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10 September 2015

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Abstract

 The massive expenditures on foreign aid programs by developed nations and international institutions, in combination with the perceived lack of results from these disbursements, raise important questions as to the actual effectiveness of monetary assistance to less developed countries (LDCs). In this analysis, I focus on 104 low- and medium-development countries, and measure the impact that foreign aid has on their growth rates of gross domestic product, using dummy variables for geography and conflict in a geometric lag model.
 The results indicate that foreign aid donations do have a positive impact on the economic growth of the recipient nation. The effect is extremely modest, however, and other factors such as armed conflict and geography can easily mitigate this impact, in some cases to the extent that foreign aid becomes detrimental to economic growth. Further analysis of the results indicate that this impact is quickly felt, with half of the total impact of foreign aid felt in approximately six months.

1. Introduction

Over the last half century, foreign aid has emerged as a dominant strategy for alleviating poverty in the third world. Not coincidentally, during this time period major international institutions, such as the United Nations, World Bank, and International Monetary Fund gained prominence in global economic affairs.[1] Yet it seems that sixty years later, the lesser developed countries (LDCs) of the world continue to suffer from economic hardship, raising questions of whether foreign aid is a worthwhile and effective approach to boosting growth and development in recipient economies. Research on the subject has attempted to draw an empirical connection between foreign aid and economic growth. Despite these efforts, however, there is no solid consensus among scholars on the actual effectiveness of foreign aid inflows.[2]

The purpose of this analysis is to study the effects of foreign aid inflows on real gross domestic product growth rates. It differs from existing research in two key ways. First, I utilize a geometric lag model to capture the continued impact of foreign aid inflows for years after its initial introduction into the economy.[3] Second, I incorporate several dummy variables for geography, political stability, and development to determine their additional impact on foreign aid's effectiveness in growing GDP.

2. Literature Review

There are two contrasting sides to this debate: one which argues that aid has a positive effect on economic growth, with even more impact in countries with sound economic and trade policies; and another which contends that foreign aid causes corruption, encourages rent-seeking behavior, and erodes bureaucratic institutions. A renewed interest in explaining cross-country economic growth emerged in the early 1990s, with numerous studies attempting to answer the

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[1] Peter Hjertholm and Howard White, "Survey of Foreign Aid: History, Trends, and Allocation," *Discussion Papers, University of Copenhagen Institute of Economics* (2000): 3.

[2] Raghuram G. Rajan and Arvind Subramanian, "Aid and Growth: What Does the Cross Country Evidence Really Show?" *International Monetary Fund Working Papers* 05 (2005): 2.

[3] Douglas C. Dacy, "Foreign Aid, Government Consumption, Saving, and Growth in Less-Developed Countries," *The Economic Journal* 85 (1975): 548.

foreign aid question. To date, however, there is no consensus among scholars as to the actual effects of foreign aid on economic growth.

There have been several prominent studies which find a causal link between foreign aid and economic growth. Perhaps the most well-known of these was performed by two researchers for the World Bank, Craig Burnside and David Dollar (1997). They found that foreign aid enhances economic growth, so long as "good" fiscal policies are in place. These policies can include maintaining small budget deficits, controlling inflation, and being open to global trade.[4] Durbarry, et. al. (1998) also found a positive association between foreign aid and economic growth, and confirmed Burnside and Dollar's finding of conditionality on good economic policy. The study also concluded, however, that the degree to which aid impacts GDP depends largely on other factors as well, such as geography.[5] Ali and Isse (2005) further confirmed the findings of Burnside and Dollar. The study also demonstrated, though, that aid is subject to decreasing marginal returns, indicating a threshold beyond which development assistance can become detrimental to economic growth.[6]

Not all research has shown a positive relationship to exist between aid and growth. Even before Burnside and Dollar's monumental findings, a study by Peter Boone (1994) found that aid-intensive African countries experienced zero per capita economic growth in the 1970s and 80s, despite foreign aid actually increasing (as measured by share of GDP).[7] Additionally, Knack (2001) found that high levels of foreign aid can erode bureaucratic and institutional quality, triggering corruption, and encouraging rent-seeking behavior.[8]

There is also evidence that the effects of foreign aid can be mitigated by other non-economic factors. Situations of state failure, such as ethnic conflict, genocide or politicide, and

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[4] Craig Burnside and David Dollar, "Aid, Policies, and Growth," *American Economic Review* 90 (1997): 847-868.
[5] Ramesh Durbarry, et. al., "New Evidence on the Impact of Foreign Aid on Growth," *Center for Research in Economic Development and International Trade* 8 (1998): 3.
[6] Abdiweli M. Ali and Hodan S. Isse, "An Empirical Analysis of the Effect of Aid on Growth," *International Advances in Economic Research* 11 (2005): 1-11.
[7] William Easterly, "Does Foreign Aid Add Up?" *Foreign Policy* 125 (July 2001): 94.
[8] Knack 2.

revolution can all potentially influence the extent to which aid impacts growth. George Mason University's Political Instability Task Force (PITF) created a binary dataset indicating in which countries and during what years these events take place. According to the PITF, an ethnic conflict requires the clash of two separate ethnic, religious, or nationalistic factions, and also must meet two threshold criteria: 1,000 people must be mobilized for armed conflict, and at least 1,000 people per year must have died as a direct result of this conflict.

