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13. ABSTRACT: In an age of globalization, the development of productive nations is paramount. Over the past century, the United States has worked to aid in the advancement of underdeveloped countries- with the hope of expanding trade and fostering worldwide growth. Humanitarian assistance is one of the most significant means by which progress is facilitated around the globe. In order to assess the merits of outside assistance, this study gathered data that illustrates the trends and behaviors of potential aid recipients. Using this data, econometric models demonstrating the relationship between GDP growth per capita and aid were fitted. Data was derived from the World Development Indicators, the leading source of data on development, and the PRS Group, a private organization that develops data used to evaluate the risks faced by potential investors and benefactors. Using the data from these sources, econometric models estimating the dependence of growth on aid were estimated. The result lends insight into many questions related to aid. First, how significantly does humanitarian aid offered affect GDP growth, and how does it affect the long-run performance of an economy? Second, do country specific variables, such as locale and economic power, influence the performance of humanitarian aid, and if so, to what extent? Based on the estimated models, one can make the determination whether it is beneficial to offer a certain category of country aid, or if aid is going to the proper locations. This study provides a resource for potential benefactors to consult. If interested in providing assistance to a low-income country, the benefactor can refer to the regressions corresponding to a sample low-income country set. Based on the statistical data and economic theory, one can see how their contribution might affect the GDP growth of a given country. With this knowledge, one is aided in making key decisions regarding assistance, and gains an understanding as to how their

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A Multinational Empirical Analysis of Humanitarian Assistance

In an age of globalization, the development of productive nations is paramount. Over the past century, the United States has worked to aid in the advancement of underdeveloped countries- with the hope of expanding trade and fostering worldwide growth. Humanitarian assistance is one of the most significant means by which progress is facilitated around the globe.

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Key Words: Humanitarian Assistance, Gross Domestic Product Growth, Econometric Modeling

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A Multinational Empirical Analysis of Humanitarian Assistance

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I. Introduction

In an age of globalization, the development of productive nations as trading partners and allies is paramount. Over the past century, the United States has worked to aid in the advancement of underdeveloped countries- with the hope of expanding trade and fostering worldwide growth. While this goal can only be attained through the implementation of numerous political and economic tools, aid is certainly one of the most significant means by which the United States facilitates a variety of interrelated objectives, including the promotion of economic growth, political stability, and peace. Indeed, the relationships between these goals make politicians' jobs quite difficult, due to the challenge incurred in assessing the impact and usefulness of certain policies.

Specifically, how can one decide whether or not humanitarian assistance should be given to a country, or if it will have a beneficial impact? Just as importantly, how does one know the degree to which aid has assisted in the growth of economies in the past? This project addresses these questions in the context of a multi-country model of growth. Using recent data on the growth performance and assistance received by countries across the spectrum of development levels, this study illustrates the trends and behaviors of potential aid recipients over the past twenty years, and offers some insight into which countries were apparently helped the most by aid. Specifically, econometric models demonstrating the impact of aid on GDP growth per capita were developed. The object is to allow one to gain insight into the relationship between aid and growth, once other factors driving growth have been controlled for. Also, the impact of aid on political instability, and some further patterns in aid awards were studied using variations on the basic growth model.

A study of this nature may potentially have a great impact upon both donor and recipient countries. Benefactors can see if a specific country will gain from their assistance, while recipients can predict the impact such contributions might have upon their country. Such a tool is useful as both a safeguard and motivator. Candidates can be tested for worth, and recipients can boost the morale and productiveness of their citizens with predictions of future growth.

This study uncovered many rather interesting conclusions regarding official development assistance. Analysis of GDP Growth Per Capita revealed that growth is indeed positively influenced by aid. Interestingly, however, official development assistance did not depend on the past performance of the economy of the country in question, but more upon its geographic location and whether or not it had received aid in the past. Another interesting finding has to do with the impact aid has upon a country, once all other factors are controlled for. For example, on the surface it is plausible that aid and growth are negatively correlated; this may occur due to the simple fact that only countries "in trouble" would receive assistance. While this is generally true, certain countries exhibit negative growth rates, but in actuality sustain marked growth due to the receipt of aid. Some may ask: how is this possible? Simply, many countries that benefit from foreign assistance would have even lower growth rates without the acceptance of aid. Official development assistance has the ability to counteract a portion of negative growth.

The remainder of this paper proceeds as follows. In Section II, the essentials of growth theory are discussed. These theories are expanded upon in Section III, where augmentations of the traditional growth model are described. Section IV further explains the augmented model, by describing the results of studies focusing on humanitarian assistance. The following section focuses upon the statistical and econometric theory underlying a study of this nature. The process of the data procurement necessary for this undertaking is covered in Section VII, and further discussed in Section VIII. The means and results of econometric analysis, the heart of the study, are detailed in Section IX, and further covered in Section X, Model Creation. Using the developed model, a variety of simulations are conducted in Section XI. Conclusions based upon the fitted model and subsequent simulations are stated in the final section.

II. Economic Growth

Economic growth, especially in a long run setting, overshadows all other economic goals in terms of importance, and as such has occupied for almost 50 years a central place in economic theory. During the 1960's, the Neoclassical growth model, developed in large part by Ramsey, Solow, Swan, Cass, and Koopmans, dominated economic thought surrounding the subject of growth. The model, often referred to as the Solow-Swan model, "assumes constant returns to scale, diminishing returns to each input, and some positive and smooth elasticity of substitution between capital and labor."[i]

This model is based upon an aggregate production function: Y=F(K,L), where Y is equal to aggregate output, K denotes the nation's aggregate stock of capital, and L denotes the nation's aggregate stock of labor. If one performs the elementary operation of dividing the entire function by L, a function representing output per worker is generated. The equation y=f(k), where k=(K/L), captures the property that if y_1 is greater than y_2, then k_1 must also be greater than k_2. In short, countries have different per capita incomes due to variant levels of capital/worker.

One type of result often generated by this model, and the most testable implication of the basic growth model, can be summarized by an equation of the form:

$$Dy = f(y, y^*),$$

where Dy is the growth rate of per capita output, y is the present level of per capita output, and y^* is the long-run value of per capita output. The value of y^* is dependent upon a variety of external factors, that affect private sector performance, government objectives, and features of the political environment. Barro summarizes many of the features that influence y^*: the private sector is generally influenced by the labor supply decisions and savings rates of its citizens; in addition, the fertility rate is also an important determinant of many long-run features of labor markets. Furthermore, governmental aims influence such things as rule of law, tax rates, terms of trade, and degrees of political freedom. All of these factors jointly determine a country's natural capacity to produce.

Within this context, the Solow-Swan model focuses upon the property of convergence: that is, whether or not low per capita income countries are catching up with high income countries. The Solow-Swan model predicts that generally they should, as the lower the initial level of real per capita gross domestic product (GDP), the higher the predicted growth rate. As capital is likely to have a very high marginal product in countries where capital stock is small, increasing the capital stock even by small amounts should greatly increase the productive capability of an underdeveloped economy. This property emerges due to the law of diminishing returns to capital. Further, this implies that a very low-income country should grow much faster, all other things being equal, than a country of higher income.

Thus, a key component of any study seeking to explain growth is consideration of the different starting points of the countries in the analysis. While the concept of convergence and the Solow-Swan model have substantial explanatory power for cross-country economic growth, they do not account for many other sources of variation in growth rates across countries. Differences in government policies, stability of the business environment, overall stability of the political situation, human capital, and quality of life are not reflected in the simple growth model. In addition, technological progress only occurs exogenously in the standard growth model. The inability to directly explain these factors results in a model that cannot explain long-term growth, or at least explain the features of long-run growth that seem to be most important. Due to this shortcoming, a new group of theorists, led by economist Paul Romer (1986), developed a class of growth models that make key determinants of growth endogenous to the model. This class of growth models is duly referred to as endogenous growth models, and requires that the researcher include measures of stability and human capital in an augmented growth model.

III. Augmentation to the Traditional Growth Model

While economists generally seek to explain growth through application of traditional growth theory, a great deal of recent new growth literature emphasizes the role of country characteristics as key determinants of growth performance. Leading economists, such as William Easterly (1993), suggest that country characteristics remain persistent or constant, while variables such as growth rates remain significantly unstable.[ii] In terms of practical application of these ideas to a growth model, one must begin with the simplest form of growth model, which is built around an aggregate production function Y=F(K,L), as described in Section II. However, to this one may add additional variables that also aid in explaining growth, such as A, the level of technology present in the country in question. Additionally, many terms should also be included in a country's aggregate production function in a manner similar to the level of technology; such items include aspects of society and government. One might include in such a list the degree to which taxes are distortionary and other features of the economic environment, such as, attitudes toward work, weather, the degree of monopoly, and market distortions.[iii] As a result, a multiplicity of possible explanatory variables for growth is possible, and the existence of a "true" model of economic growth is hard to establish. Indeed, one might think of a variety of other variables that also influence aggregate output, and therefore should be included in a growth equation. A substantial and wide-ranging literature has intensively studied the various determinants of growth, in an effort to establish a "true model," and diminish the ambiguity surrounding the proper variables to include in augmented growth models.

The closest one can come to summarizing the many things that lead to economic growth is what can be called the standard growth regression generated by Barro (1991). He has identified four primary measures that seem to relate particularly well to the rate of economic growth. They include the initial level of income, investment rate, various measures of education, and some policy indicators. Barro's version of the "true" model is further supported by the studies of Sala-I-Martin (1995) and Doppelhofer (2000).

Furthermore, his findings serve as a base model in the work of, Levine (1997); Easterly et. al. (1993), De Long and Summers (1991), and Quah (1993), to name a few. Generally speaking, these economists determined that the variable most robustly related to growth is the initial level of income. Furthermore, they found that "other important variables include regional dummies [such as Africa and Latin America], some measures of human capital [such as life expectancy and primary schooling], and some sectoral variables, such as measures of openness."[iv] Thus, any study of growth should include some measures of these variables.

IV. Humanitarian Assistance Theory

Over the past decade, a great deal of research has examined humanitarian assistance, and its role in the augmented growth model. Researchers have looked at this topic from a variety of angles, but the majority focus upon the study of growth's dependency on assistance.

Empirical findings concerning aid effectiveness first started emerging in large scale in 1994. Boone conducted a study spanning eighteen years, which ultimately proved that aid had a positive, but statistically insignificant effect on growth. In addition, his study, which utilized five and ten year averages, showed that all private and public aid was consumed. A year later, Mosley performed a similar analysis, but expanded his work to cover 33 years, but only 19 countries. Like Boone, he found that aid had a minimally positive impact on growth. However, he also concluded that a lag structure increases the degree of aid effectiveness. In 1995, Hadji-Michael and others worked to unveil the mystery behind the behavior of Sub-Saharan African countries. Once again, he found that aid had a positive influence on growth, and that the performance of Sub-Saharan African countries depends on its economic policies. Burnside and Dollar took these theories a bit further in 1997, when they concluded that aid only has a positive impact on growth when it is given to countries with good macroeconomic policy. Interestingly, they found that donors reward good policy, but that aid does not affect such policy. In line with previous studies, they focused their efforts on 23 years of data and fifty-six developing countries. Ramesh Durbarry et al. (1998) and Guillamont and Chauvet (1999) reaffirmed these findings in their follow-on work. Guillamont and Chauvet further concluded that aid should only be allocated to countries facing difficult external environments. Conversely, Henrik Hansen and Finn Trap (1999) determined that aid works even in an unfavorable policy environment. The work done recently has been noteworthy, but there are still many issues that require further investigation.

