons learned from past mistakes and the evolution of development theory over the past half-century, this study builds on and extends the earlier work of Adelman and Morris (1967) to provide a typology with six types of countries for 37 African countries. The typology is particularly relevant for informing national and donor strategies aimed at reducing malnutrition and increasing growth.

This paper is organized in six parts. Section II briefly highlights the background and motivation of the study. Section III discusses the choice of factor and CART analysis as the methodological approach and describes each technique in detail, as well as the data used. Section IV presents the factor and CART results and describes how these results help map out a development typology. Section V concludes with policy implications.

II. BACKGROUND

Development strategies over the past half-century have reflected shifts in ideology, international environment, accumulated knowledge and learning, and chosen policy thrusts. Often, monocausal explanations dominated, either linking under-development to inadequate physical capital and entrepreneurship, excessive state intervention, incorrect relative prices and resistance to trade liberalization, or ineffective government institutions. Traditionally, development strategies have been shaped according to the prevailing development paradigm. For example, believing that LDCs were hindered by their physical capital constraints, many developing countries in the early 1950s and 1960s adopted centrally planned and capital-intensive strategies. With a rise in thinking that LDCs suffered from adverse terms of trade for their exports, countries and donors then promoted import substitution strategies during the 1970s to help LDCs catch up with industrialized countries. Due to the dismal performance of the policy in many countries, development thinking shifted to more market-oriented and outward-oriented policies in the 1980s and early 1990s. Indeed, the strategies prescribed by the "Washington Consensus" represented this shift with their emphasis on structural adjustment to "get prices right." However, the disappointing performance of some Latin American and African countries that adopted such prescriptions, compared with the rapid growth in East Asian countries that resorted to alternative and unorthodox strategies, demonstrated rather strongly that countries follow different paths to development. In reality, development trajectories are dynamic, malleable, and even elusive, and therefore simple one-size-fits-all strategies do not work (Adelman 1999; Easterly 2002; Rodrik 2003).

This is particularly true for Africa. A more useful approach would, on the one hand, acknowledge that Africa is not a homogenous entity. Indeed, the continent consists of numerous countries with diverse agro-climatic resources, livelihood options, human and institutional capital, histories, and social and political experiences. On the other hand, many African countries are small and some countries do share similar characteristics and face similar development constraints. It is inefficient to simply treat

all countries separately and fail to take advantage of economies of scale. Instead, it is worthwhile to group countries into different types as part of a typology defined along different dimensions and thereby search for shared solutions among similar countries.

Adelman and Morris (hereafter A&M) followed this approach in their seminal book *Society, Politics, and Economic Development: A Quantitative Approach* (1967) where they argued strongly that development is a multifaceted and nonlinear process, and countries at different stages of development require different strategies. Believing that development strategies must be designed according to the social, economic, and political characteristics of each country, they incorporated 41 variables over the period 1957-1962 for seventy-four of the least developed countries (LDCs) at that time. Using the technique of factor analysis, they focused their attention on determining the key social and political variables that demonstrated the greatest influence on GNP per capita in 1961. The analysis revealed that these variables could be grouped into four main factors with the first factor, subsequently named the "socioeconomic development index," explaining fifty-three percent of inter-country variations in GNP per capita. Using the country factor scores for the "socioeconomic development index," A&M ranked the countries and divided them into three groups of high, medium, and low development. The countries within each of these three groups or types demonstrated similar socio-political characteristics. In this way, their study offered a means for identifying priority areas for intervention in different type of countries.

This paper builds on the philosophy and the tool of factor analysis underlying A&M's work while also extending their research in several ways. First, more structure is imposed on the analysis by initially grouping the data into several classes of variables that describe certain broad phenomena (e.g. governance or political variables). Due to methodological limitations at that time, A&M did not distinguish the outcome variables and the independent variables in the factor analysis. Thus, a second methodological contribution made by the present study is the use of the newly developed classification and regression tree (CART) technique to explore links between the final factors matrix and outcome variables, such as national income and child malnutrition.

This methodology is quite different from typical cross-country regressions, which are inappropriate for guiding development strategies in two main respects. First, cross-country regressions are most useful when they are guided by theory. Yet, as discussed above, there is neither a uniform theory about the development process nor does development occur along a linear continuum. Therefore, it is unsuitable to impose a structural, linear relationship on variables on the common surface associated with the development process. Secondly, cross-country regressions often include dummy variables to capture large differences among regions. For example, in the global cross-country regression empirics, a dummy variable for Africa is often imposed, masking the diverse nature of the continent and providing little practical information from which African countries can benefit.

Despite such shortcomings, however, cross-country growth regressions are useful for exploring correlates of growth and for uncovering key explanatory variables to consider in our analysis. For example, the variables of interest for factor analysis and CART analysis, and the criteria used to initially group the variables into categories, were primarily based on the large body of cross-country regression literature.

III. METHODOLOGICAL APPROACH AND DATA SOURCES

Since development is multi-dimensional, there exist many outcome variables to measure the development process. However, in light of the MDGs, ending hunger is the top of the agenda for many countries and their donor partners. In Africa, the problem is particularly severe with approximately one in three children underweight for their age. Therefore, in this paper, we use the prevalence of children under age 5 who are underweight as an outcome indicator to show how to identify a set of key factors and map out a unique country typology with respect to this outcome variable.[1] Nevertheless, the framework can be easily adopted for other outcome variables of interest. For example, we can also use per capita GDP and growth as outcome variables. As shown later in the paper, depending on the chosen outcome variable, the top factors may vary and in turn affect the final typology. Despite this non-uniqueness, the methodology does help to highlight respective development strategy options along different dimensions.

Given multiple and vague measurements surrounding development conditions and outcomes that often measure the same phenomena, we first use factor analysis as in A&M to extract only the most relevant information describing these phenomena. Once we have a unique set of measurements surrounding these concepts, we would then like to look at the relationships of these concepts with the prevalence of child malnutrition in order to begin mapping a development typology that has distinctive options for informing hunger reduction strategies. In order to accomplish this, we use a classification and regression tree analysis (CART) technique. We now review the two techniques in more detail.

Factor Analysis

Factor analysis is an inductive statistical method that helps to discern a minimum set of underlying factors patterns from a large data set, so that these factors are essentially independent subgroups partitioned from the fuller data set. The approach is especially

[1] Moreover, we use this variable because initially the work was commissioned by the United States Agency for International Development (USAID) to support the Initiative to Ender Hunger in Africa.

useful for exploratory research where a theory may yet be insufficient to empirically test or validate. Rather than a study of causality, factor analysis should be interpreted as a study of mutual association that disentangles interdependence among multiple qualitative and quantitative variables (Adelman and Morris 1967).

From an algebraic perspective, the goal of factor analysis is to represent a large set of variables in a given data set as functions of a few underlying common factors $f_1, f_2, \ldots, f_m$ such that:[2]

$$x_1 = \lambda_{11} f_1 + \lambda_{12} f_2 + \ldots + \lambda_{1m} f_m + e_1 \qquad (1)$$

$$x_2 = \lambda_{21} f_1 + \lambda_{22} f_2 + \ldots + \lambda_{2m} f_m + e_2$$

$$\vdots$$

$$x_p = \lambda_{p1} f_1 + \lambda_{p2} f_2 + \ldots + \lambda_{pm} f_m + e_p$$

The coefficients λ_{ij} are referred to as *factor loadings* that show the importance of the jth factor f_j to the variable x_i, for all $i = 1, \ldots, p$ and $j = 1,\ldots,m$. This is analogous to regression coefficients in regression analysis and measures the degree to which a variable is closely related to a certain factor pattern. The usual assumption is that the common factors are uncorrelated with the error terms and independent among themselves.

Given that we only have data on the x's in equation (1), the problem in factor analysis is really about "recovering" unknown common factors that represent a group or cluster of original variables that share similar data patterns and regularities (such as those that are highly correlated with each other), and ultimately inverting the relationships to create mutual interdependence. In essence, the common "factors" become linear functions of the initial variables, and thus, although they are far fewer, they can explain much of what the data explains in the variables. Meanwhile, the variables allocated to each factor are nearly independent of the variables allocated to other factors, such that,

[2] See Adelman and Morris for a useful mathematical overview of factor analysis.

the number of factors derived will depend to a large degree on how much the original variables are interrelated or have independent patterns of occurrences among them.

Factor patterns are initially estimated from the correlation matrix through an iterative process that replaces the principal diagonal of the matrix (which is always one) with 'communality' estimates. The communality estimates measure the extent to which common factors can account for the variation in a variable, and thus can be viewed as a goodness-of-fit measure. Since factors corresponding to any correlation matrix are not unique, any rotation or linear combination can simplify the factor structure further by successively reducing variations in the data. In fact, the most commonly used approach and one used in the present study is the *varimax* technique. This technique derives a factor structure that results in simpler and uncorrelated patterns of interrelationships among variables, i.e. ones that are "orthogonal," or independent to each other.

During factor analysis, individual factor scores are also estimated for each observation in the sample and are useful for ranking the observations (such as countries in our case) under each derived factor. The scores are estimated according to a variable's proportional importance to a derived factor, or composite indicator. Although factor analysis works with standardized variables that are equally weighted and considered equally important, final factor scores can be normalized to allow for easier comparisons across factors.

Even though it can handle a wide array of variables, factor analysis is sensitive to the number and type of variables included. For example, variables that have a very low correlation with any other variables can lower the communality of any given variable, especially if additional factors are not included. Similarly, arbitrarily increasing the number of factors increases the communality estimates for a given variable. To decide on the relevant factors to retain, a threshold criterion, known as the *eigenvalue*, can be used on how much the overall variance of a rotated factor matrix is accounted for by a single factor. The actual threshold chosen is obviously subject to the data and variables used.

As mentioned above, A&M's study represents one of the most well known uses of factor analysis in development economics. Immediately following A&M's study, during the late 1960s and early 1970s, there was a flurry of research using the technique of factor analysis. For example, the method was used by Tsantis (1969) to examine relationships between politics and economic development, by Kobrin (1976) to understand links between foreign direct investment and industrialization, and by Adelman and Dalton (1971) to uncover the forces of micro-development within an Indian village. More recent studies, however, focus primarily on the predictive power of A&M's original work rather than utilize the approach as a means for answering new research questions. For instance, Temple and Johnson (1998) use cross-country regression analysis to demonstrate causality between A&M's country factor scores in the socioeconomic development index and per capita GDP between 1960 and 1985.

The Classification And Regression Tree Analysis (CART)

CART is a nonparametric technique developed by Breiman et al. (1984). It has been widely used in many fields, particularly in clinical and marketing research, to identify key variables and create decision rules. In the field of finance, Kelly and Gráda (2000) use it to analyze financial market contagion. In the development literature, Yohannes and Webb (1999) have used CART to identify indicators of vulnerability to famine in Africa. Like factor analysis, classification and regression tree analysis is motivated by the need to deal with the kinds of complex multivariate data and analytical processes that arise in the social science disciplines. Also like factor analysis, CART analysis does not make any assumptions about the distribution and interactions of variables but it nonetheless helps to uncover complex structures in the data set.

CART is specifically useful for analyzing classification issues for either categorical or continuous variables, with the former producing a classification tree while the latter produces a regression tree. For the classification tree, CART analysis provides a better understanding of the interaction of variables or conditions with respect to when they best fit in one class of a certain phenomena rather than another (e.g. high malnutrition versus low malnutrition), in order to produce accurate classifiers and further

insights into the predictive structure of the data (Breinam *et al*., 1984). In building a tree, pre-defined splitting rules and goodness-of-split criteria are used to split the nodes along an entire tree structure, as well as other criteria for choosing the optimal number of tree nodes.

For the regression tree, CART seeks to produce a tree-structured predictor of a continuous outcome variable while explaining the relationship that exists between the outcome (or dependent variable) and predictor variables (or independent variables). The steps in the tree building process can be viewed as a form of binary recursive partitioning. In other words, at each node, CART splits data into groups that are as homogenous as possible, regarding the mean value of the dependent (or outcome) variable as the predicted value. After splitting the first parent (or root) node into two child nodes, the process continues until a terminal node is reached when all the predictors have been exhausted or certain criteria have been met. The various paths between the parent and terminal nodes characterize unique groupings.

For regression trees, one commonly adopted splitting rule is the least squares criterion. Using a within-node sum of squares (SS) to measure the 'impurity' of a node, or more specifically,

$$SS(j) = \sum \left(y_{ij} - \bar{y}_j \right)^2, \forall i = 1,..., N \qquad (2)$$

where, y_{ij} = individual values of the dependent variable at node *j*, and $\bar{y}_j$ = the mean of the dependent variable at node *j*. Now, given a split '*s*' between two groups or child nodes (j_L) and (j_R), a goodness-of-split is measured as,

$$\phi(s, j) = SS(j) - SS(j_L) - SS(j_R) \qquad (3)$$

The best split is therefore one where there is maximum reduction in the impurity of a node, in this case the parent node *j*. Given many series of splitting options, the simple rule is to choose that split which will result in the highest $\phi(s, j)$ in equation (3).

For our purposes, we compare each series of potential splits at the parent node only to avoid running into a degrees of freedom problem due to a small sample size (N = 37). Ultimately, the best predictors for each series of regressions are ranked based on their goodness-of-split measurements, which provides sufficient and useful information on the degree to which certain factors from the factor analysis are associated with a key outcome variable.

In summary, the analytical approach used in this study proceeds through two logical steps. First, factor analysis is conducted to extract key underlying factors that best describe the complete set of available information. Secondly, the potential relationships or correlates between the set of underlying factors and a few key outcome variables is explored further using 'classification and regression tree analysis' (CART) in order to delineate unique development patterns or typologies across countries, and ultimately, future strategy options under each typology.

Data Sources and Classification

In order to encompass the economic, social, political, physical, and cultural aspects of the development process, 63 variables were collected and examined for 37 African countries. A few simple criteria guided the variable selection procedure. Specifically, the variables needed to be available for most of the countries in the sample, conceptually relevant, reliable to some degree, and comparable across countries. Variables that had particular relevance to the comparison of development challenges and constraints across countries in Africa were preferred. Another important consideration was the ultimate goal of discerning any unique interrelationships between many of these key variables in distinguishing unique development typologies across countries as a way for informing future options for developing strategies to end hunger and poverty in the region.[3]

[3] In the future, this analysis may be widened to a global sample. Under those circumstances, more variables would be included.

These variables consist of a mixture of raw data and indices and come from international organizations, academic research, and surveys performed by policy think tanks. Although there are exceptions, much of the data on development level, infrastructure, security, natural disasters, agricultural potential, and human disease come from the World Bank, World Health Organization, the Food and Agricultural Organization, the United Nations Development Program, and the Emergency Events Database. Most of the governance and macroeconomic policy variables are indices created by Freedom House and the Heritage Foundation. We recognize that these organizations have ideological biases and that the index rankings they provide are highly subjective. However, subjective indices are possibly unavoidable when attempting to quantify concepts such as "foreign investment restrictions" and "existence of civil liberties" and when they are constructed based on information gained from surveys. Moreover, a recent study on governance found that while the Heritage Foundation is notable for assigning higher scores to right-of-center governments, the magnitude of this bias is quite small (Kaufmann, Kraay, and Mastruzzi 2003).

To help provide more structure, given the multiple variables and various subsets of these variables, variables were classified according to particular development concepts. This also helps avoid the likelihood of some variables being randomly associated with a factor during factor analysis, while also reducing the risk of artificially lowering the communality estimates by including too many variables in our small sample size. Adelman and Morris included all variables in the factor analysis, and thereby implicitly assumed that all the social, political and economic factors are totally orthogonal. By contrast, pre-grouping the variables lessens the strength of this orthogonal assumption.

Moreover, this decision reflects our confidence that past empirical evidence provides us with a certain degree of *a priori* knowledge about which phenomena are independently important for development in general and Africa in particular. For instance, Gallup, Sachs, and Mellinger (1998) have demonstrated that geography impacts macroeconomic growth through its effects on disease burdens and agricultural

productivity, among other channels. Sachs and Warner (1995, 1997) have also shown that geography, represented by physical distance and access to waterways, affects how well a country can integrate with world markets. Findings by Easterly and Levine (1995) indicated that Africa's ethnic diversity accounts for 35 percent of the region's growth differential with the rest of the world. Work by Collier (1998) highlights that civil war reduces GDP per capita by 2.2 percent, and Stewart (2003) shows that countries in conflict are more unlikely to achieve the MDGs. According to Kaufmann, Kraay, and Zoido-Lobaton (1999), governance demonstrates a strong causal relationship with development, and Chong and Calderon (1997) show that institutional improvements reduce the severity and incidence of poverty. Altogether, eleven broad development concepts were identified from the set of variables in our data set: development outcome; geography, macroeconomic environment; level of security; governance; natural disasters; infrastructure; agricultural potential; cultural homogeneity; human disease, and other factors (**Table 1**).

We keep the original outcome variables and do not transform them into factors. Given their relative importance as stand alone measurements, HIV/AIDS prevalence and long-term investment rates were removed from the factor analysis and used solely as independent variables in the tree regression analysis. Therefore, the actual factor analysis incorporated 56 variables rather than 58.