V. Statistical/Econometric Theory

Section III focused upon basic growth theory and Section IV on the history behind the study of humanitarian assistance, but in order to understand their application some statistical and econometric groundwork must be established. This section more fully elucidates many of the mathematical theories and operations utilized in this study. The most important ideas that need to be covered surround endogenous and exogenous variables, weighted least squares, and adjusted R^2 values. Other more elementary topics in statistics and econometrics are not covered in this section. Basic Econometrics authored by Damodar Gujarati and Applied Linear Statistical Models by John Neter are both useful resources to consult if more in-depth explanation is needed.

A linear model with one dependent variable, Y, and one or more explanatory variables, X clearly can be used to characterize the cause and effect relationship between variables. However, this direct causality can only be assumed if none of the X's are endogenous. This type of variable is correlated with the dependent variable, but is also dependent on other dependent variables. Such is the case with the model being estimated in this study. For example, official development assistance and government stability may cause GDP growth, but at the same time, official development assistance may cause government stability, or vise versa. Additionally, aid awards may depend on the past or current performance of the economy, to the extent that aid should go to troubled economies. In order to account for this, many researchers run simultaneous equation models. For the purpose of this study, is was more informative to run three separate regressions, treating each variable in question as a dependant variable, and relying on past, or predetermined, values of independent variables. For regressions explaining the degree of aid or government stability, lagged values of dependent variables were relied upon, which keeps the time structure of the model consistent across all of the empirical work.

Estimation was done using weighted least squares. Weighted least squares is a technique that more reliably estimates regression functions when subsets of the data sample may have different variances. More weight is given to observations that are closely clustered around their mean, decreasing the effect of those observations more widely dispersed.

VI. Data Procurement

In order to develop and estimate a model, an extensive dataset was constructed. The idea was to develop a relatively recent data series that captured salient features of growth models that are generally accepted in the growth literature, while also allowing for estimation of models most likely to be of interest to researchers. The World Development Indicators (WDI) and the Political Risk Services (PRS) Group, two of the most reputable and widely used databanks for econometric research, were the primary sources of data. Many researchers have used the Penn World tables as their main source of figures; however, this databank is insufficient for a study of this nature, since it only covers a period up to 1992 and reliable aid information is only available after 1982.

The World Development Indicators is the World Bank's leading compilation of data concerning development around the world. Currently, the WDI includes approximately 800 indicators arranged in 87 tables, and six sections: World View, People, Environment, Economy, States and Markets, and Global Links. The tables cover 148 unique economies and 14 specific country groups.[v]

The PRS Group, Inc., publishes two systems used to evaluate the risks faced by potential international investors and benefactors. The International Country Risk Guide (ICRG) system proved to be the most useful in this study, and also contributed prominently to Nobel Prize winner Robert Barro's analysis of growth. This dataset is designed to help private investors who are interested in doing business in different countries, and provides ratings for the political, economic, and financial characteristics of a country. In order to offer such a service, the PRS Group carefully compiles composite ratings and forecasts summarizing various economic, demographic, and political features of a country. Furthermore, the group backs up their calculations with extensive econometric analysis of the data they have created. The result of all of this work is a comprehensive system that enables various types of risk to be measured and compared between countries.[vi] The PRS Group's dedication to "data series development and commitment to independent and unbiased analysis make it the standard for any organization practicing effective risk management."[vii] For the purposes of this study, the aforementioned data provides useful measures and indices of concepts that are generally difficult to capture specifically or numerically, such as a useful "stability of government" index.

Data spanning the past twenty years was acquired for 191 countries. This choice was made based upon the availability and completeness of the data; also, such a selection served to slant the study towards recent development/aid experience, and is thus more likely to be useful to policy makers. The World Development Indicators provided the majority of economic variables, while the PRS Group supplied a great deal of political variables. A listing of the variables included in the dataset with which exploratory work was done is provided below in Tables 1.1 and 1.2.

Table 1.1

World Development Indicators Variables
Aid Imported
Arms Imported
Death Rate
Fertility Rate
Foreign Direct Investment
GDP Growth
GDP per capita
General Government Consumption
Gross Domestic Savings
Health Expenditure
Hospital Beds
Illiteracy Rate
Inflation
Labor Force
Land Use
Military Expenditure
Military per capita
Military Personnel
Infant Mortality Rate
Official Development Assistance
Water Pollution
Overall Budget Deficit
Population
Primary Education
Private Consumption
Secondary Education
Terms of Trade
Unemployment
Urban Population
IMF credit

Table 1.2

PRS Group Variables
Government Stability
Democracy
Religion
Ethnic
Internal Conflict
External Conflict
Military in Politics
Socioeconomic
Law and Order

VII. Dataset Construction

A. Quantitative Variables

In its entirety, the dataset used for this model had 4168 observations and 55 variables. In the end, the dataset used for model estimation was much smaller. Instead of covering the period from 1980-2000, the truncated version spanned the period from 1980-1998. The span covered was shortened due to the unavailability of data for all years and variables, but is in any case commensurate with the sample sizes of other studies of aid. In addition, some of the variables listed above in Tables 1 and 2 were incomplete or not present for all of the countries, while others occurred only sporadically at different points in time. Generally, this required elimination of variables that were not sufficiently present in the sample for extended analysis. In the end, both the span of time and number of variables included in this model were decreased due to the data available.

Once, the proper dataset was determined, many other operations needed to be conducted in order to prepare the raw numbers for analysis. In order to reflect and account for the differences between countries, much of the data was scaled. Official Development Assistance and Primary Education were divided by population, converting them into per capita terms. In addition, Government Consumption was reflected as a percentage of GDP, easing comparability across countries.

Also in keeping with prior econometric studies, the data was averaged over time. Three averages were computed: one spanning from 1980-1985, another from 1986-1992, and a final from 1993-1998. In general, such averaging smoothes out discrepancies in data, eliminates the impact of recessions and other short-run deviations within the economy, and reduces the impact of potential outliers.

Unfortunately, due to copyright laws, the developed dataset cannot be released; however, any individual can reproduce it, if they purchase both WDI and PRS data and then follow the process mentioned above. As a result, this study can easily be replicated, given the necessary tools are made available and data purchased.

B. Qualitative Variables

In addition to numeric variables, two other types of indicator variables were developed. Each country was assigned both economic and geographic identifiers, allowing for subsequent sorting of data. The criteria for the assignment of these variables were provided by the WDI; all countries were already categorized based on their income level and location, as listed by this source (these listings are seen in Tables 1.4 and 1.5). The variables created for this study, and their descriptions are seen below in the Tables 1.6 and 1.7. However, it is important to note at this point that the inclusion of these types of indicator variables will, to some degree, cloud the dependence of growth on particular variables. For example, by including a dummy for Latin America, one can see how the growth rate of Latin American Countries differed from that of other countries, but is also likely to remove key aspects of the regression controlled for by other things. If Latin American Countries generally have less stable governments, this reduces the chances that government stability proves to be a significant variable in the growth regression once a dummy variable has been included for Latin America.

Why is inclusion of dummy variables in this study justified? The answer rests in the fact that the primary focus of our study is not on fully describing the determinants of growth, but in particular on describing the impact of one thing, humanitarian assistance, on the growth experience of a country.

Table 1.4 – Geographic Identifiers

East Asia and Pacific

American Samoa	Lao PDR	Philippines
Cambodia	Malaysia	Samoa
China	Marshall Islands	Solomon Islands
Fiji	Micronesia, Fed. Sts	Thailand
Indonesia	Mongolia	Tonga
Kiribati	Myanmar	Vanuatu
Korea, Dem. Rep.	Palau	Vietnam
Korea, Rep.	Papua New Guinea	

Europe and Central Asia

Albania	Hungary	Russian Federation
Armenia	Isle of Man	Slovak Republic
Azerbaijan	Kazakhstan	Tajikistan
Belarus	Kyrgyz Republic	Turkey
Bosnia and Herzegovina	Latvia	Turkmenistan
Bulgaria	Lithuania	Ukraine
Croatia	Macedonia, FYR	Uzbekistan
Czech Republic	Moldova	Yugoslavia, Fed. Rep.
Estonia	Poland	
Georgia	Romania	

Latin America and the Caribbean

Antigua and Barbuda	Ecuador	Paraguay
Argentina	El Salvador	Peru
Belize	Grenada	Puerto Rico
Bolivia	Guatemala	St. Kitts and Nevis
Brazil	Guyana	St. Lucia
Chile	Haiti	St. Vincent and the Grenadines
Colombia	Honduras	Suriname
Costa Rica	Jamaica	Trinidad and Tobago
Cuba	Mexico	Uruguay
Dominica	Nicaragua	Venezuela, RB
Dominican Republic	Panama	

Middle East and North Africa

Algeria	Jordan	Syrian Arab Republic
Bahrain	Lebanon	Tunisia
Djibouti	Libya	West Bank and Gaza
Egypt, Arab Rep.	Morocco	Yemen, Rep.
Iran, Islamic Rep.	Oman	
Iraq	Saudi Arabia	

South Asia

Afghanistan	India	Pakistan
Bangladesh	Maldives	Sri Lanka
Bhutan	Nepal	

Sub-Saharan Africa

Angola	Gabon	Niger
Benin	Gambia, The	Nigeria
Botswana	Ghana	Rwanda
Burkina Faso	Guinea	Sao Tome and Principe
Burundi	Guinea-Bissau	Senegal
Cameroon	Kenya	Seychelles
Cape Verde	Lesotho	Sierra Leone
Central African Republic	Liberia	Somalia
Chad	Madagascar	South Africa
Comoros	Malawi	Sudan
Congo, Dem. Rep.	Mali	Swaziland
Congo, Rep	Mauritania	Tanzania
Cote d'Ivoire	Mauritius	Togo
Equatorial Guinea	Mayotte	Uganda
Eritrea	Mozambique	Zambia
Ethiopia	Namibia	Zimbabwe

Low-income economies

Afghanistan	Ghana	Nicaragua
Angola	Guinea	Niger
Armenia	Guinea-Bissau	Nigeria
Azerbaijan	Haiti	Pakistan
Bangladesh	India	Rwanda
Benin	Indonesia	Sao Tome and Principe
Bhutan	Kenya	Senegal
Burkina Faso	Korea, Dem Rep.	Sierra Leone
Burundi	Kyrgyz Republic	Solomon Islands
Cambodia	Lao PDR	Somalia
Cameroon	Lesotho	Sudan
Central African Republic	Liberia	Tajikistan
Chad	Madagascar	Tanzania
Comoros	Malawi	Togo
Congo, Dem. Rep	Mali	Uganda
Congo, Rep.	Mauritania	Ukraine
Cote d'Ivoire	Moldova	Uzbekistan
Eritrea	Mongolia	Vietnam
Ethiopia	Mozambique	Yemen, Rep.
Gambia, The	Myanmar	Zambia
Georgia	Nepal	Zimbabwe

Lower-middle-income economies

Albania	Guatemala	Paraguay
Algeria	Guyana	Peru
Belarus	Honduras	Philippines
Belize	Iran, Islamic Rep.	Romania
Bolivia	Iraq	Russian Federation
Bosnia and Herzegovina	Jamaica	Samoa
Bulgaria	Jordan	Sri Lanka
Cape Verde	Kazakhstan	St. Vincent and the Grenadines
China	Kiribati	Suriname
Colombia	Latvia	Swaziland
Cuba	Lithuania	Syrian Arab Republic
Djibouti	Macedonia, FYR	Thailand
Dominican Republic	Maldives	Tonga
Ecuador	Marshall Islands	Tunisia
Egypt, Arab Rep.	Micronesia, Fed. Sts.	Turkmenistan
El Salvador	Morocco	Vanuatu
Equatorial Guinea	Namibia	West Bank and Gaza
Fiji	Papua New Guinea	Yugoslavia, Fed. Rep.