Table 1. Final Groupings and Variables

Outcome Variables[1]
GDP per capita
Agricultural GDP per capita
Long-term GDP growth, twenty-year average
Percent of children under five who are undernourished

Macroeconomic environment
Foreign investment restrictions
Banking and finance restrictions
Euromoney country credit worthinesss index
Weighted average tariff rate
Inflation, annual % GDP deflator
Weighted long run average annual rate of inflation

Governance
Promotion of political rights index
Existence of civil liberties index
Voice and accountability index
Burdensome regulation index
Government effectiveness index
Regulatory quality index
Rule of law index
Control of corruption index
Protection of property rights index
Prevalence of black market transactions index

Social and physical infrastructure
Child immunization, DPT (% under 12 months)
Total public spending on education (% of GDP)
Gross % of females enrolled in primary school
Total public spending on health (% of GDP)
Percent of total roads paved
Density of roads

Cultural homogeneity
Ethnolinguistic fractionalization index
Ethnic fractionalization measure
Largest ethnic group (% of total population)
Largest language (% of total population)
Religious fractionalization measure
Largest religion (% of total population)

Geography
Proportion of a country's total land area within 100km of ocean coastline
Proportion of a country's population within 100km of ocean coastline
Proportion of a country's total land area within 100km of an ocean or an ocean-navigable river
Proportion of a country's population within 100km of an ocean or an ocean-navigable river
Percent of land area in drylands
Percent of population living in the drylands
Percent of land area in the tropics
Percent of population living in the tropics

Insecurity
Share of refugees and internally displace people in total population
Years of civil war since 1960
Military expenditure as a % of GNI
Military expenditure as a % of total government expenditure

Natural disasters
Number of droughts since 1965
Number of Insect Infestations since 1965
Number of Floods since 1965
Number of Landslides since 1965

Agricultural potential
Percent of potential arable land actually in use
Potential arable land per agricultural population (ha/person)
Soil without major constraints (% of total area)
Average precipitation 1961-1990 (mm/year)
Actual total renewable water resources (cubic m/capita per year)
Percent area under irrigation (total irrigation / total arable land x 100)

Human diseases
Percent of country area with Malaria
Percent of population living in areas with Malaria
Number of epidemics since 1965
Number of Measles cases reported to the WHO since 1965

Other variables[2]
Prevalence of HIV/AIDS
Long-term investment rate

Notes: A description of variables and data sources is provided in more detail in the Appendix. [1] Key outcome variables not included in the factor analysis.[2] HIV/AIDS and the long-term investment rates were retained due to their relative importance as stand alone variables.

IV. RESULTS

The factor analysis reduced the original set of 58 variables to 18 factors, and as shown in **Table 2**, resulted in one to three factors for each of the nine broadly defined concepts. These factors not only provide a means of measuring these concepts, but also extract the most relevant information about them. The number of factors retained under each concept was determined according to the factor loadings and the eigenvalue. A minimum threshold level of 0.45 was chosen for the eigenvalues, even though the eigenvalue cut-off point was actually much higher in most cases because retaining additional factors offered little explanatory value. The final factor loadings for each variable as well as the factor to which each variable is assigned, the eigenvalue for each factor, and the communalities are provided in **Appendix A**. Although inherently subjective, the names we assigned to each factor index were intended to provide the most accurate description of the aggregate concept being conveyed by the variables underlying each factor. For comparison and ranking purposes, the factor scores for each country were normalized around one hundred with a standard deviation of ten. **Appendix B** lists the country rankings based on different factors.

Table 2. Summary of Final Factors by Initial Classification

Initial classification	Factor 1	Factor 2	Factor 3
1. Infrastructure	Social infrastructure index	Physical infrastructure index	
3. Cultural homogeneity	Ethnic homogeneity index	Religious homogeneity index	
4. Governance	Climate of political freedom index	Strength of legal institutions index	
5. Geography	Degree of land lockedness	Dryland index	Tropics index
6. Insecurity level	Level of insecurity index	--	--
7. Agricultural potential	Land quality and potential index	Access to natural water index	--
8. Natural disasters	Drought index	Floods index	--
9. Human diseases[1]	Malaria prevalence index	Other epidemics index	

Notes: Other key variables were retained in their original format as outcome variables (prevalence of child malnutrition, per capita GDP, and per capita agricultural GDP). Defining the underlying factors is a principle challenge in factor analysis. We believe we have accurately defined the principle indices here based on the relative importance of each variable in explaining the underlying factor. We recommend the reader to periodically refer to the tables in Annex B and C to get a clearer understanding of which variables are 'important' in defining the factors.

[1] The prevalence of HIV/AIDS variable was considered unique and uncorrelated with other disease variables. We chose to use its original data format.

Through regression tree analysis, we then explored the relationships between the factors and our key outcome variable: child malnutrition.[4] In addition to the factors, per capita GDP, per capita agricultural GDP, HIV/AIDS, and long-term investment rate were also used as independent variables. As **Table 3** reveals, per capita GDP demonstrates the greatest association with child malnutrition, followed by per capita agricultural GDP, level of security, social infrastructure, governance and legal institutions, and whether a country is located in the tropics. As shown in Table 3, because per capita GDP is heavily determined by agricultural productivity, a strategy for reducing child malnutrition should accord priority to increasing agricultural productivity and reducing conflict. Unsurprisingly, social infrastructure, which refers to investments in health and education, also requires attention. Governance and legal institutions, a factor that captures government effectiveness, regulatory quality, rule of law, control of corruption, and protection of property rights, also seem to matter.

In order to gain a better understanding of the factors most important in explaining malnutrition, both per capita agricultural GDP and the level of security were used as outcome variables in the CART analysis.[5] For the former, the factors land quality and potential, flood disaster, and drylands all prove to be highly important. In other words, natural endowments and geography play a large role in determining agricultural productivity. For level of security, climate of political freedom, investment and trade environment, monetary policy, tropics, and governance and legal institutions showed the most importance. This supports recent findings that contrary to common belief, most conflict in Africa is primarily driven by unaccountable governments and poor economic policies rather than by entrenched rivalries created by the region's vast ethnic diversity (Collier and Hoeffler 2001).

[4] We define child malnutrition as the proportion of children five years of age or less who are under weight. While the inclusion of stunting, wasting, and nutrient deficiency would provide a more complete picture of child malnutrition, this data was not available for all the countries in our sample.

[5] Since GDP is highly associated with agricultural GDP in Africa, we focus on agricultural GDP here.

Table 3: Results from CART Analysis

Variables and Indices	Degree of Importance
Malnutrition	
Per capita GDP	100
Per capita agricultural GDP	81.66
Insecurity	42.42
Social infrastructure	34.54
Governance and legal institution	25.22
Tropics	20.38
Per capita GDP	
Per capita agricultural GDP	100
Investment and trade environment	77.81
Tropics	62.55
Flood disaster	51.64
Governance and legal institution	45.58
Drylands	27.56
Long-term GDP growth	
Governance and legal institution	100
Degree of landlock	74.36
Ethnic homogeneity	59.43
Tropics	44.66
Drought disaster	40.51
Measles	34.85
Per capita agricultural GDP	
Land quality and potentials	100
Flood disaster	97.86
Drylands	97.24
Malnutrition	5.67
Physical infrastructure	2.66
Social infrastructure	1.56
Insecurity	
Climate of political freedom	100
Investment and trade environment	84.36
Monetary policy	74.48
Tropics	46.83
Governance and legal institution	27.58
Malaria	24.66

Thus far, we have only provided a static and single period overview of cross-country development performance and constraints. In order to uncover those factors that matter most in regards to long-run performance, we use the twenty-year average annual growth rate as an outcome variable. Interestingly, neither of the factor indices capturing aspects of the concept macroeconomic environment shows a high association with long-term GDP growth. Instead, governance and legal institutions show the greatest degree of importance, highlighting the crucial role of governments in directing their countries' economic development in the long run. This echoes the sentiments of economist Arthur Lewis (1965), who noted that "No country has made economic progress without positive stimulus from intelligent governments…On the other hand, there are so many examples of the mischief done to economic life by governments" (p. 376). Moreover, CART reveals that the degree of landlockedness, ethnic homogeneity, tropics, drought disaster, and social infrastructure also are important. Since many of these factors relate to geography and culture, which change very little over time, they highlight the importance of initial conditions in driving growth (Rodrik, 2003).

Based on these results from the CART analysis, we can gain further insight into the unique development types that exist across countries. Ideally, these types would depend on the vast array of factors we identified through factor analysis. However, in order to be both informative and manageable, we have based our typology on malnutrition, per capita agricultural GDP, and level of security. The reason for this is that our overriding goal is to focus on strategies for alleviating malnutrition and, as described above, per capita GDP, per capita agricultural GDP and the level of security prevailing in a country were shown to be highly associated with child malnutrition.

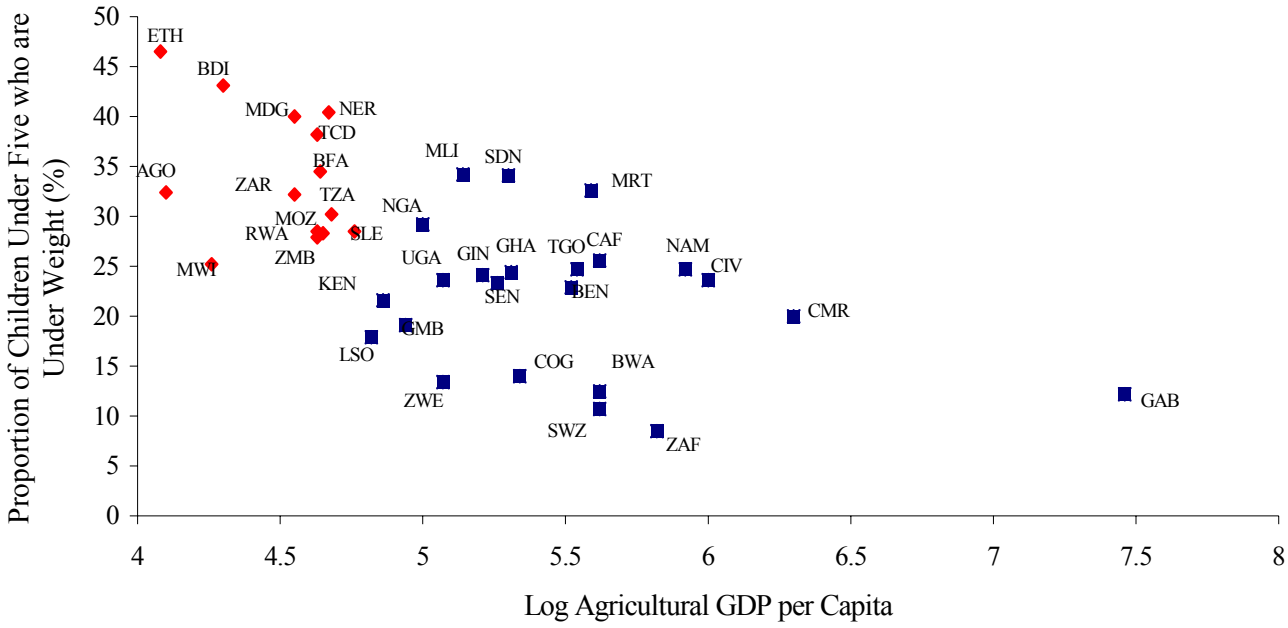
Using the country data on child malnutrition and per capita agricultural GDP, as well as the country factor scores for the level of security, we construct two scatter plots. **Figure 1** plots per capita agricultural GDP against malnutrition and demonstrates a clear negative and linear relationship between the two variables. **Figure 2** plots the degree of insecurity against malnutrition and reinforces the expected finding that countries with a high degree of insecurity generally have higher levels of malnutrition. More importantly,

the relationship depicts a threshold effect that implies that only when a country reaches a certain degree of security can long-term development strategies aimed at reducing hunger and poverty become effective. Below the threshold, establishing a stable and peaceful environment is paramount and has significant effects on reducing the high malnutrition and poverty levels brought on by civil unrest.

Recall that CART analysis splits each independent variable into two distinct groups to establish the best predictor of the dependent variable. In our sample, this means dividing countries into two groups for the degree of insecurity. In both **Figure 1** and **Figure 2**, this distinction is represented by diamonds and squares. It is such a split that uncovers the threshold effect in **Figure 2**. Specifically, Ethiopia, Chad, Rwanda, Central African Republic, Burundi, the Democratic Republic of the Congo, Sierra Leone, Angola, and Sudan have much higher factor scores with regard to the degree of insecurity than the other countries in the sample. The recognition of this threshold effect for security enables us to divide our countries into two simple groups: "high" and "low" insecurity.

Even though some countries within the "high" insecurity group are no longer involved in a civil or cross-border war, they are grappling with the aftermath of protracted conflict. Their priorities consist more of consolidating peace processes, integrating rebels into civilian life, rebuilding infrastructure, and re-settling large populations of internally displaced people and refugees. It is exactly because countries directly involved in or just recovering from conflict has a number of distinct priorities that, out of our three indicators, we use the degree of insecurity as the primary indicator to distinguish cross-country development types. Given more recent events, it could be argued that countries like Ethiopia and Zimbabwe have since crossed the threshold of insecurity in opposite directions. Meanwhile, for countries like Uganda, conflict is mostly localized in the Northern part of the country, limiting direct exposure to its effects to the population within that region. In any case, our framework provides a systematic way to monitor the key variables and can be updated over time to show whether countries are shifting typologies.

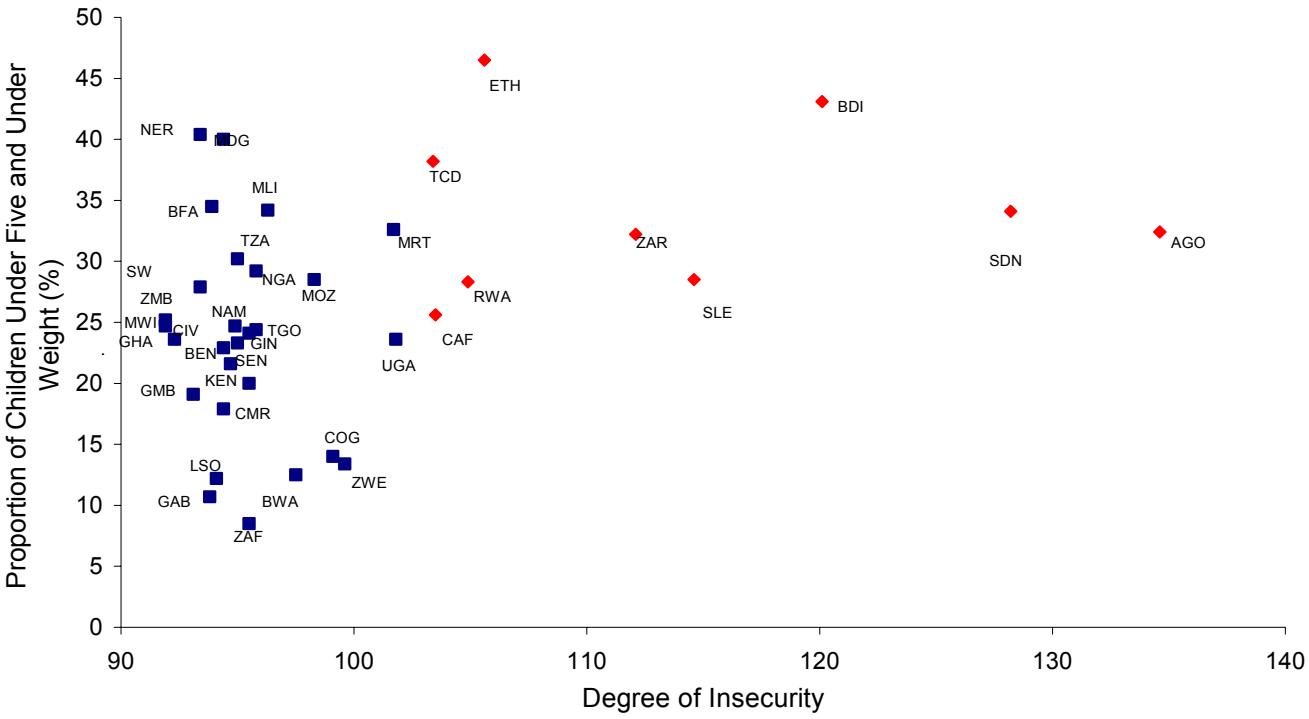
Figure 1: Scatter Plot of Prevalence of Child Malnutrition and Per Capita Ag GDP



Key to Abbreviations:

AGO	Angola	**MWI**	Malawi
BEN	Benin	**MLI**	Mali
BWA	Botswana	**MRT**	Mauritania
BFA	Burkina Faso	**MOZ**	Mozambique
BDI	Burundi	**NAM**	Namibia
CMR	Cameroon	**NER**	Niger
CAF	Central African Republic	**NGA**	Nigeria
TCD	Chad	**RWA**	Rwanda
ZAR	Democratic Republic of the Congo	**SEN**	Senegal
CIV	Cote d'Ivoire	**SLE**	Sierra Leone
ETH	Ethiopia	**ZAF**	South Africa
GAB	Gabon	**SDN**	Sudan
GMB	Gambia	**SWZ**	Swaziland
GHA	Ghana	**TZA**	Tanzania
GIN	Guinea	**TGO**	Togo
KEN	Kenya	**UGA**	Uganda
LSO	Lesotho	**ZMB**	Zambia
MDG	Madagascar	**ZWE**	Zimbabwe

Figure 2: Scatter Plot of Prevalence of Child Malnutrition and Degree of Insecurity



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BDI	Burundi	**NAM**	Namibia
CMR	Cameroon	**NER**	Niger
CAF	Central African Republic	**NGA**	Nigeria
TCD	Chad	**RWA**	Rwanda
ZAR	Democratic Republic of the Congo	**SEN**	Senegal
CIV	Cote d'Ivoire	**SLE**	Sierra Leone
ETH	Ethiopia	**ZAF**	South Africa
GAB	Gabon	**SDN**	Sudan
GMB	Gambia	**SWZ**	Swaziland
GHA	Ghana	**TZA**	Tanzania
GIN	Guinea	**TGO**	Togo
KEN	Kenya	**UGA**	Uganda
LSO	Lesotho	**ZMB**	Zambia
MDG	Madagascar	**ZWE**	Zimbabwe

In order to assess where countries with both high and low insecure environments fit with regard to the other two key variables, child malnutrition and per capita agricultural GDP, we classify countries into "high," "medium," and "low". Countries falling within one standard deviation of the mean for each variable are categorized as "medium," and those above and below one standard deviation are classified as "high" and "low," respectively.