Upper-middle-income economies

American Samoa	Grenada	Poland
Antigua and Barbuda	Hungary	Puerto Rico
Argentina	Isle of Man	Saudi Arabia
Bahrain	Korea, Rep.	Seychelles
Botswana	Lebanon	Slovak Republic
Brazil	Libya	South Africa
Chile	Malaysia	St. Kitts and Nevis
Costa Rica	Mauritius	St. Lucia
Croatia	Mayotte	Trinidad and Tobago
Czech Republic	Mexico	Turkey
Dominica	Oman	Uruguay
Estonia	Palau	Venezuela, RB
Gabon	Panama	

High-income economies

Andorra	Germany	New Caledonia
Aruba	Greece	New Zealand
Australia	Greenland	Northern Mariana Islands
Austria	Guam	Norway
Bahamas, The	Hong Kong, China	Portugal
Barbados	Iceland	Qatar
Belgium	Ireland	San Marino
Bermuda	Israel	Singapore
Brunei	Italy	Slovenia
Canada	Japan	Spain
Cayman Islands	Kuwait	Sweden
Channel Islands	Liechtenstein	Switzerland
Cyprus	Luxembourg	United Arab Emirates
Denmark	Macao, China	United Kingdom
Faeroe Islands	Malta	United States
Finland	Monaco	Virgin Islands (U.S.)
France	Netherlands	
French Polynesia	Netherlands Antilles	

	High-income OECD members	
Australia	Greece	Norway
Austria	Iceland	Portugal
Belgium	Ireland	Spain
Canada	Italy	Sweden
Denmark	Japan	Switzerland
Finland	Luxembourg	United Kingdom
France	Netherlands	United States
Germany	New Zealand	

Locale Variables:

Table 1.6

Variable Identifier	Variable Description
EAP	East Asia & Pacific
ECA	Europe & Central Asia
LAC	Latin America & Caribbean
ME	Middle East & North Africa
NA	North America
SA	South America
SSA	Sub-Saharan Africa

Income Variables:

Table 1.7

Variable Identifier	Variable Description
LOI	Low Income
LMI	Lower Middle Income
UMI	Upper Middle Income
HIOECD	High Income Countries belonging to the Organization for Economic Co-Operation and Development
HINOECD	High Income Non-OECD Countries

VIII. Analysis

A. Graphical

Looking at some simple diagrams can also allow one to discover basic relationships between countries, income classes, and the amount of aid received. In order for such comparisons to be made, selected variables were graphed as a function of income and location. The variables included: Gross Domestic Product Per Capita Growth (the percentage change in GDP over a six-year period), Government Stability, and Official Development Assistance. These variables were selected for display due to the trends they illustrate, the interest they have for the study, and the overall significance they exhibited in econometric models. Also, all countries classified as HIOCED were excluded from the analysis, as none of these countries received development assistance, and the study should focus on the experience of less-developed nations that did receive aid.

Gross Domestic Product Per Capita Growth:

Per capita GDP growth is an important indicator as to what is taking place within a country, and even small changes in a country's growth rate can amount to huge changes in welfare over a short period of time. For example, in 1980, China reported a GDP of 201,687 million. From 1980 to 1990 their GDP grew 10.1 percent, roughly 20,370 million.[viii] This increase in output allowed for rural and economic reform, which inevitably led to China's move to the market.[ix] Indeed, it has often been observed that a 2 or 3 percent increase in the growth rate is sufficient to double a country's welfare in a generation. In fact, income doubles every 35 years at a growth rate of 2 percent, but every 23 years at a growth rate of 3 percent per year.

As discovered by Nobel Prize winner Robert Solow, technical progress, increased labor supply, and capital accumulation are all key determinants of GDP growth.[x] Therefore, a low level of growth may be indicative of deeper problems. However, the magnitude of GDP growth is difficult to explain and occurs through a very complex process. Figure (1A) shows that Upper Middle Income (UMI) countries on average demonstrate the highest level of GDP growth over the span of our dataset, whereas High Income Non-OECD (HINOECD) countries produce the lowest levels of growth. While one can explain why UMI countries have an increased tendency to grow, it is difficult to validate why HIOECD countries do not grow as rapidly, until one considers the theory of conditional convergence: a country that is below the steady state growth rate should, according to classical growth theory, grow faster than a country starting at a higher level of initial GDP.[xi] If a country is already operating at its steady-state growth rate, as are perhaps many HIOECD countries, then the growth rate of these economies should be lower.

As evidenced by the diagrams, countries in North America (NA) and Sub-Saharan Africa (SSA) tend to grow less rapidly than those in the Eastern Pacific (EAP) over the time period, as seen in Figure (1B). North America's low growth can be explained by convergence, however; it is important to recall that this is due to the fact that North American countries start at a relatively high level of GDP. On the other hand, Sub-Saharan Africa experiences low growth due to "large and persistent balance of payments and inflation problems, very low levels of saving and investment, and a declining productivity of investment."[xii] Many critics blame poor economic policies for Africa's poor performance, and the history of social strife in the region certainly cannot help. This statement helps explain why studies of this nature are conducted. Generating economic models can help forecast the positive and negative effects of certain policies upon distinct groups of countries and economies, after isolating the impact of extraneous items.

Figure (1A) - GDP Per Capita Growth, 6-year average

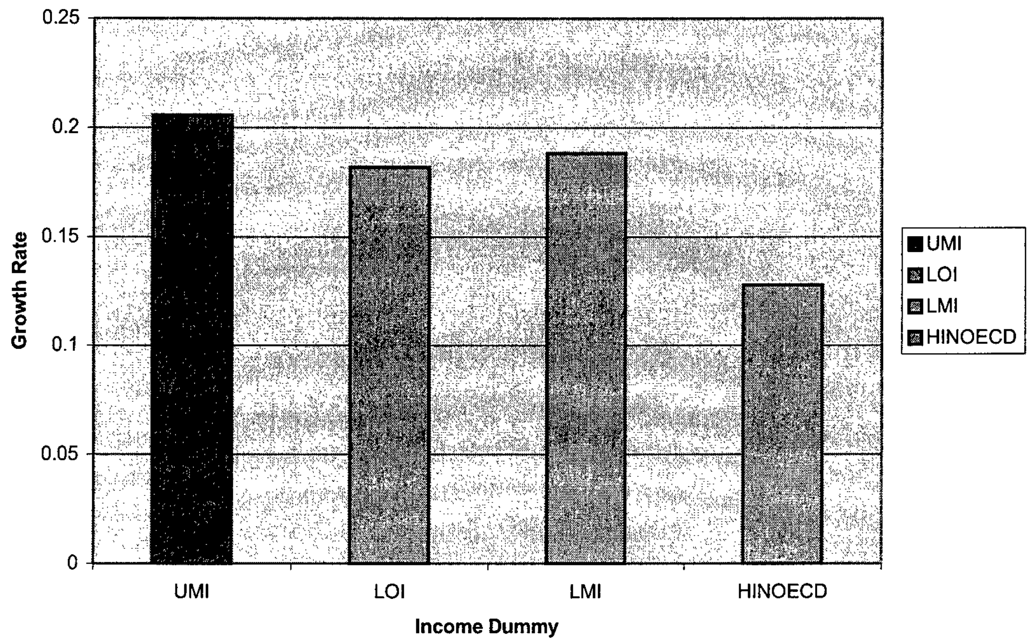
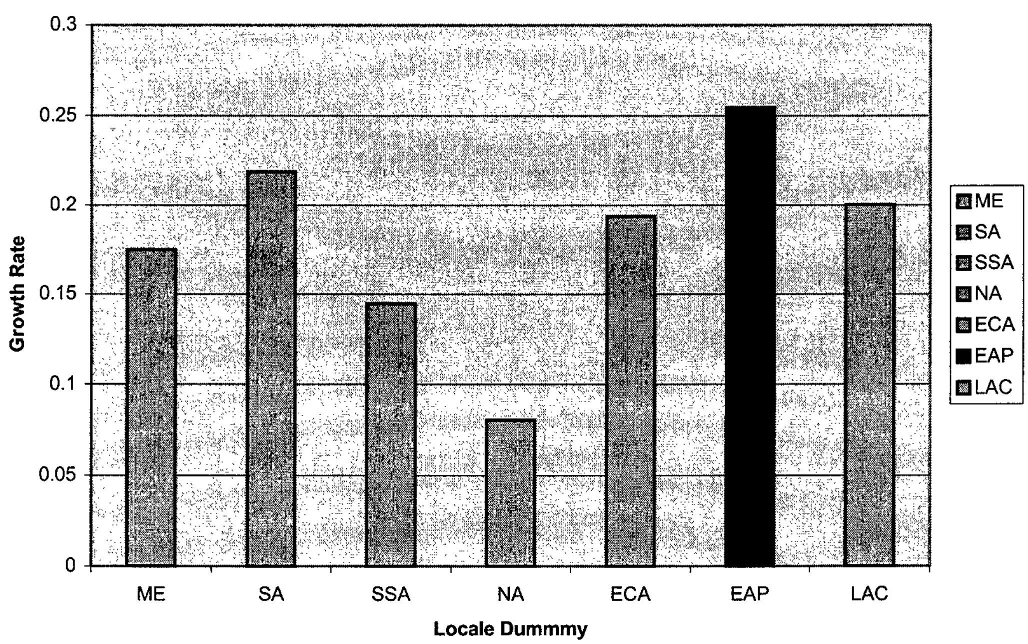


Figure (1B) - GDP Per Capita Growth, 6-year average



Government Stability:

Quantifying government stability is useful in predicting a country's growth performance. In addition, increasing the stability of government in a country may be an important objective of aid in and of itself. Since a direct number describing stability does not exist, either exactly or in theory, some proxy of stability must be employed. Data providers such as PRS create perhaps the best possible proxies of government stability. The number provided by PRS is a rank value measuring the stability of a country's government. The range is from 0 to 12, with 0 representing the least stable and 12 the most stable. Comparison of different income identifiers and country identifiers uncovered many interesting trends, as illustrated in Figures (2A) and (2B). Figure (2A) reveals that HINOECD countries are generally the most stable. Countries such as Paraguay, Iraq, and Kenya are included in this group. Higher-income, well-established countries are more likely to exhibit an effective government, than say struggling, third world nations. This could occur for many reasons; people are less likely to participate in revolution if they are satisfied with their lifestyle, and governments are also more likely to be able to collect necessary funds for day-to-day functioning. Apparently and not surprisingly, governments in some parts of the world are less stable than others. North America and the Middle East (ME) display much higher levels of stability on average than South American countries on the whole. This is seen by inspection of Figure (2B).