Just as with insecurity, the priorities for countries with medium to high malnutrition are different than those with low malnutrition. Moreover, addressing different levels of malnutrition requires an understanding of whether there are constraints to agricultural productivity. Obviously, an agricultural development strategy should be different for countries that already have a high degree of agricultural productivity than for those with a low to medium degree of productivity.

Based on this reasoning, six main development types emerge. **Table 4** presents the factor scores of the three variables for the country sample, and **Table 5** summarizes the countries that belong to each type. In principle, an agricultural development strategy intended to reduce hunger and poverty should be targeted according to two basic principles: need and feasibility. Those countries demonstrating need have "medium" to "high" malnutrition. This includes countries within the first four typologies. However, the feasibility of implementing an agricultural development strategy for the first two types is hampered by the insecurity factor. These countries require a different set of interventions, including immediate ones with respect to short-term food relief. But they also require a long-term view. Based on the CART analysis, governance and macroeconomic environmental factors are key areas that will need attention, which emphasizes the need for local solutions to improve the political climate and economic incentives.

For countries of types three and four, security is not an overriding concern but malnutrition remains a major problem. These countries would benefit most from an agricultural growth strategy focused on reducing poverty and hunger in rural areas, where the bulk of the population earns income from agriculture. Although raising agricultural

Table 4. Final Clusters of Development Typologies

Region	Country	Degree of Insecurity [A]	Child Malnutrition [B]	Agricultural Income [C]	Grouping [A]+[B]+[C]	Final Clusters
East	Ethiopia	105.6	120.0	79.6	high-high-low	1
East	Burundi	120.1	117.6	83.8	high-high-low	1
East	Congo, DR	112.1	108.6	88.9	high-high-low	1
Southern	Angola	134.6	108.7	80.0	high-high-low	1
West& Central	Chad	103.4	113.9	90.3	high-high-low	1
East	Sudan	128.2	110.3	103.6	high-high-med	1
East	Rwanda	104.9	104.5	90.9	high-med-low	2
West& Central	Sierra Leone	114.6	104.7	93.0	high-med-med	2
West& Central	C.African Rep	103.5	101.3	109.7	high-med-high	2
West& Central	Mauritania	101.7	108.9	109.1	low-high-high	3
Southern	Namibia	94.9	100.2	115.7	low-med-high	3
West& Central	Ghana	91.9	100.2	108.2	low-med-high	3
West& Central	Cote d'Ivoire	92.3	98.8	117.2	low-med-high	3
West& Central	Togo	95.8	99.8	103.7	low-med-high	3
East	Madagascar	94.4	115.3	88.9	low-high-low	4
West& Central	Niger	93.4	115.6	91.2	low-high-low	4
West& Central	Burkina Faso	93.9	110.7	90.7	low-high-low	4
East	Tanzania	95.0	106.5	91.4	low-high-med	4
West& Central	Mali	96.3	110.4	100.3	low-high-med	4
West& Central	Nigeria	95.8	105.5	97.7	low-high-med	4
Southern	Zambia	93.4	104.0	90.5	low-med-low	4
Southern	Malawi	91.9	100.9	83.2	low-med-low	4
Southern	Mozambique	98.3	104.7	90.5	low-med-low	4
East	Uganda	101.8	98.8	99.0	low-med-med	4
West& Central	Guinea	95.5	99.5	101.7	low-med-med	4
Southern	Zimbabwe	99.6	81.1	99.1	low-low-med	5
East	Kenya	94.7	96.0	94.7	low-low-med	5
Southern	Lesotho	94.4	90.2	94.0	low-low-med	5
West& Central	Senegal	95.0	98.4	102.8	low-low-med	5
West& Central	Gambia	93.1	92.2	96.5	low-low-med	5
West& Central	Congo, Rep	99.1	82.5	104.2	low-low-high	6
Southern	Swaziland	93.8	74.7	109.8	low-low-high	6
Southern	Botswana	97.5	78.9	109.8	low-low-high	6
Southern	South Africa	95.5	66.9	113.6	low-low-high	6
West& Central	Benin	94.4	97.9	107.8	low-low-high	6
West& Central	Gabon	94.1	78.2	145.7	low-low-high	6
West& Central	Cameroon	95.5	93.6	123.0	low-low-high	6

productivity is critical, the extent to which this can be achieved will also depend on initial conditions with respect land quality and potential, flood disaster, and drylands, as shown by the CART analysis. This implies that for the countries with low to medium agricultural productivity, a strategy that focuses on increasing appropriate investments in science and technology to help overcome localized constraints of resource endowments and geography is a good option. Because access to markets ultimately affects the productivity gains, improving physical and transportation infrastructure will also be important, as will investments in social services such as health and education.

For countries with high agricultural productivity, the priority of a development strategy would most likely involve expanding trade linkages and widening market opportunities for livestock and value-added agriculture, while also expanding rural non-farm employment opportunities. The imperative for such strategies may not be as great in those countries of type six. Many of these countries derive a large part of their income from non-agriculture and rely less on smallholder agriculture. However, countries of type five are uniquely placed in that they report low to medium agricultural incomes, yet have a reportedly low prevalence of child malnutrition.[6]

Table 5. Summary of Development Typologies in Table 4.

High Insecurity		**Low Insecurity**			
1	2	3	4	5	6
Angola Burundi Chad DRC Ethiopia Sudan	CAR Rwanda Sierra Leone	Cote I'voire Ghana Mauritania Namibia Togo	Burkina Faso Guinea Madagascar Malawi Mali Mozambique Niger Nigeria Tanzania Uganda Zambia	Gambia Kenya Lesotho Senegal Zimbabwe	Benin Botswana Cameroon Congo, Rep. Gabon South Africa Swaziland

[6] This may be no longer true for Zimbabwe or Kenya.

V. POLICY RECOMMENDATIONS AND CONCLUSION

This study offers three key contributions. First, at the empirical level, the study shows that, at least from a cross-sectional perspective, agricultural productivity and security are highly related to the prevalence of child malnutrition in Africa. This finding enabled us to group the countries into six main types and examine the implications for agricultural development strategies for each type. For agricultural development, the endowment of natural resources matters in influencing the type of strategic options available, and improved technology and market solutions are necessary to achieve greater growth. Meanwhile, the degree of insecurity in some countries will hinder the success of an agricultural development strategy and instead, short-term relief and food aid may play a more immediate role. For long-term GDP growth, however, greater attention needs to be given to strengthening government institutions, stressing the role of strong and stable governments in economic development over time.

Our second contribution is methodological. Through the technique of factor analysis, we do not impose a structural relationship on the variables but rather explore the interrelationships among the many economic and non-economic variables. While Adelman and Morris used the same technique in their seminal study, we extend their study considerably by incorporating regression tree analysis to delve further into the relationships between the factors and key outcome variables.

Thirdly, the choice of methodology represents a way of capturing the relatively recent theoretical shift in thinking about the development process. Indeed, development is so complex and multi-faceted that exclusively relying on cross-country regressions to uncover relationships may be misleading. There exist threshold effects in some key variables, particularly security. Without minimal security and rule of law, it is extremely difficult for economic exchange and development to occur.

Nevertheless, the analysis presented in this study has its own caveats. First, the analysis is uniquely dependent on the strategic goal of reducing hunger in Africa. The resulting development typologies are therefore uniquely mapped according to achieving

this goal. Secondly, due to data availability, the information used in this analysis is incomplete. For example, information on markets and trade access were not included. Thirdly, although the analysis attempted to look at broader implications with respect to development strategies, the inclusion of other key variables (e.g. inequality, trade, crime rates, etc.) in the initial factor analysis would have been useful. Fourthly, our study only captures aspects of development at the national level, yet a significant degree of heterogeneity exists at the sub-national level, which would enhance the typologies and further inform development strategies.

Finally, the study is primarily a static and cross-sectional one. This means for many of the socio-economic and outcome variables, their values are dependent on the period chosen for the analysis. Therefore, changes that have occurred since then, such as the deterioration in security in Zimbabwe, are not adequately addressed. However, the internal consistency of the analysis, as well as historical considerations, provides a far more coherent and practical look at the options facing different countries at different stages of development. In other words the typology could be viewed as representing different patterns with respect to initial conditions, the stage of development, and the point at which countries are at certain transition through the dynamic process of development.

Bearing these caveats in mind, the study highlights the diversity of opportunities and constraints across African countries, especially in terms of reducing malnutrition, increasing growth, and improving agricultural productivity. The typology emphasizes that development strategies need to be targeted to local conditions appropriately. Indeed, as Adelman (1999) notes, "development policy requires a more complex understanding of social systems which combines economic, social, cultural, and political institutions and their changing interactions over time" (p.2). Continued ignorance of where differences and similarities exist across these countries does not forebode well for the success of donor initiatives.

The challenge for policy makers and the economists who advise them is to creatively package a set of policies or institutional designs that are sensitive to local

opportunities and constraints. Identifying country typologies that show local conditions represents the first step.