Figure (2A) - Government Stability

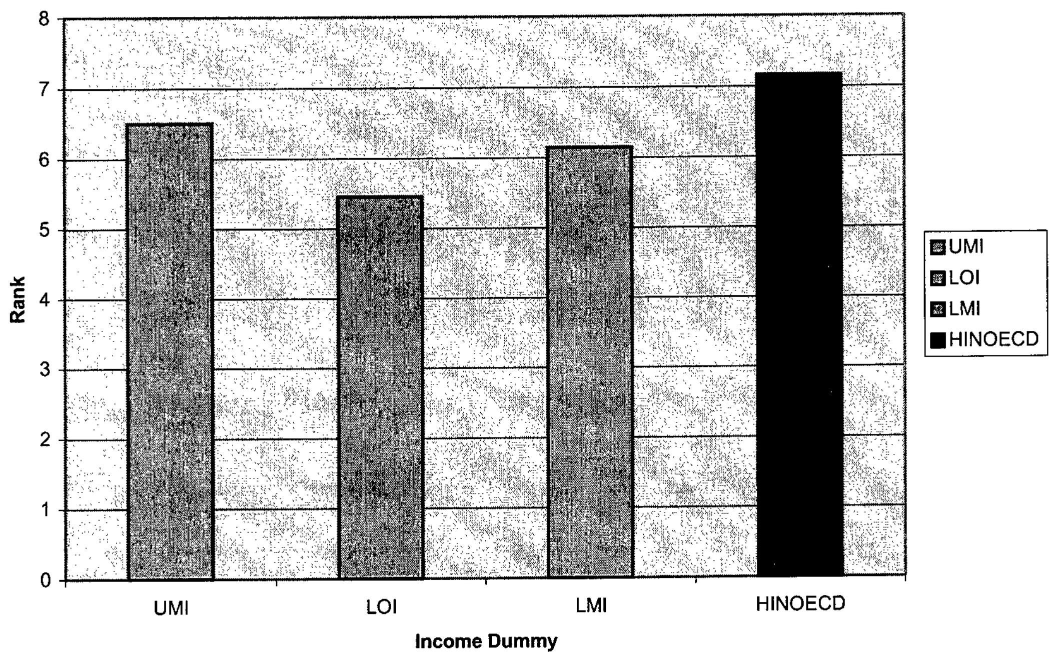
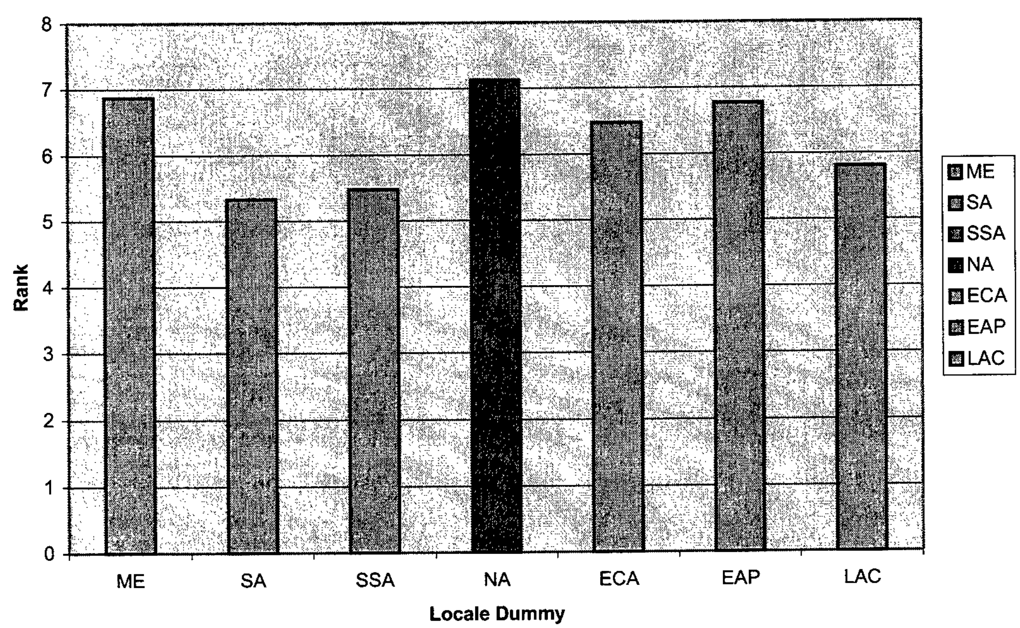


Figure (2B) - Government Stability



Official Development Assistance:

Many policy makers claim that underdeveloped countries and those in need will benefit greatly from foreign assistance, while others argue that aid has no positive impact upon recipients and may in fact do more harm than good. These two differing opinions make Official Development Assistance a very interesting variable to work with.

As previously mentioned in the Dataset Construction section, aid was measured in per capita terms. This form was preferred since it controls for country size. At first, it may seem as if a country that received 5 million dollars of assistance has benefited greatly, but say that country also had a population of 5 million. A dollar per person does not look as grand. Furthermore, think of a country that receives 1 million dollars of aid. Initially, this does not seem like a significant donation. However, if the country has a population of 25, 000, then 40 dollars per person seems much more noteworthy. These examples help explain why official development assistance is computed in this manner; a per capita measure allows for meaningful comparisons across countries of varying size.

In keeping with what one would expect, graphical analysis reveals that countries in Sub-Saharan Africa received more aid relative to the size of their economies, much more than those comprising North America and Europe & Central Asia (ECA). In addition, Lower Income (LOI) countries also were given more aid per capita than countries in other groups. Note that, on the surface, this might lead one to believe that growth and aid, or stability and aid, are negatively correlated, to the extent that the lower income countries grew slower or have less-stable governments than other countries.

In addition to correlation, the causality underlying the aid process is an important issue to address. Why do countries receive aid? Are they getting assistance because they are in trouble, or does a dependence upon assistance cause them to grow slower? As seen in later sections, regression analysis shows that countries grow in response to receiving aid, but do not necessarily receive it when they need it most. Additionally, assistance may not be large enough to overcome the negative growth already experienced by the country.

Figure (3A) - Official Development Assistance as a % of GDP

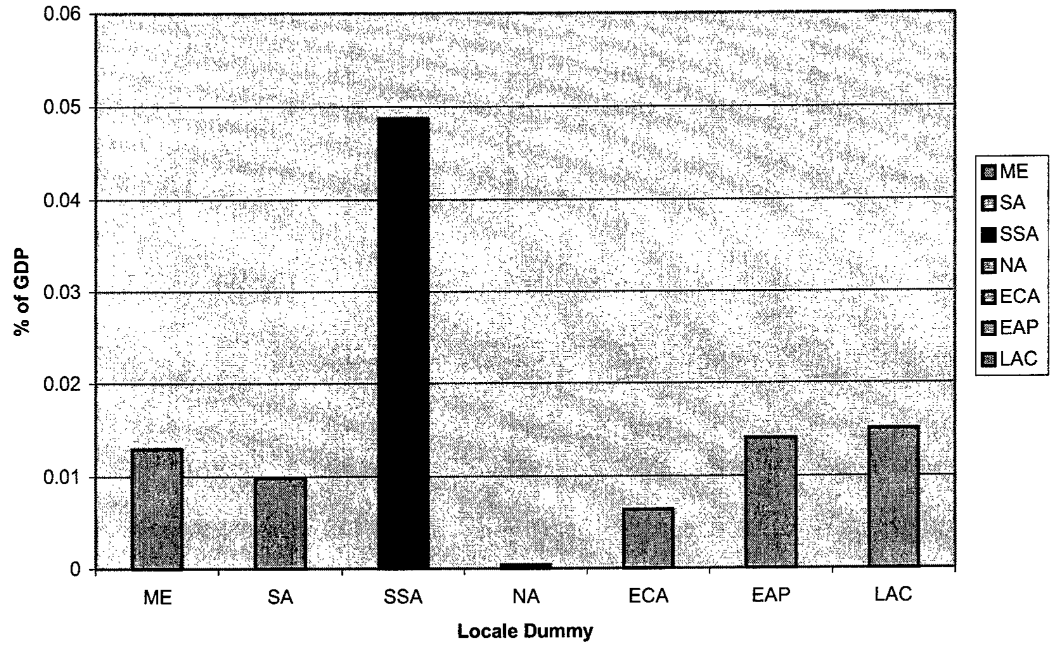
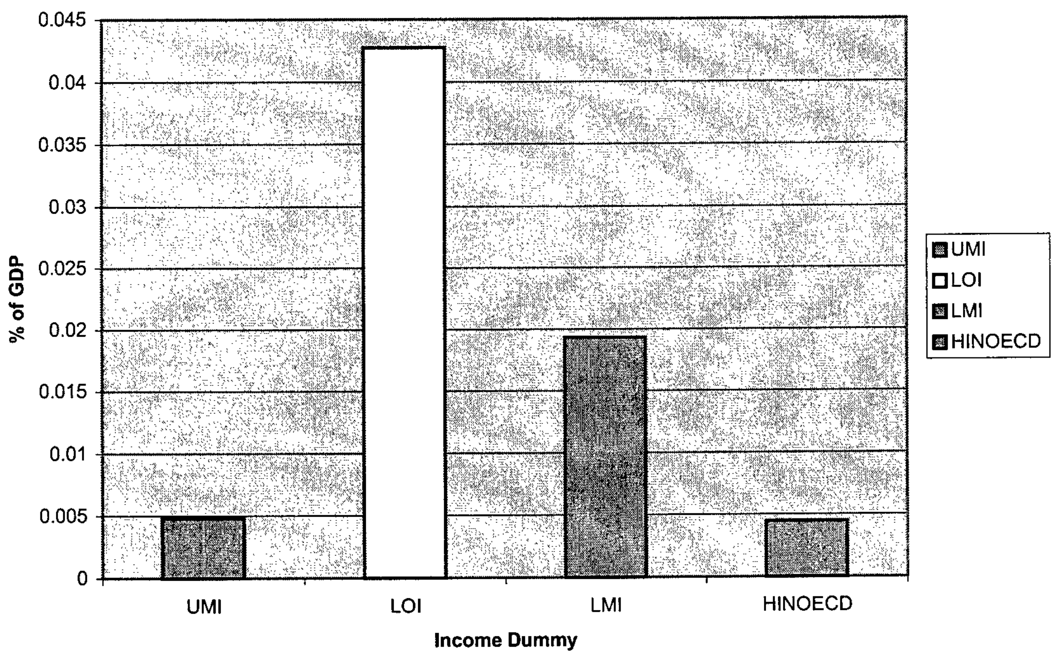


Figure (3B) - Official Development Assistance as a % of GDP



B. Econometric Analysis

The diagrams studied above only serve as a general indicator as to what the relationships are between variables, income, and location. In order to gain a more meaningful understanding, econometric analysis is conducted. This also serves to control for various other features influencing growth, and isolates the impact of aid on growth.

The dataset initially developed for this study included a variety of variables, all used in studies by respected economists. However, in order to construct a robust model that best fit the data and predicted growth, it was necessary to cut down the number of variables utilized to a manageable, yet representative set of variables. After running a series of regressions, and testing experimental models including different variables, it was determined that the initial level of GDP, Government Consumption, Primary Education, and Government Stability were most significant and most important to include in the model. The first three of these variables are often referred to as the components of the "true" growth model, or the components of a "base Barro model." Much of Barro's (1991) work builds upon these measures, as has much subsequent work (see, for example, the many papers on different aspects of growth in Meier and Rauch). It was found that many of the variables in the PRS dataset were redundant, in that the government stability index and the internal conflict index, for example, were highly correlated. Thus, stability generally made the degree of internal conflict insignificant in explaining growth. Government stability also seemed to account for levels of democracy, law, and conflict, all individual PRS variables. The nature of the four basic variables mentioned above is further explained in the following sub-sections. These variables generally prove to have both a significant statistical and practical impact on growth, and are also in line with existing growth theory.

Initial Level of GDP:

In Tables 2.1, a variety of models are presented which take growth in per capita GDP as the dependent variable. The estimated regressions reassert the fact already described by the standard Neoclassical model of growth, that the initial value of GDP will have a negative coefficient, as also seen in Tables 2.2-2.4. That is, the convergence hypothesis predicts that low-income countries should be growing at a faster rate than high-income countries, and in short should be "catching up." However, this statement only makes sense if one controls for other things that influence growth, as argued by Romer. It is standard to include initial level of GDP on the right-hand side of the regression in logarithmic form, as done in this study, because the relationship between initial GDP and growth should be nonlinear. The coefficient of this variable explains the conditional rate of convergence. If all other explanatory variables are held constant, countries exhibiting lower starting levels of GDP should experience higher growth. Studies conducted by Barro (1991) and Mankiw, Romer, and Weil (1992) established this relationship, and this result backs up these previous studies.

Government Consumption:

Government Consumption is introduced into the model in the form of a percentage of GDP, allowing one to account for its value relative to each country. Summers and Heston (1993) are credited with the development of this ratio and the importance it has for growth. Such a measure serves as an approximation of the outlays that do not improve productivity, or more specifically, of the magnitude of strict transfers across and around the country. One can conclude that a high volume on nonproductive government spending reduces the growth rate, explaining the negative coefficient seen in growth regressions; additionally, it is well established that high levels of government spending can have deleterious effects on interest rates and private savings rates. Again, this result supports this general idea, as seen by the negative coefficient on government consumption found in the models included in Tables 2.1-2.4.

Level of Human Capital:

Human capital enters this model in the form of the total number of pupils receiving primary education as a percentage of total population. This was the best measure available in the data set and is generally very similar to the standard level of secondary school attainment included in most growth regressions. One can conclude that those who begin schooling early in life are more likely to continue their education. Further, a country's human capital, which is determined by education, should be directly dependent on schooling. Somewhat surprising was the result that the coefficient on primary education was negative, meaning that countries with higher primary school enrollment experienced lower growth. This is possibly due to this variable actually capturing features of the age distribution of populations; indeed, countries with younger populations or rapid population growth rates generally grow slower than others. Furthermore, one may venture to say that in some countries, those attending school are temporarily removed from the workforce, thus decreasing the level of productivity.

Level of Government Stability:

Fischer and Thomas (1990) assert,

"a government that creates a favorable enabling environment has a large role to play [in development]; for instance in ensuring the provision of infrastructure, including social services, such as poverty alleviation, basic education, and access to health care; public security; a stable macroeconomic framework; and an efficient fiscal and regulatory system."[xiii]

Claims such as these reinforce the need to include a measure of government stability in a growth model. Economists such as Knack and Keefer (1995) have used similar variables in their studies. The main idea is that such values, while subjective, can "gauge the attractiveness of a country's investment climate by considering the effectiveness of law enforcement, the sanctity of contracts, and the state of other influences on the security of property rights."[xiv] Within all the regressions run in this study, government stability is included in two forms; one is linear - a simple stability value, and the other non-linear - the simple stability value squared. It is of some interest that an increase in the linear variable decreases the growth rate, while an increase in the non-linear term increases it. One can see the difference of degree between these coefficients best in the regression on contemporaneous values of the independent variables on growth detailed in Table 2.1. This result suggests that the influence of government stability on growth is, on the whole, nonlinear.

IX. Model Creation

In order to test the effects of growth upon aid, the "true" growth regression mentioned in Section VII needed to be somewhat modified to suit the data available.

Still, the base structure remained the same, and to this, a measure of official development assistance and regional and economic dummy variables were added. It is important to mention that two dummy variables, one from each set, had to be excluded from regression analysis. One dummy within a group of dummies must be omitted in order to establish a base to which all other variables are compared. The High Income Non-OECD income class dummy and East Asia Pacific regional dummy were the two variables excluded. As a result, all estimated coefficients of dummy variables are relative to these two groups. The inclusion of dummy variables also allowed for interaction variables. In essence, this form of variable is a cross-product between a quantitative and qualitative term. For the purpose of this study, all interactions were between official development assistance and geographic and economic dummies.

At the beginning of this study, the only goals were those of proving that a relationship between growth and aid received existed; however, after further exploration, more interesting connections were discovered. As a result, the single model turned into a series of three models: the first depicting aid and its impact upon growth, the second showing the effect of previous aid received upon government stability, and a final regression presenting the result of past levels of aid and the state of conditions in the country on the aid rewards received by countries. The idea was to study the impact of past and current aid, and investigate any patterns present in the way in which aid is awarded. Prior to conducting this study, it was optimistically assumed that aid would benefit a country, improve stability, and only be given to countries that are performing poorly. While the study found that aid helped countries grow, it did not allow one to conclude that it is necessarily going to the most stricken economies.

GDP Growth as the Dependent Variable:

The first estimated model focusing upon the growth of GDP per capita included all contemporaneous variables. In addition to the base variables mentioned above and a measure of official development assistance, all locale dummies, excluding North America (NA) and East Asia Pacific (EAP), and all income dummies with the exception of High Income Non-OECD (HINOECD) countries were included in the model. To further explain the nature of aid, interaction variables for aid and each dummy variable were introduced.

The addition of dummy variables and interaction variables assisted in determining the effect of location, income, and aid upon growth. In essence, these variables allowed for isolation and comparison. For example, a positive and significant coefficient for a Low Income country would signify the fact that if a country falls into the category of lower income, then they are likely to have an increasing level of GDP growth per capita. The meaning of locale dummy variables follows the same logic. Interaction variables are somewhat different. In the case of this model, an interaction occurs between both locale and income dummy variables and official development assistance. This variable explains what happens to growth if a country from the designated locale or income identifier receives aid.

This regression ((1) of Table 2.1) constructed from all of the variables mentioned above validated many of the theories and trends previously discussed. The initial value of GDP was significant based on a p-value of .0685 and displayed a negative sign, as predicted by the convergence hypothesis. This same theory was furthered by the nature of all the income dummies. Generally, all of these variables remained significant, and seemed to contribute to the explanatory power of the model, as evidenced by the drop in adjusted R^2 from .8359 to .7534 upon omission of the income dummies. Relative to the HINOECD countries, all other countries grew faster, which makes sense, since they began at a lower level of initial income compared to high-income countries. However, Regressions (2) and (3) of Table 2.1 generate estimated coefficients of about .09-.1 on the low and middle income dummies, and about .2 on the upper-middle income dummy. This result is of note, due to the fact that it does not coincide with conditional convergence; instead, it suggests that countries with high initial income grow faster than low initial income countries. One guess is that this might be due to some sort of agglomeration or spillover effects once countries reach some cutoff level of GDP per capita.

Looking once again at Regression (1) seen in Table 2.1, one can see that the coefficient of government consumption, like the Log(Initial GDP), was a negative number (-.842240), leading one to believe that more government consumption decreases growth. Only one regional dummy turned out to be significant in this regression. A 10% increase in the percentage of GDP consumed by government, for example, would lower the country's 6-year growth rate by (.842240)*.10=.08 or 8%, a substantial amount. Countries located in Sub-Saharan Africa tended to grow significantly slower, as reflected in its coefficient of -.168884, meaning that SSA countries grew at a yearly rate 16 percentage points lower than countries from East Asia Pacific, which furthers the statements made in Section VII concerning this region's level of economic development.

Dummy variables and interaction variables are quite useful, but the removal of these values offers unique insight into the nature of the dependent variable at hand. As interaction variables are eliminated from the regression, the significance of official development assistance increases. In the full model, this variable was insignificant, but the p-value dropped to .0710 when income interactions were removed, and then to .0388 when all interactions were excluded. The p-value of official development assistance continued to decrease as more dummies were removed from the model. In the final model, free of all dummy variables, aid produced a p-value of .0006. While this p-value did decrease as variables were removed, the adjusted R^2 decreased from an initial value of .855822 to a final value of .728189. The final equation, which greatly resembles "Barro's true model", displays significance for all variables other than Log(Initial GDP) and Primary Education. These results can be interpreted as follows: for the average country, an increase in government consumption and government stability will lead to a decrease in GDP growth, while an increase in government stability squared and aid will be reflected in an increase of growth. Incidentally, it appears that the Barro model does a fairly good job of capturing regional differences, as omitting dummies does not greatly alter the performance of the model

To further convey the ideas covered in the above models, an example is of use. What if a country received an additional hundred dollars per capita in aid? Since the estimated coefficient on aid in the regression ranges from .0006 to .001, the impact on the 6-year growth rate would be between .06 and .1 percent; this impact is relatively modest. For example, this modest change would cost approximately two hundred million dollars of supplemental aid, if the population of the given country was two million. One may conclude from this example that substantial amounts of aid are required to greatly stimulate growth. Still, this ignores the short-run impact of aid on the economy and overall welfare of the population.

While current values of variables are very useful in predicting and explaining growth, lagged values eliminate the potential problem of endogeneity. When running a regression utilizing lagged values, one is trying to explain the effect of a variable change occurring in a previous time period. Due to the number of observations in the constructed dataset, only one lag was implemented. Furthermore, the lag of GDP Growth Per Capita was also included, along with the variables used in the contemporaneous model. In all of the regressions, the lagged value of GDP Per Capita Growth was highly significant. P-values as low as .00000 indicate a strong dependency of current growth upon past values. The estimated coefficient on past growth ranged from .17 to .26, which implies that about a quarter of current growth experience is explained by its own past values. One may claim that once a trend and confidence in a country's abilities is established, that such activities will continue. All in all, the use of lagged values produced better fitting regressions; the highest R^2 value for the contemporaneous regression was .855822, whereas the lagged regression produced a model with a value of .999316. Furthermore, the use of lags quiets all concerns concerning reverse causality one may have. Similar to the regressions run above, the coefficients of Log(Initial GDP) and Primary Education were negative and significant. In addition, all income dummies and the SSA variable in Regression (1) of Table 2.2 remained important to the model. Unlike the contemporaneous regression, government stability and government stability squared were not significant. Therefore it can be inferred that past levels of stability do not determine growth.

The major difference between the regressions in Tables 2.1 and 2.2 was in the behavior of the interaction variables. Both ODAPECA and ODAPLAC were significant with p-values of .0000 and .0588 respectively. If a country in Europe and Central Asia received aid in the past, then they are likely to experience negative growth, while a country in Latin America would be likely to show signs of positive GDP Per Capita growth. This may lead one to believe that Latin American countries utilize aid in a more constructive and beneficial manner, or that European and Central Asian countries do not dedicate the assistance received to increasing production. Still, one must make this conclusion carefully. The dependence may also be due to the conversion of former socialist economies that received huge amounts of aid when they initially began transitioning, and also experienced tremendous declines in growth and economic performance at the same time.

As done above, three additional regressions were run: one eliminating all interaction variables, another eliminating all income dummies, and a final eliminating all locale dummies. Removing all interaction variables made government consumption significant and the LAC dummy insignificant. At the same time, the adjusted-R^2 value decreased to .951116. Other than this one difference, all other variables behaved similar to equation (1) and (2), seen in Table 2.2.

When all income dummies were removed, a different result was produced; instead of increasing significance, many of the remaining variables became insignificant. This suggests the dummy variables occupy an important place in determining the model. Those affected were the Log of GDP, Government Consumption, and Latin American & Caribbean countries. While these variables became less important, the coefficients of

GDP per Capita Growth, Primary Education, and the Europe and Central Asia dummy changed. The value of the estimated coefficient for GDP Growth increased to .245. Another increase in value was seen in regard to the ECA dummy, whose coefficient rose from -.086 to -.044. Furthermore, the p-values for all of these variables decreased, signifying their continued importance within the mode. While, these numbers did improve, the overall fit of the model dropped to .898943.

The complete absence of dummies produced the least desirable R^2 value, and had the fewest number of significant variables. GDP per capita growth and Primary Education were the only strongly significant variables, producing p-values of .0000 and .0094 respectively. From this, one can assert that the average country would display increased growth if it grew in the past, and decreased growth if Primary Education per Capita increased in the prior period. Unlike the contemporaneous model, official development assistance had no impact upon growth, suggesting assistance does not, on its own, generate lasting benefits.