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APPENDIX

Tables A.1- A.9 Final Factor Indices and Corresponding Rotated Factor Loadings

Table A.1: Rotated Factor Loadings for Macroeconomic Environment [a]

Variables	Investment and Trade Environment (2.21)[b]	Monetary Policy (0.49)	Communality[c] (R^2)
Banking and Finance Restrictions, 2001	**0.84**	0.03	0.72
Foreign Investment Restrictions, 2001	**0.77**	0.23	0.66
Euromoney Country Credit Worthinesss Index, 2001	**-0.66**	-0.11	0.47
Weighted Average Tariff Rate, 2001	**0.47**	0.24	0.30
Weighted Average Annual Rate of Inflation from 1992-2001	0.14	**0.53**	0.31
Inflation, Annual % GDP Deflator, 1998-2000 Average	0.16	**0.52**	0.30

Notes: [a] Bold figures indicate the factor to which each variable is assigned. [b] Eigenvalues are listed in parentheses. [c] Communality represents the percentage of variance explained by the factor.

Table A.2: Rotated Factor Loadings for Governance [a]

Variables	Climate of Political Freedom (5.70)[b]	Strength of Legal Institutions (0.91)	Communality[c] (R^2)
Promotion of Political Rights, 2000/2001	**-0.90**	-0.20	0.88
Existence of Civil Liberties, 2000/2001	**-0.88**	-0.31	0.89
Voice and Accountability, 2000/2001	**0.88**	0.36	0.94
Burdensome Regulation, 2001	**-0.51**	-0.42	0.52
Rule of Law, 2000/2001	0.36	**0.82**	0.83
Government Effectiveness, 2000/2001	0.34	**0.75**	0.74
Protection of Property Rights, 2001	-0.40	**-0.70**	0.72
Control of Corruption, 2000/2001	0.25	**0.69**	0.74
Regulatory Quality, 2000/2001	0.43	**0.67**	0.70
Prevalence of Black Market Transactions, 2001	-0.30	**-0.40**	0.42

Notes: a, b, c, see Table A1.

Table A.3: Rotated Factor Loadings for Infrastructure [a]

Variables	Social Infrastructure (2.38)[b]	Physical Infrastructure (0.45)	Communality[c] (R^2)
Total Public Spending on Health as a % of GDP, 1996-2000 Average	**0.76**	0.12	0.60
Immunization, DPT (% of Children under 12 Months), 1997-1999 Average	**0.75**	0.1	0.58
Total Public Spending on Education as a % of GDP, Average of 1995, 1996, 1998	**0.71**	0.32	0.62
Gross % of Females Enrolled in Primary School, 1996-1998 Average	**0.63**	0	0.40
Percent of Total Roads Paved, 1997-1999 Average	0.35	**0.57**	0.45
Density of Roads, 1995	-0.04	**0.43**	0.20

Notes: a, b, c, see Table A1.

Table A.4: Rotated Factor Loadings for Cultural Homogeneity [a]

Variables	Ethnic Homogeneity (3.36)[b]	Religious Homogeneity (1.75)	Communality[c] (R^2)
Ethnic Fractionalization Measure, dates vary	**0.97**	-0.06	0.96
Largest Ethnic Group as a % of the Total Population, dates vary	**-0.91**	-0.01	0.89
Ethnolinguistic Fractionalization Index, 1985	**0.88**	-0.18	0.85
Largest Language as a % of the Total Population, 2001	**-0.77**	0.22	0.68
Religious Fractionalization Measure, 2001	0.09	**-0.97**	0.94
Largest Religion as a % of the Total Population, 2001	-0.08	**0.96**	0.94

Notes: a, b, c, Table A1.

Table A.5: Rotated Factor Loadings for Geography [a]

Variables	Access to Coastlines (3.96)[b]	Drylands (1.70)	Tropics (1.51)	Communality[c] (R^2)
Proportion of a Country's Population within 100km of an Ocean or an Ocean-Navigable River, 1994	**0.97**	0	-0.04	1.00
Proportion of a Country's Population within 100km of Ocean Coastline, 1994	**0.96**	-0.14	-0.05	1.00
Proportion of a Country's Total Land Area within 100km of an Ocean or an Ocean-Navigable River	**0.95**	0.18	-0.06	0.99
Proportion of a Country's Total Land Area within 100km of Ocean Coastline	**0.92**	-0.05	-0.09	0.98
Percent of Land Area in Drylands	0.1	**0.89**	0.03	0.81
Percent of Population Living in the Drylands	-0.11	**0.88**	0.02	0.78
Percent of Land Area in the Tropics	0.16	0	**0.96**	0.94
Percent of Population Living in the Tropics	-0.46	0.06	**0.86**	0.96

Notes: a, b, c, see Table A1.

Table A.6: Rotated Factor Loadings for Level of Insecurity [a]

Variables	**Insecurity** (2.51)[b]	**Communality**[c] (R^2)
Military Expenditure as a % of Central Government Expenditure, 1997-1999 Average	**0.87**	0.76
Share of Refugees and Internally Displace People (IDPs) in Total Population, 2001	**0.85**	0.72
Military Expenditure as a % of GNI, 1997-1999 Average	**0.75**	0.56
Years of Civil War (1960-1999)	**0.69**	0.48

Notes: a, b, c, see Table A1.

Table A.7: Rotated Factor Loadings for Natural Disasters [a]

Variables	**Drought** (1.7)[b]	**Floods** (0.87)	**Communality**[c] (R^2)
Number of Droughts since 1965	**0.84**	0.19	0.74
Number of Insect Infestations since 1965	**0.83**	0.01	0.69
Number of Floods since 1965	0.31	**0.73**	0.63
Number of Landslides since 1965	-0.05	**0.71**	0.51

Notes: a, b, c, see Table A1.

Table A.8: Rotated Factor Loadings for Agricultural Potential [a]

Variables	**Land Quality and Potential** (1.14)[b]	**Access to Natural Water** (0.59)	**Communality**[c] (R^2)
Percent of Potential Arable Land Actually in Use, 1994	**-0.53**	-0.05	0.32
Potential Arable Land per Agricultural Population (ha/ person), 1994	**0.62**	0.17	0.43
Soil without Major Constraints (% of Total Area), 1994	**-0.42**	0.25	0.24
Average Precipitation 1961-1990 (mm/year)	0.03	**0.62**	0.38
Actual Total Renewable Water Resources (cubic m/capita per year)	0.40	**0.49**	0.40

Notes: a, b, c, see Table A1.

Table A.9: Rotated Factor Loadings for Human Diseases [a]

Variables	**Malaria Prevalence** (2.03)[b]	**Epidemics** (0.69)	**Communality**[c] (R^2)
Percent of Country Area with Malaria, 1994	**0.89**	0.15	0.82
Percent of 1995 Population Living in Areas with Malaria	**0.89**	0.17	0.82
Number of Epidemics since 1965	0.28	**0.7**	0.57
Number of Measles Cases Reported to the WHO since 1965	0.14	**0.7**	0.51

Notes: a, b, c, see Table A1.

Tables B.1- B.9 Country Rankings

Table B.1: Countries Ranked According to Enabling Macroeconomic Environment

Region	Country	Investment and Trade Environment	Rank	Monetary Policy	Rank
Southern	Botswana	78.5	1	104.5	28
Southern	South Africa	84.4	2	97.1	16
Southern	Swaziland	88.5	3	96.5	14
Southern	Zambia	89.9	4	104.9	29
West& Central	Mali	90.4	5	88.5	3
West& Central	Burkina Faso	91.7	6	90.5	5
Southern	Lesotho	92.5	7	100.0	25
Southern	Namibia	92.8	8	98.8	22
West& Central	Ghana	93.5	9	106.5	31
Southern	Mozambique	93.6	10	99.9	24
East	Kenya	93.9	11	98.1	19
West& Central	CAR	94.5	12	92.8	7
West& Central	Senegal	95.0	13	94.0	8
West& Central	Guinea	95.4	14	96.4	13
Southern	Malawi	95.4	15	111.6	35
West& Central	Cameroon	95.7	16	94.2	10
West& Central	Cote d'Ivoire	95.7	17	94.1	9
West& Central	Gambia	96.0	18	98.1	17
East	Tanzania	96.2	19	104.2	27
West& Central	Benin	96.8	20	94.6	12
West& Central	Gabon	96.9	21	96.5	15
East	Madagascar	97.1	22	104.1	26
East	Uganda	100.5	23	90.4	4
West& Central	Nigeria	104.6	24	98.6	21
West& Central	Mauritania	106.2	25	98.4	20
West& Central	Sierra Leone	107.8	26	108.4	32
West& Central	Niger	107.8	27	92.3	6
Southern	Angola	108.8	28	141.2	37
East	Sudan	109.6	29	110.0	34
East	Ethiopia	109.6	30	98.1	18
East	Burundi	109.8	31	106.2	30
West& Central	Congo, Rep	110.1	32	99.7	23
West& Central	Chad	110.5	33	94.3	11
Southern	Zimbabwe	113.4	34	117.0	36
East	Rwanda	115.7	35	84.7	1
West& Central	Togo	116.2	36	86.4	2
West& Central	Congo, DR	125.3	37	108.7	33

Note: Countries are ranked from the most to least enabling macroeconomic environment.

Table B.2: Countries Ranked According to Governance

Region	Country	Climate of Political Freedom Index	Rank	Governance and Legal Institutions Index	Rank
Southern	South Africa	122.7	1	103.9	11
West & Central	Benin	119.0	2	96.2	25
West & Central	Mali	115.7	3	94.4	29
Southern	Botswana	114.0	4	120.9	2
East	Madagascar	112.3	5	97.3	21
West & Central	Ghana	110.8	6	105.2	8
West & Central	Niger	109.2	7	88.1	35
Southern	Malawi	108.4	8	102.2	14
West & Central	Senegal	106.9	9	105.0	9
Southern	Namibia	106.8	10	126.0	1
West & Central	Nigeria	105.7	11	90.4	33
West & Central	CAR	105.7	12	94.8	28
West & Central	Burkina Faso	104.1	13	97.1	23
Southern	Mozambique	104.1	14	101.1	15
East	Tanzania	103.9	15	103.1	13
Southern	Lesotho	102.9	16	105.8	6
Southern	Zambia	101.9	17	103.8	12
West & Central	Gabon	100.7	18	104.1	10
West & Central	Congo, DR	100.0	19	72.6	37
Southern	Zimbabwe	96.8	20	88.4	34
East	Kenya	96.4	21	97.3	22
West & Central	Mauritania	95.8	22	99.1	19
West & Central	Sierra Leone	95.6	23	94.0	30
West & Central	Togo	95.3	24	92.6	32
East	Ethiopia	95.1	25	100.5	18
West & Central	Chad	94.5	26	96.2	24
East	Uganda	94.3	27	105.4	7
Southern	Angola	91.6	28	86.8	36
West & Central	Cote d'Ivoire	91.3	29	101.1	16
East	Burundi	89.3	30	93.6	31
West & Central	Guinea	89.4	31	109.0	5
Southern	Swaziland	88.9	32	119.5	3
West & Central	Cameroon	88.8	33	100.6	17
West & Central	Gambia	88.0	34	116.1	4
West & Central	Congo, Rep	86.8	35	95.2	27
East	Rwanda	84.5	36	95.3	26
East	Sudan	82.8	37	97.5	20

Note: Countries are ranked from highest to lowest level of governance

Table B.3: Countries Ranked According to Infrastructure

Region	Country	Social Infrastructure Index	Rank	Physical Infrastructure Index	Rank
Southern	Namibia	119.0	1	96.6	21
Southern	Malawi	118.5	2	92.0	29
Southern	Zimbabwe	117.9	3	124.7	1
Southern	Lesotho	117.0	4	112.1	5
Southern	South Africa	115.5	5	103.0	14
Eastern	Kenya	114.9	6	96.6	20
Southern	Botswana	111.3	7	124.4	2
Southern	Swaziland	110.1	8	103.1	12
Southern	Zambia	108.2	9	94.3	24
Eastern	Rwanda	106.8	10	90.0	34
West & Central	Gabon	104.0	11	87.3	36
Eastern	Uganda	102.1	12	93.1	26
West & Central	Ghana	101.3	13	107.6	9
Eastern	Burundi	100.3	14	92.4	27
West & Central	Mauritania	99.0	15	91.3	31
West & Central	Congo, Rep	99.0	16	90.8	32
Eastern	Tanzania	98.8	17	86.7	37
West & Central	Gambia	98.7	18	116.0	3
Eastern	Sudan	98.6	19	116.0	4
West & Central	Cote d'Ivoire	98.5	20	98.9	16
West & Central	Benin	97.5	21	103.1	13
West & Central	Senegal	97.2	22	110.8	6
West & Central	Togo	96.9	23	109.2	8
West & Central	Cameroon	96.8	24	98.2	18
Southern	Mozambique	96.2	25	96.9	19
Eastern	Madagascar	95.4	26	92.1	28
West & Central	Mali	93.7	27	95.3	23
Eastern	Ethiopia	92.4	28	98.3	17
West & Central	Sierra Leone	91.8	29	96.3	22
West & Central	CAR	90.6	30	90.0	33
Southern	Angola	89.9	31	101.4	15
West & Central	Guinea	89.6	32	104.4	10
West & Central	Burkina Faso	88.6	33	104.1	11
West & Central	Chad	87.1	34	87.9	35
West & Central	Nigeria	86.3	35	110.3	7
West & Central	Niger	86.1	36	93.5	25
West & Central	Congo, DR	84.5	37	91.3	30

Note: Countries are ranked from most to least developed infrastructure.

Table B.4: Countries Ranked According to Cultural Homogeneity Factors

Region	Country	Ethnic Homogeneity Index	Rank	Religious Homogeneity Index	Rank
Southern	Swaziland	128.9	1	103.5	9
Southern	Lesotho	123.1	2	91.7	31
East	Rwanda	119.9	3	103.1	11
East	Burundi	119.8	4	102.5	13
Southern	Zimbabwe	115.5	5	91.8	30
Southern	Botswana	115.3	6	92.6	29
Southern	Malawi	103.4	7	86.7	37
West & Central	Mauritania	103.4	8	125.2	1
Southern	Namibia	103.1	9	96.9	21
West & Central	Niger	100.8	10	116.8	5
West & Central	Ghana	100.8	11	88.6	35
Southern	Mozambique	99.8	12	96.0	24
West & Central	Burkina Faso	98.9	13	99.3	14
East	Sudan	98.8	14	107.9	7
West & Central	Togo	98.7	15	97.2	19
East	Ethiopia	98.2	16	98.3	17
West & Central	Benin	97.8	17	103.3	10
West & Central	Senegal	97.8	18	118.9	3
West & Central	Mali	97.1	19	117.4	4
Southern	South Africa	96.6	20	87.2	36
West & Central	Guinea	96.2	21	114.9	6
West & Central	Gabon	96.0	22	97.2	20
Southern	Zambia	95.7	23	90.4	33
Southern	Angola	95.6	24	98.5	16
East	Tanzania	94.9	25	96.5	22
West & Central	Gambia	93.8	26	121.6	2
West & Central	Sierra Leone	93.8	27	103.1	12
West & Central	CAR	93.3	28	89.2	34
West & Central	Congo, Rep	93.3	29	96.4	23
East	Madagascar	93.1	30	105.0	8
West & Central	Cote d'Ivoire	92.7	31	93.0	27
West & Central	Nigeria	91.7	32	94.4	26
West & Central	Chad	91.6	33	99.2	15
East	Kenya	91.5	34	90.6	32
West & Central	Cameroon	91.0	35	92.7	28
West & Central	Congo, DR	90.1	36	94.9	25
East	Uganda	87.9	37	97.6	18

Note: Countries are ranked from the highest to lowest level of homogeneity.

Table B.5: Countries Ranked According to Geography Factors

Region	Country	Access to Coastlines Index	Rank	Drylands Index	Rank	Tropics Index	Rank
West& Central	Gambia	129.6	1	121.1	1	99.9	27
West& Central	Senegal	120.5	2	117.9	2	100.2	25
West& Central	Sierra Leone	119.2	3	87.5	33	101.5	22
East	Madagascar	118.9	4	102.6	15	98.2	29
West& Central	Gabon	111.0	5	86.9	35	102.7	20
Southern	Mozambique	110.3	6	100.5	18	95.0	30
West& Central	Ghana	107.7	7	88.9	31	101.1	23
West& Central	Benin	106.6	8	90.7	27	99.9	26
West& Central	Togo	106.4	9	89.1	30	100.9	24
West& Central	Cote d'Ivoire	106.0	10	87.4	34	102.3	21
Southern	South Africa	105.4	11	99.7	21	72.7	33
West& Central	Guinea	103.1	12	91.5	25	103.6	17
Southern	Angola	102.3	13	98.1	22	103.3	19
West& Central	Nigeria	101.8	14	100.6	17	103.4	18
West& Central	Cameroon	99.4	15	94.0	23	105.0	14
East	Tanzania	98.6	16	100.4	19	104.1	16
West& Central	Congo, Rep	98.0	17	88.2	32	105.0	13
West& Central	Mauritania	97.9	18	100.2	20	98.4	28
Southern	Namibia	96.9	19	106.7	10	89.9	32
East	Kenya	95.5	20	103.7	13	105.0	12
East	Sudan	93.2	21	106.1	11	105.7	6
East	Congo, DR	93.0	22	90.5	28	106.3	2
West& Central	Niger	92.7	23	108.3	8	106.0	4
East	Ethiopia	92.7	24	102.1	16	104.8	15
West& Central	Mali	92.6	25	107.8	9	105.3	11
West& Central	Chad	92.5	26	110.5	7	105.8	5
Southern	Malawi	92.3	27	111.7	6	105.7	7
Southern	Zambia	92.3	28	115.7	4	105.5	8
East	Burundi	92.2	29	89.9	29	106.3	1
East	Rwanda	92.2	29	89.9	29	106.3	1
East	Uganda	92.2	29	89.9	29	106.3	1
Southern	Zimbabwe	92.2	30	116.3	3	105.5	10
West& Central	Burkina Faso	92.2	31	114.6	5	105.5	9
West& Central	CAR	92.2	32	90.9	26	106.3	3
Southern	Botswana	90.9	33	104.8	12	90.2	31
Southern	Lesotho	89.9	34	93.2	24	68.5	34
Southern	Swaziland	89.7	35	102.7	14	68.1	35

Note: Countries are ranked according to the level at which they possess the characteristics embodied in the three geography factors listed above.