Official Development Assistance as the Dependent Variable:

Treating aid as an independent variable is useful; however, looking at its dependency upon other variables is just as valuable. Similar to the above analysis, five regressions were estimated, starting with all variables and working down to the base regression. Regression (1) in Table 2.3 was the largest model estimated. Consistent with what one would expect, as a country's past level of GDP rises, the aid received decreases, as seen in the negative coefficient of –2.402819. A higher level of GDP is indicative of higher-income, larger, more self-sufficient countries that do not necessarily need foreign assistance. Countries from Sub-Saharan Africa, Latin America & the Caribbean, and the Middle East are those who get aid most frequently. The low p-values and positive nature of their regional coefficients prove this point. The values of these measures can be found in Table 2.3. The interaction variables for these three variables were also significant. Once again, all three experienced the same trend: if they received aid in the past, then they were less likely to receive aid in the future. Such a result is what benefactors would hope to see. This is an example of countries that properly utilize aid, and do not become dependent upon its support. Overall, this model fit the data rather well, exhibiting an R^2 value of .957368.

In order to further explore the nature of this variable, another regression was estimated excluding all income interaction variables. As in previous cases, this omission made all country dummies increase in significance, except for Europe and Central Asia and Latin America. Furthermore, Official Development Assistance became significant, as its p-value decreased from .2916 to .0000. The positive sign of its coefficient shows that if a country received aid in the past; they are more prone to receive it in the future; this value is indicative of a country's "propensity to receive aid." A great deal of this tendency hinges upon dependence. When countries receive assistance from an outside source, there is no need for them to work on becoming more stable and developed. Instead, a recipient will continue asking for help, never fixing the root of their problems. However, this may not always be the case for all countries, as illustrated by the interaction variables for SSA, ME, and LAC. These three regions behave quite differently than the average, as mentioned when discussing the results obtained from Regression (1) of Table 2.3. The coefficients exhibited by these variables are all negative, and range from -.214 to -.586, leading one to conclude that if a country in one of these regions received aid in the past, then they are less likely to receive it again in the future.

Regression (3) (Table 2.3) removed all interaction variables, allowing for the analysis of both base and dummy variables. When interactions were omitted, all income dummies became significant, producing p-values in the range of .0046 to .0904. Relative to HINOECD countries, all income groups receive more aid. Lower income countries receive the most aid, as seen by the coefficient of 13.29491; on average, a $13 difference compared to HINOECD countries. As expected, upper middle-income countries are not the recipients of assistance to the same degree as other countries. Similar to Regression (2) seen in Table 2.3, SSA and LAC dummies were significant, however the removal of all interactions, led to a sign change in the coefficient of the variables. The magnitude remained similar, but both values turned negative, leading one to think that these regions are not likely to receive aid. As seen in previous regressions, Official Development Assistance was very significant within the model, indicated by a .0000 p-value. Out of all the regressions run, this model emerged as the best fit, supported by a R^2 value of .999526. The coefficient is always in the neighborhood of 1, suggesting aid awards have a high tendency to repeat themselves.

Due to the fascinating effects of dummy variables, two more regressions were run: one removing all income dummies and another excluding all other dummies. The omission of all income dummies did not alter the locale variables significant to the regression; however, the importance of Government Consumption increased. For the first time, this variable produced a p-value low enough to be considered significant. As past levels of Government Consumption increased, the level of Official Development Assistance decreased, signifying a negative relationship. The coefficient on this variable is very large in magnitude (-41.63286), leading one to believe that it is capturing the relationship once encompassed in the income dummy, which is now removed. It turns out that this regression is the second best estimate of the model, due to its R^2 value of .990666, as seen in Table 2.3.

The final regression run removed all dummy variables, leaving only the most basic regression. Two variables remained significant in this estimate: Log(GDP) and Official Development Assistance. However, the magnitude of both of these variables decreased, along with the adjusted R^2. For all countries included in this study, an increase in a country's past values of GDP decreases the amount of assistance received. Furthermore, Regression (5) (Table 2.3) reasserts the fact that countries who receive aid in the past are much more likely to receive it in the future.

Government Stability as a Dependent Variable:

Using government stability as a dependent variable allows one to investigate the dependence of a different characteristic of a country upon official development assistance. Again, lags are used to eliminate dual causality. This regression can be seen in Table 2.4. Interestingly enough, an increase in GDP last year, produced a decrease in government stability this year, as explained by its negative coefficient of -.102038. A similar response was noticed with an increase in government consumption. It is worth mentioning the magnitude of the coefficient for this variable. Government consumption is measured as a percentage, making a coefficient of -3.621926 quite meaningful. It is important to see how much of an effect a past increase in government consumption has upon the current level of government stability. Spending more money on political issues instead of on the population and overall country welfare can be detrimental to the overall well being of a government. Regression analysis also shows that countries in SSA, ECA, and LAC are unstable; however, it also proves that if countries included in ECA and LAC received aid in the past that their level of government stability increased. P-values of .0000 allow for this conclusion to be made. Such an observation proves that there is not a relationship between stability and how well a country utilizes aid. Obviously, countries located in ECA and LAC, while not stable, can use the assistance they receive to improve their country. While assistance may not turn a country into a stable country, it can make its overall level better. Countries located in the Middle East behave quite differently. If a country is included in the ME dummy variable, it will be characterized by high levels of government stability, as depicted in its coefficient of .697254. In other respects, ME behaves similar to the other significant locale dummies. If it received aid in the past, then it is more likely to show signs of increased government stability.

The last issue of importance to discuss in relation to Regression (1) has to do with the tendencies of government stability. It is interesting to observe that past levels of government stability do not affect its current levels. Such an observation can say a great deal about causality.

As done in the previous sub-section four subsequent regressions were run. The first removed only income related interaction variables. Such an action did not significantly alter the model; however, it did cause official development assistance to become significant. The low p-value, .0004, produced indicates that some relationship must exist between the interaction of income and aid, and aid. One might infer that the interaction between past aid and income explained the nature of past aid, explaining why the removal of this variable would cause official development assistance to become significant. Overall, this model did not fit as well as Regression (1). As seen on Table 2.4, the first regression produced a R^2 value of .997899, whereas Regression (2) produced a value of .995636.

The elimination of all interaction variables had a much more noticeable impact on the model, as seen in the decrease in R^2 from .997899 to .990158. Analysis of the p-values for each variable showed that many of the variables, which were once significant, such as Log(GDP), Official Development Assistance, ECA, and LAC, now became insignificant. The South American dummy, a once insignificant variable, turned significant in this regression. The negative coefficient of –1.079959 it displays leads one to believe that in general, South American countries are less stable. Interestingly, the income dummies all became even more insignificant than previously noted. Their insignificance allows one to conclude that government stability does not depend as much on income, as it does location. Past history supports that it is more the tendency of a certain region to be burdened by conflict and ineffective government, than a country's income class. Some may even say that the location of a country encompasses its income identifier. For instance, most countries in Sub-Saharan Africa are Low Income countries. This relationship is one that would be interesting to explore in other studies.

The removal of all income dummies, as previously shown, increased the validity of the model, and reduced all p-values. In this regression, all country dummy variables other than ECA and LAC were significant. The most noteworthy change was seen in the p-value for GDP Per Capita Growth, decreasing from .1829 in Regression (3) to .0705 in Regression (4), both seen in Table 2.4. An increase in past growth had a negative impact upon government stability. This tendency could be explained by the fact that an increase in output is not what will increase stability. Instead, a country needs to focus its efforts on the people and government, thus fixing the root of the problem. One relationship still of interest is the past level of government stability. The omission of income dummies did not improve the significance of government stability. Therefore, one can still assert that prior levels of government stability do not affect current values.

The last regression run utilizing government stability as the dependent variable was one free of all dummy variables. The regression fit better than Regression (3), but worse than all other previous runs. GDP Growth per Capita once again became insignificant, while Log(GDP) and Primary Education turned significant. Log(GDP) had at one time been significant, but Primary Education had not been important to the model until this point. Its coefficient, 1.712332, shows that a rise in the level of education per capita in the past increases a country's level of government stability. A more educated population is apt to be able to handle conflict and governmental issues better than those without. Therefore, one can see why education and stability bear a positive relationship. While this is an interesting point, there is one of much more significance that needs to be mentioned. Regression (5) is unique due to the sign change from negative to positive of the coefficients on two variables: Log(GDP) and Government Consumption. Not only does this show that an increase in past values of GDP and Government Consumption increases government stability, but it also illustrates the nature of dummy variables. In Regressions (1-4), the negative nature of Government Consumption was explained, but the inclusion of dummy variables forced all values to be a comparison to High Income Non-OECD countries and Eastern Pacific countries. In relation to the performance of these two identifiers, past Government Consumption was negative. However, for all countries included in this study it has a positive impact (2.092789). Not only does this demonstrate the point mentioned above, but it also sheds light onto the power of HINOECD and EAP countries.

X. Regression Specific Tables

Table 2.1: GDP Growth Per Capita, Contemporaneous Values

	(1)	(2)	(3)	(4)	(5)
Log(GDP)	**-0.015874** **(0.0685)**	**-0.015251** **(0.0803)**	**-0.022773** **(0.0040)**	**-0.012515** **(0.0827)**	0.002576 (0.6576)
Primary Education as a % of Population	-0.207332 (0.2696)	-0.102126 (0.5911)	-0.103739 (0.5646)	-0.011607 (0.9425)	0.027029 (0.8506)
Government Consumption as a % of GDP	**-0.842240** **(0.0000)**	**-0.919113** **(0.0000)**	**-0.937821** **(0.0000)**	**-0.903823** **(0.0000)**	**-0.820872** **(0.0000)**
Government Stability	**-0.062459** **(0.0774)**	**-0.063764** **(0.0801)**	**-0.062343** **(0.0777)**	**-0.087771** **(0.0268)**	**-0.117560** **(0.0003)**
(Government Stability)^2	**0.006788** **(0.0181)**	**0.006922** **(0.0186)**	**0.006536** **(0.0226)**	**0.008866** **(0.0069)**	**0.011729** **(0.0000)**
Official Development Assistance Per Capita	0.000673 (0.5678)	**0.001013** **(0.0710)**	**0.000511** **(0.0388)**	**0.000586** **(0.0180)**	**0.000848** **(0.0006)**
Sub-Saharan Africa dummy	**-0.168884** **(0.0315)**	-0.086271 (0.1279)	**-0.091342** **(0.0652)**	-0.039798 (0.2759)	
Europe and Central Asia dummy	0.012094 (0.8806)	-0.022800 (0.7624)	-0.076016 (0.1551)	0.027051 (0.4787)	
South America dummy	-0.101558 (0.4030)	-0.009920 (0.9281)	0.031341 (0.5457)	0.048773 (0.3032)	
Middle East & North Africa dummy	0.067722 (0.1351)	0.063049 (0.1531)	0.030989 (0.4068)	0.042937 (0.2221)	
Latin American & Caribbean dummy	-0.004139 (0.9338)	-0.022079 (0.6486)	-0.053314 (0.1985)	0.031334 (0.3766)	
Lower Income Dummy	**0.178749** **(0.0241)**	**0.086383** **(0.0592)**	**0.096053** **(0.0317)**		
Lower Middle Income Dummy	**0.091338** **(0.0584)**	**0.092058** **(0.0141)**	**0.102261** **(0.0043)**		
Upper Middle Income Dummy	**0.147593** **(0.0055)**	**0.185029** **(0.0000)**	**0.211520** **(0.0000)**		
Interaction ODAPSSA Variable	0.000921 (0.4062)	0.000130 (0.8321)			
Interaction ODAPSA Variable	0.005099 (0.4403)	0.003852 (0.5680)			
Interaction ODAPME Variable	-0.000899 (0.1667)	-0.000896 (0.1707)			
Interaction ODAPECA Variable	-0.002507 (0.3254)	-0.001609 (0.4748)			
Interaction ODAPLAC Variable	-0.000552 (0.3371)	-0.000446 (0.4511)			
Interaction ODAPLOI Variable	-0.000678 (0.6437)				
Interaction ODAPLMI Variable	0.000382 (0.7323)				
Interaction ODAPUMI Variable	0.001121 (0.4023)				
Adjusted R^2	**0.855822**	0.835480	0.835903	0.753456	0.728189
Number of Observations	**192**	192	192	192	192

Notes: All independent variables are contemporaneous. Estimates were calculated using the method of weighted least squares. P-values of the coefficient estimates are shown in parentheses, below the estimated coefficient. R^2 values are reported as adjusted measures.

Table 2.2: GDP Per Capita Growth, Lagged Values

	(1)	(2)	(3)	(4)	(5)
GDP Per Capita Growth	**0.174022**	**0.170289**	**0.198470**	**0.244677**	**0.261052**
	(0.0008)	**(0.0008)**	**(0.0000)**	**(0.0000)**	**(0.0000)**
Log(GDP)	**-0.016434**	**-0.017174**	**-0.016780**	-0.002493	-0.001144
	(0.0460)	**(0.0276)**	**(0.0143)**	(0.6727)	(0.7860)
Primary Education as a % of Population	**-0.456414**	**-0.475569**	**-0.320342**	**-0.377918**	**-0.306838**
	(0.0160)	**(0.0101)**	**(0.0535)**	**(0.0240)**	**(0.0094)**
Government Consumption as a % of GDP	-0.217191	-0.220497	**-0.297459**	-0.188375	-0.084870
	(0.2059)	(0.1900)	**(0.0801)**	(0.2451)	(0.5209)
Government Stability	-0.030221	-0.029866	-0.034449	0.006084	-0.001218
	(0.4390)	(0.4341)	(0.2541)	(0.8214)	(0.9520)
(Government Stability)^2	0.002829	0.002912	0.003531	0.000205	0.000599
	(0.3913)	(0.3658)	(0.1591)	(0.9293)	(0.7326)
Official Development Assistance Per Capita	-0.000101	-0.000900	3.99E-05	0.000238	5.99E-05
	(0.9554)	(0.1899)	(0.8584)	(0.2461)	(0.6711)
Sub-Saharan Africa dummy	**-0.222526**	**-0.202996**	**-0.078335**	-0.024250	
	(0.0112)	**(0.0016)**	**(0.0485)**	(0.1971)	
Europe and Central Asia dummy	0.084907	**0.101591**	**-0.086329**	**-0.044344**	
	(0.1896)	**(0.0888)**	**(0.0215)**	**(0.0086)**	
South America dummy	-0.119066	-0.101793	0.016864	0.055699	
	(0.4855)	(0.5162)	(0.7612)	(0.2547)	
Middle East & North Africa dummy	-0.015745	-0.010234	0.026890	0.004232	
	(0.7321)	(0.8085)	(0.3499)	(0.8076)	
Latin American & Caribbean dummy	**-0.110887**	**-0.100519**	-0.046551	-0.007332	
	(0.0458)	**(0.0484)**	(0.1658)	(0.7260)	
Lower Income Dummy	**0.142463**	**0.121505**	**0.087607**		
	(0.0954)	**(0.0053)**	**(0.0134)**		
Lower Middle Income Dummy	**0.082565**	**0.069262**	**0.049715**		
	(0.0686)	**(0.0277)**	**(0.0737)**		
Upper Middle Income Dummy	**0.154435**	**0.130095**	**0.109938**		
	(0.0053)	**(0.0021)**	**(0.0026)**		
Interaction ODAPSSA Variable	**0.002851**	**0.002171**			
	(0.0473)	**(0.0055)**			
Interaction ODAPSA Variable	0.005359	0.004864			
	(0.6010)	(0.6291)			
Interaction ODAPME Variable	0.000666	0.000718			
	(0.3946)	(0.3532)			
Interaction ODAPECA Variable	**-0.008324**	**-0.008975**			
	(0.0000)	**(0.0000)**			
Interaction ODAPLAC Variable	**0.001428**	**0.001292**			
	(0.0588)	**(0.0723)**			
Interaction ODAPLOI Variable	-0.001278				
	(0.5365)				
Interaction ODAPLMI Variable	-0.000847				
	(0.6399)				
Interaction ODAPUMI Variable	-0.001526				
	(0.4475)				
Adjusted R^2	0.998027	**0.999316**	0.951116	0.898943	0.868949
Number of Observations	131	**131**	131	131	131

Notes: All independent variables are lagged on period. Estimates were calculated using the method of weighted least squares. P-values of the coefficient estimates are shown in parentheses, below the estimated coefficient. R^2 values are reported as adjusted measures.

	(1)	(2)	(3)	(4)	(5)
GDP Per Capita Growth	0.008508 (0.9982)	0.985603 (0.8064)	-0.968878 (0.7605)	-2.181045 (0.3956)	4.656844 (0.1221)
Log(GDP)	**-2.402819** **(0.0390)**	**-2.143589** **(0.0632)**	**-6.074838** **(0.0000)**	**-4.989471** **(0.0000)**	**-2.393751** **(0.0003)**
Primary Education as a % of Population	19.16048 (0.2657)	20.78401 (0.2411)	6.476149 (0.6851)	-4.064632 (0.7772)	2.841096 (0.8229)
Government Consumption as a % of GDP	10.88204 (0.6652)	8.074277 (0.7601)	-10.08116 (0.6777)	**-41.63286** **(0.0753)**	-11.68879 (0.5120)
Government Stability	-0.742111 (0.8518)	-0.633114 (0.8693)	0.349638 (0.8310)	1.519107 (0.2983)	2.050918 (0.4407)
$(\text{Government Stability})^2$	0.091712 (0.8014)	0.100710 (0.7758)	0.014537 (0.9330)	-0.100118 (0.5173)	-0.204546 (0.4075)
Official Development Assistance Per Capita	0.925526 (0.2916)	**1.245895** **(0.0000)**	**0.832102** **(0.0000)**	**0.882657** **(0.0000)**	**0.879863** **(0.0000)**
Sub-Saharan Africa dummy	**10.66135** **(0.0438)**	**12.80429** **(0.0043)**	**-15.54088** **(0.0001)**	**-9.574189** **(0.0001)**	
Europe and Central Asia dummy	7.292606 (0.1578)	4.749958 (0.3108)	1.146370 (0.6375)	-0.037737 (0.9865)	
South America dummy	2.807053 (0.6771)	5.856947 (0.3877)	-4.283354 (0.4485)	-0.273727 (0.9558)	
Middle East & North Africa dummy	**13.14212** **(0.0129)**	**8.936602** **(0.0849)**	-3.358489 (0.4164)	-1.191999 (0.7524)	
Latin American & Caribbean dummy	**7.614310** **(0.0883)**	5.050603 (0.2538)	**-5.431991** **(0.0286)**	**-3.786710** **(0.0808)**	
Lower Income Dummy	9.689627 (0.3497)	7.625657 (0.1709)	**13.29491** **(0.0046)**		
Lower Middle Income Dummy	-4.813314 (0.6457)	1.068107 (0.8538)	**9.021621** **(0.0238)**		
Upper Middle Income Dummy	-1.088138 (0.9173)	2.260939 (0.6928)	**6.811379** **(0.0904)**		
Interaction ODAPSSA Variable	**-0.328591** **(0.0727)**	**-0.590583** **(0.0000)**			
Interaction ODAPSA Variable	-0.360291 (0.4615)	-0.612475 (0.2185)			
Interaction ODAPME Variable	**-0.586049** **(0.0000)**	**-0.565194** **(0.0000)**			
Interaction ODAPECA Variable	0.073024 (0.7812)	-0.100269 (0.5987)			
Interaction ODAPLAC Variable	**-0.214375** **(0.0443)**	**-0.258050** **(0.0148)**			
Interaction ODAPLOI Variable	-0.007505 (0.9932)				
Interaction ODAPLMI Variable	0.339196 (0.6973)				
Interaction ODAPUMI Variable	0.115032 (0.8968)				
Adjusted R^2	0.957368	0.948788	**0.999526**	0.990666	0.912417
Number of Observations	131	131	**131**	131	131

Notes: All independent variables are lagged on period. Estimates were calculated using the method of weighted least squares. P-values of the coefficient estimates are shown in parentheses, below the estimated coefficient. R^2 values are reported as adjusted measures.

	(1)	(2)	(3)	(4)	(5)
GDP Per Capita Growth	-0.084364 (0.8198)	-0.246860 (0.4605)	-0.476296 (0.1829)	**-0.544994** **(0.0705)**	-0.082219 (0.8015)
Log(GDP)	**-0.102038** **(0.0566)**	**-0.115490** **(0.0106)**	-0.063497 (0.1816)	-0.020909 (0.4993)	**0.107236** **(0.0065)**
Primary Education as a % of Population	1.072520 (0.4191)	0.756393 (0.5418)	-0.166790 (0.8863)	-0.259888 (0.8138)	**1.712332** **(0.0821)**
Government Consumption as a % of GDP	**-3.621926** **(0.0057)**	**-3.817127** **(0.0015)**	**-2.790166** **(0.0377)**	**-2.404991** **(0.0410)**	**2.092789** **(0.0384)**
Government Stability	0.455454 (0.2341)	0.394915 (0.2378)	0.400895 (0.2820)	0.249233 (0.4680)	0.228257 (0.4483)
(Government Stability)^2	-0.018553 (0.5890)	-0.011360 (0.7018)	-0.012206 (0.7136)	0.000263 (0.9933)	0.007650 (0.7647)
Official Development Assistance Per Capita	-0.008170 (0.6234)	**-0.007337** **(0.0004)**	-0.001551 (0.3191)	-0.000848 (0.4789)	0.001222 (0.4411)
Sub-Saharan Africa dummy	**-0.888591** **(0.0055)**	**-0.805159** **(0.0015)**	**-0.613099** **(0.0068)**	**-0.552431** **(0.0009)**	
Europe and Central Asia dummy	**-1.730905** **(0.0000)**	**-1.409619** **(0.0000)**	-0.368986 (0.2331)	-0.265611 (0.1084)	
South America dummy	-1.227763 (0.2158)	-1.292560 (0.1822)	**-1.079959** **(0.0088)**	**-1.184791** **(0.0009)**	
Middle East & North Africa dummy	**0.697254** **(0.0738)**	**0.993514** **(0.0012)**	**1.204685** **(0.0000)**	**1.140850** **(0.0000)**	
Latin American & Caribbean dummy	**-1.246281** **(0.0007)**	**-0.906013** **(0.0009)**	-0.302635 (0.2402)	-0.202820 (0.1509)	
Lower Income Dummy	-0.286246 (0.5482)	0.128108 (0.6186)	0.116186 (0.6585)		
Lower Middle Income Dummy	0.217870 (0.5957)	0.263930 (0.2224)	0.133778 (0.5941)		
Upper Middle Income Dummy	0.657150 (0.1165)	**0.693285** **(0.0075)**	0.307407 (0.2772)		
Interaction ODAPSSA Variable	0.003366 (0.5828)	0.003759 (0.4097)			
Interaction ODAPSA Variable	0.002166 (0.9748)	0.007394 (0.9132)			
Interaction ODAPME Variable	**0.005695** **(0.0321)**	**0.004480** **(0.0514)**			
Interaction ODAPECA Variable	**0.044159** **(0.0000)**	**0.040387** **(0.0000)**			
Interaction ODAPLAC Variable	**0.010904** **(0.0000)**	**0.009150** **(0.0000)**			
Interaction ODAPLOI Variable	0.005872 (0.7273)				
Interaction ODAPLMI Variable	-0.000392 (0.9809)				
Interaction ODAPUMI Variable	-0.003813 (0.8301)				
Adjusted R^2	**0.997899**	0.995636	0.990158	0.995002	0.994596
Number of Observations	**131**	131	131	131	131

Notes: All independent variables are lagged on period. Estimates were calculated using the method of weighted least squares. P-values of the coefficient estimates are shown in parentheses, below the estimated coefficient. R^2 values are reported as adjusted measures.