Table B.6: Countries Ranked According to Level of Insecurity

Region	Country	Level of Insecurity Index	Rank
Southern	Angola	134.6	1
East	Sudan	128.2	2
East	Burundi	120.1	3
West& Central	Sierra Leone	114.6	4
East	Congo, DR	112.1	5
East	Ethiopia	105.6	6
East	Rwanda	104.9	7
West& Central	CAR	103.5	8
West& Central	Chad	103.4	9
East	Uganda	101.8	10
West& Central	Mauritania	101.7	11
Southern	Zimbabwe	99.6	12
West& Central	Congo, Rep	99.1	13
Southern	Mozambique	98.3	14
Southern	Botswana	97.5	15
West& Central	Mali	96.3	16
West& Central	Togo	95.8	17
West& Central	Nigeria	95.8	18
West& Central	Guinea	95.5	19
Southern	South Africa	95.5	20
West& Central	Cameroon	95.5	21
East	Tanzania	95.0	22
West& Central	Senegal	95.0	23
Southern	Namibia	94.9	24
East	Kenya	94.7	25
East	Madagascar	94.4	26
Southern	Lesotho	94.4	27
West& Central	Benin	94.4	28
West& Central	Gabon	94.1	29
West& Central	Burkina Faso	93.9	30
Southern	Swaziland	93.8	31
West& Central	Niger	93.4	32
Southern	Zambia	93.4	33
West& Central	Gambia	93.1	34
West& Central	Cote d'Ivoire	92.3	35
West& Central	Ghana	91.9	36
Southern	Malawi	91.9	37

Note: Countries are ranked from highest to lowest level of security.

Table B.7: Countries Ranked According to Incidence of Natural Disasters

Region	Country	Drought Index	Rank	Flood Index	Rank
East	Ethiopia	122.9	1	132.0	1
West& Central	Chad	122.7	2	94.7	22
West& Central	Mauritania	117.0	3	95.6	18
West& Central	Mali	115.9	4	94.9	20
West& Central	Senegal	115.1	5	95.8	17
West& Central	Niger	113.6	6	96.1	16
East	Sudan	112.7	7	101.9	11
West& Central	Gambia	110.9	8	91.3	36
West& Central	Burkina Faso	109.5	9	95.4	19
Southern	Mozambique	105.6	10	112.2	6
Southern	Zambia	102.6	11	93.7	29
Southern	Botswana	101.2	12	94.1	27
East	Tanzania	99.7	13	116.1	4
East	Madagascar	98.5	14	92.0	33
East	Uganda	98.0	15	104.6	9
West& Central	Cameroon	97.5	16	94.1	26
Southern	South Africa	97.4	17	117.3	3
East	Kenya	97.2	18	108.2	7
Southern	Zimbabwe	97.1	19	94.2	25
Southern	Swaziland	97.1	20	92.4	31
Southern	Malawi	96.5	21	106.0	8
West& Central	Benin	95.6	22	101.4	12
Southern	Lesotho	95.4	23	94.1	28
Southern	Namibia	95.3	24	92.2	32
East	Rwanda	94.6	25	94.9	21
Southern	Angola	94.5	26	104.3	10
West& Central	Ghana	93.8	27	98.4	14
West& Central	Togo	92.8	28	94.7	23
East	Burundi	92.0	29	94.6	24
West& Central	CAR	91.2	30	96.4	15
West& Central	Guinea	91.1	31	93.6	30
West& Central	Cote d'Ivoire	90.2	32	91.7	34
West& Central	Sierra Leone	89.4	33	91.6	35
West& Central	Gabon	89.3	34	90.7	37
West& Central	Congo, Rep	89.3	35	100.1	13
West& Central	Nigeria	88.6	36	124.3	2
East	Congo, DR	88.3	37	114.3	5

Note: Countries are ranked from highest to lowest incidence of natural disasters.

Table B.8: Countries Ranked According to Agricultural Potential

Region	Country	Land Quality & Potential Index	Rank	Access to Natural Water Index	Rank
West & Central	Gabon	124.4	1	124.9	2
West & Central	Congo, Rep.	118.4	2	129.3	1
Southern	Namibia	116.1	3	88.2	34
West & Central	Congo, DR	116.0	4	106.6	6
Southern	Botswana	115.4	5	88.9	32
West & Central	CAR	114.8	6	106.1	8
Southern	Angola	108.2	7	98.9	22
Southern	Zambia	106.5	8	97.5	25
West & Central	Chad	105.1	9	89.0	31
West & Central	Mauritania	103.9	10	82.4	37
West & Central	Mali	103.3	11	87.8	35
East	Sudan	101.7	12	90.1	30
Southern	Zimbabwe	101.3	13	93.0	29
Southern	South Africa	100.9	14	88.8	33
West & Central	Niger	100.8	15	83.8	36
West & Central	Cameroon	100.0	16	106.2	7
Southern	Swaziland	99.6	17	93.5	28
West & Central	Sierra Leone	99.4	18	117.4	3
West & Central	Guinea	98.9	19	108.9	4
West & Central	Cote d'Ivoire	98.1	20	103.1	11
Southern	Mozambique	97.5	21	103.5	10
East	Tanzania	97.5	22	100.8	18
West & Central	Senegal	97.2	23	95.5	26
West & Central	Ghana	96.5	24	100.5	20
East	Madagascar	96.1	25	108.7	5
West & Central	Burkina Faso	95.1	26	97.6	24
East	Kenya	95.0	27	94.8	27
West & Central	Benin	94.4	28	102.3	14
Southern	Malawi	93.8	29	101.6	15
East	Ethiopia	93.7	30	98.2	23
West & Central	Togo	92.2	31	100.6	19
West & Central	Nigeria	92.1	32	101.1	17
East	Uganda	90.0	33	102.8	12
East	Burundi	88.5	34	100.2	21
West & Central	Gambia	88.3	35	103.9	9
Southern	Lesotho	80.7	36	102.4	13
East	Rwanda	78.7	37	101.3	16

Note: Countries are ranked from the highest to lowest level of agricultural potential.

Table B.9: Countries Ranked According to Disease Prevalence

Region	Country	Malaria Index	Rank	Epidemics Index	Rank	HIV Prevalence	Rank
West& Central	Gambia	106.6	1	90.0	37	1.6	32
West& Central	Gabon	106.6	2	90.7	36	9.0	13
West& Central	Congo, Rep	106.5	3	91.9	34	7.2	17
West& Central	CAR	106.3	4	93.2	33	12.9	10
West& Central	Togo	106.3	5	93.6	32	6.0	21
Southern	Angola	106.2	6	94.3	28	5.5	23
West& Central	Sierra Leone	106.2	7	94.6	26	7.0	18
West& Central	Guinea	106.2	8	95.0	25	1.5	33
East	Madagascar	106.1	9	95.5	24	0.3	35
Southern	Malawi	106.0	10	96.3	23	15.0	8
East	Rwanda	106.0	11	97.0	21	8.9	14
West& Central	Senegal	105.9	12	97.3	20	0.5	34
West& Central	Cote d'Ivoire	105.9	13	97.7	19	9.7	12
West& Central	Burkina Faso	105.7	14	99.3	15	6.5	19
Southern	Zambia	105.7	15	99.5	13	21.5	6
Southern	Mozambique	105.7	16	99.6	12	13.0	9
West& Central	Benin	105.6	17	100.5	10	3.6	27
West& Central	Cameroon	105.6	18	101.0	9	11.8	11
West& Central	Ghana	105.1	19	105.9	6	3.0	28
East	Tanzania	105.0	20	106.6	5	7.8	16
East	Uganda	104.4	21	112.0	4	5.0	24
East	Congo, DR	103.9	22	118.6	2	4.9	25
East	Burundi	102.6	23	98.5	17	8.3	15
East	Sudan	102.1	24	103.6	8	2.6	29
West& Central	Nigeria	101.2	25	144.5	1	5.8	22
East	Kenya	100.8	26	104.5	7	15.0	8
West& Central	Chad	100.3	27	99.4	14	3.6	27
West& Central	Mali	98.8	28	98.2	18	1.7	31
West& Central	Niger	97.4	29	117.5	3	4.0	26
Southern	Zimbabwe	94.9	30	99.2	16	33.7	2
East	Ethiopia	94.7	31	100.3	11	6.4	20
West& Central	Mauritania	91.9	32	94.3	27	1.8	30
Southern	Namibia	86.0	33	93.7	31	22.5	5
Southern	Botswana	83.9	34	91.8	35	38.8	1
Southern	Swaziland	75.8	35	94.1	30	33.4	3
Southern	South Africa	71.6	36	96.4	22	20.1	7
Southern	Lesotho	70.7	37	94.2	29	31.0	4

Note: Countries are ranked from highest to lowest disease prevalence.

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