XI. Simulation

In order to take this study one step further, a simple simulation was developed, highlighting the key findings of this work. In order to develop a proper simulation, a few assumptions were made about the hypothetical economy being modeled: 1) the initial level of GDP Per Capita was $2000 2) the six-year growth rate was (.15) 3) the aid received per capita was $15.

Using the parameters mentioned above, a simulation illustrating the impact of aid on a country's GDP growth was developed. This simulation shows the positive effect humanitarian assistance has on a country's growth rate. In addition to the assumptions made above, the population of the country in question was fixed at 1000000. Furthermore, the coefficient for aid, determined by the model, was used to compute the country's augmented growth. The table below shows the before and after values of GDP growth, giving a numerical meaning to the effects of humanitarian assistance.

Table 3.1

Predictions, no government stability effects			
Initial GDP per capita?	2000		
6-year growth rate?	0.15		
Aid per capita? (assumed effect = .0008)	15		
Population of country?	1000000		
	1985	1991	1997
Growth predictions/no aid	2000	2300	2645
Growth predictions - with aid	2000	2324	2672.6
Total cost of policy over 12 years:	180000000		
Total increase in income generated by policy:	309600000		
Net benefit	129600000		
Net benefit per capita	129.6		

The calculations used to determine these values were rather simple. To predict growth, in absence of aid, the following equation was used.

(1) Current Level of GDP for Given Period Without Aid =

*Level of GDP from previous period * (1 + Growth Rate)*

In order, to calculate growth after the receipt of aid, this equation was altered slightly.

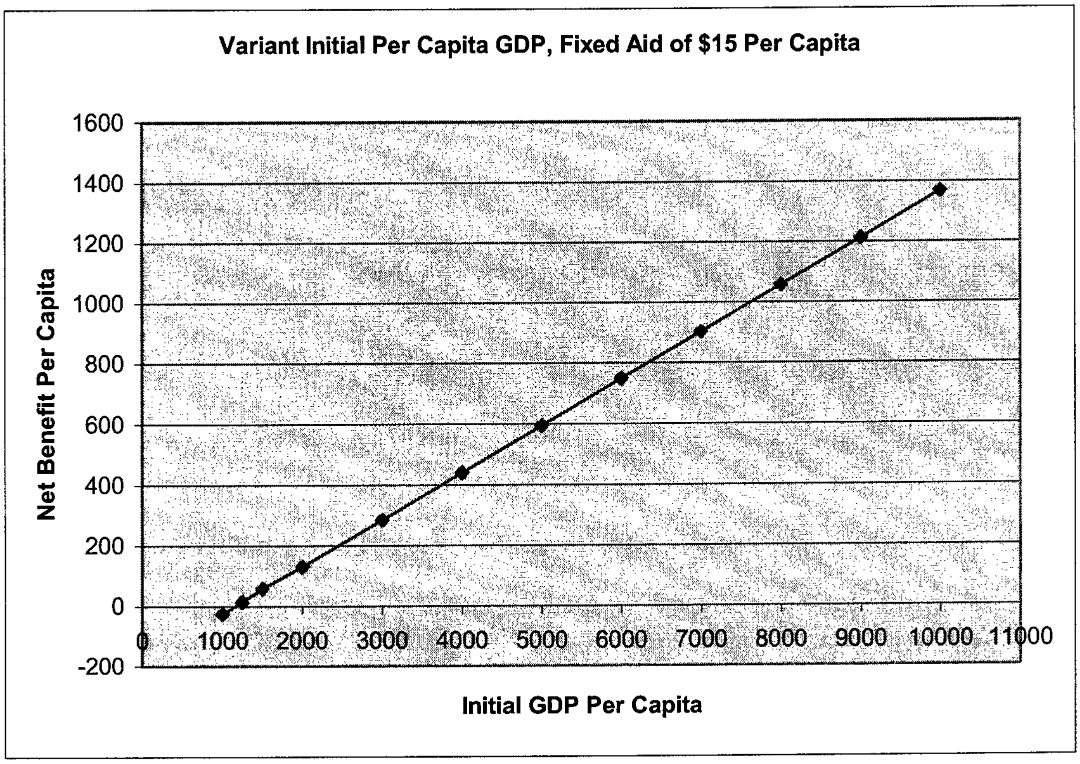
(2) Current Level of GDP for Given Period With Aid =

*Level of GDP from previous period * ((1 + Growth Rate)+(.0008 * Aid per capita))*

It is important to note that the value .0008 is the coefficient determined in Regression 5 of Table 2.1, which lies roughly in the middle of all the estimates in the table. After running these calculations, it is clear that a country that receives aid will show an increase in GDP growth. So that one could further understand the impact of assistance, the net benefit of the aid received was also calculated.

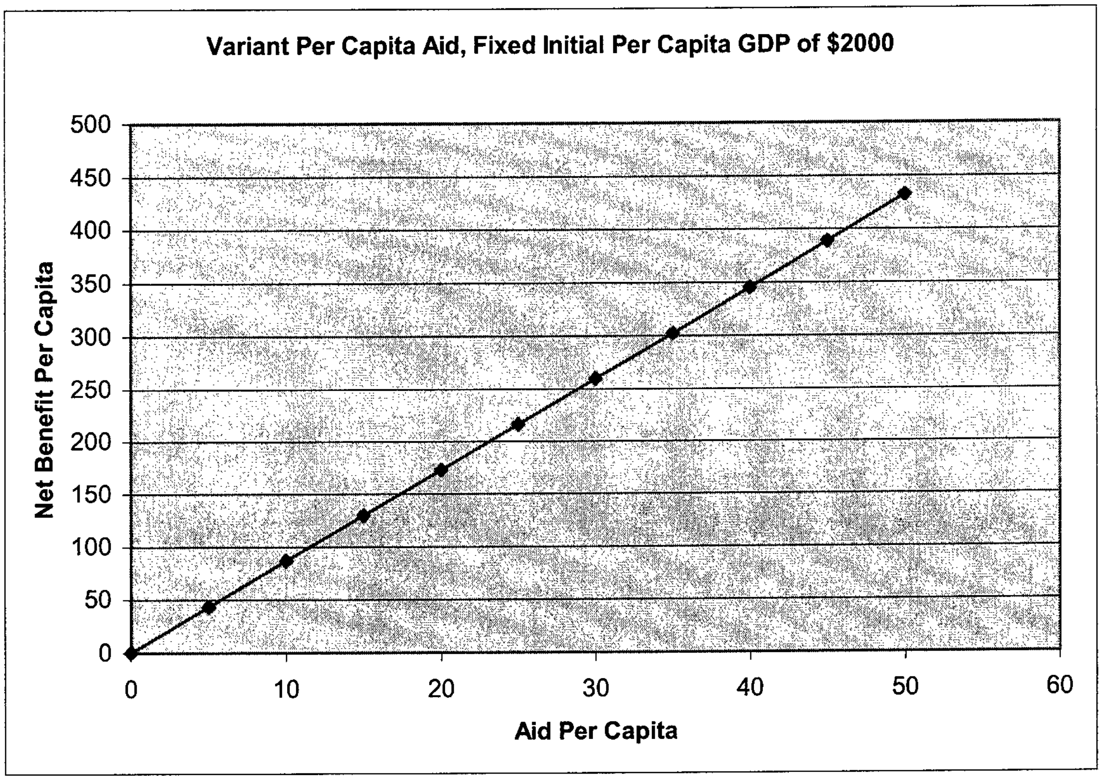
In addition to the simulation mentioned above, others were conducted in order to see how changes in the initial level of GDP and amount of aid received per capita would affect the net benefit per capita. Graphic (4A) illustrates that as the level of initial GDP per capita increases, while keeping the aid per capita received constant ($15), then the net benefit per capita will also increase. It is interesting to note that fifteen dollars of aid is not beneficial to countries with a GDP per capita less than $1200.

Graphic (4A)



Graphic (4B) investigates what occurs when the initial level of GDP per capita remains constant ($2000), and the amount of aid received per capita is varied. From the graph below, one can claim that a positive relationship exists between the net benefit per capita, and the quantity of aid received per capita.

Graphic (4B)



XII. Conclusion

Initially, this study's purpose was to investigate the nature of aid, and its effect upon growth. However, after beginning this process, the study at hand expanded. The endogenous nature of growth theory led to the development of research that analyzed not only growth, but also the variables that determine it, specifically, official development assistance and government stability. Numerous regressions were estimated in order to understand the relationship between growth, official development assistance, and government stability. These regressions produced estimates that allowed key conclusions to be drawn.

As predicted, GDP Growth Per Capita does depend on contemporaneous values of Official Development Assistance. What is interesting about this fact is how a country's growth rate reacts to aid. One would initially imagine that the outcome of receiving assistance would be a positive growth rate. However, this is not the case. Official Development Assistance does increase growth, but not necessarily enough for a country's growth rate to turn positive. What this does show, is that without aid, a country would be growing even slower than observed. Of even more interest was the behavior a country displayed after receiving assistance. Some countries apparently utilized aid well. Latin American, Sub-Saharan, and Middle Eastern countries all made the most out of what they received.

While this conclusion is noteworthy, it causes one to wonder: who really receives aid? Regression analysis indicates that much of this is determined by a country's location, which indirectly encompasses income levels. In addition, government stability is also a factor considered. Aid is generally correlated with past values of government stability, and aid received depends only on whether or not a country has received it in the past.

From this study one can easily see how aid affects growth, how designated countries respond to aid, and who generally receives assistance. With this information, scholars and even benefactors can make informative decisions surrounding development, risk, and likelihood. The final item mentioned leads into an issue that was unable to be explored due to the short duration of this study.

Time restrictions greatly limited the extent to which the findings of this study could be applied. In the future, predictions based upon this model would be of great interest. One could investigate the likelihood that a country would receive aid, the response such a country would have to assistance received, and the trickle-down affects of these responses. From this, one can see the all-encompassing nature of the study at hand.

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XII. Glossary

Adjusted R^2- A measure of the proportionate reduction of total variation Y associated with the use of the set X variables $X_1, \ldots, X_{p-1}$. The adjusted measure adjusts for the number of independent variables in the model. This adjustment is made by dividing each sum of squares by its associated degrees of freedom.

Conditional Convergence- Tendency of growth rates of output in different countries to approach each other over time, and for their steady-state values to be the same

Dummy Variable/Indicator Variable- A qualitative variable assuming a value of 0 or 1 depending on the absence or presence of an attribute; a 0 indicates the absence of an attribute, while a 1 indicates its presence

Endogenous Growth- Steady-state output growth determined by endogenous variables

Endogenous Variable- A variable that is determined within a particular model, whose value is affected by the values of other variables

Exogenous Variable- A variable that is determined outside a particular model, whose value is independent of the values of a model's other variables

Gross Domestic Product (GDP)- The market value of an economy's domestically produced goods and services over a specific period of time

Interaction Variables- Variables computed by calculating the product of two qualitative variables, two quantitative variables, or one qualitative and one quantitative variable.

Marginal Product- The amount of extra output produced when the capital input/labor input is increased by one unit

Original Least Squares (OLS)- A method used to construct a sample regression function and determine estimators.

P-Value- The probability, under the null hypothesis, of obtaining a test statistic value bigger than its observed value. Alternatively, the smallest level of significance (type I error) for which the observed test statistic value results in a rejection of the null hypothesis

Pool- A combination of time series and cross-sectional observations

Two-Stage Least Squares (2SLS)- A method involving two successive applications of OLS

Weighted Least Squares- A form of hypothesis testing that accounts for unequal variances of the error terms, otherwise known as heteroscedasticity

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