Easterly and Levine (1997) studied the effects of high ethnic fractionalization on economic growth. By fractionalization, they mean the probability that two randomly chosen people from a population will be of different ethno-linguistic backgrounds. Easterly and Levine conclude that movement from heterogeneity to homogeneity (decreasing fractionalization) results in better schooling, more efficient infrastructures, and more developed financial systems and foreign exchange markets.[9] According to their findings, then, it is entirely possible that ethnic conflict, in its attempt to move away from ethnic diversity and towards ethnic homogeneity, will actually improve economic growth. Despite their findings, however, the instability of the regime could still negatively impact the degree of aid's effectiveness.

Not a lot of attention is paid to genocide, politicide, and revolution and their effects on growth in the literature. Moreover, there has been virtually no research performed on this question as it concerns the effectiveness of aid. It is reasonable to believe, though, that resources (including foreign aid) are siphoned off by the dominant party and used for individual benefit rather than for economically efficient activities, as intended.

Furthermore, out of respect for state sovereignty, these events are not likely to prompt a major international response, which would perhaps eliminate local control over resources and allow them to be used productively. Ethnic conflict, on the other hand, typically ignores state boundaries. One study by Gurr (1993) estimated that over two-thirds of identified ethnic

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[9] William Easterly and Ross Levine, "Africa's Growth Tragedy: Policies and Ethnic Divisions," *The Quarterly Journal of Economics* 112 (1997): 1203.

communal groups in the world have kindred in another country. The spread across state borders

allows other states to intervene without violating state sovereignty, which could positively

impact how resources are used, and ultimately, economic growth.

Additionally, a country's geographic location can influence economic performance;

nations that are landlocked, for instance, are at a natural disadvantage in global trade. Sachs and

Warner (1996) write,

> Landlocked countries, in particular, face very high costs of shipping, since they must pay
> road transport costs across at least on international boundary in addition to sea freight
> costs. Although air shipments can help overcome many of these problems, only certain
> goods can be economically shipped by air, and most countries still import and export the
> majority of goods by the sea.[10]

A study by Jaouadi & Hermassi (2013)[11] specifically mentions the negative relationship between

aid and governance in developing countries, noting that they are at a disadvantage for these

reasons, as well, the outcome of this relationship would affect the economic growth of recipient

countries.

3. Methodology

3.1 Data

I direct the focus of this analysis to low- and medium-development countries as defined

by the United Nations Development Programme (UNDP) in its Human Development Index

(HDI).[12] These nations were selected since they are the most likely to be recipients of foreign

aid, whereas high-development nations are the most likely to be donors. I select the HDI as a

basis for classification because in addition to income, the index accounts for life expectancy as

measured by infant mortality rates, and educational attainment as measured by adult literacy

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[10] Jeffrey Sachs and Andrew Warner, "Sources of Slow Growth in African Economies," *Harvard Institute for International Development, Development Discussion Papers* 545 (1996): 14.

[11] Said Jaouadi, and Hela Hermassi. "Official Development Assistance and its Impact on Governance in short term: The Threshold theory." *International Journal of Business and Social Research* 3, no. 3 (2013): 185-193.

[12] Available at http://hdr.undp.org/reports/global/2005/pdf/HDR05_HDI.pdf, pages 219-222. Medium-development nations are defined as those with scores below 0.800, and low-development nations are defined as those below 0.500.

rates and gross enrollment ratios for primary, secondary, and tertiary schools. This provides for a more thorough understanding of a country's stage of development and a comprehensive measure of quality of life.[13] In all, 104 countries of the 113 analyzed by the UNDP (67%) meet the development criteria and were included in this study.[14]

I collect the data in annual format from several sources. Most of the data come from the United Nations Conference on Trade and Development (UNCTAD)[15] and the International Monetary Fund (IMF).[16] Table 1 below lists the variables included in this study and the source from which they were gathered:

Table 1: Data Sources

Variable	Unit	Source
Gross Domestic Product	Growth Rate	IMF
Official Development Assistance	Millions $US	UNCTAD
Household Consumption	Growth Rate	UNCTAD
Government Expenditures	Growth Rate	UNCTAD
Exports*Petroleum Exporter	Growth Rate	UNCTAD
Imports	Growth Rate	UNCTAD
Agricultural Production	Growth Rate	UNCTAD
Gross Capital Formation	Growth Rate	UNCTAD
Inflation	Growth Rate	IMF
Openness to Trade[17]	Share of GDP	UNCTAD
Energy Consumption Per Capita	Millions of BTUs	Energy Information Agency, U.S. Dept of Energy
Major Petroleum Exporter Dummy	1=Yes, 0=Otherwise	UNCTAD
Non-Tropics Dummy[18]	1=Yes, 0=Otherwise	IUCN World Conservation Union
Foreign Direct Investment Inflows	Millions $US	UNCTAD

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[13] Ibid. 214.
[14] See Appendix A for a list of included countries.
[15] Available at http://www.unctad.org.
[16] Available at http://www.imf.org.
[17] I measure openness to trade by adding Exports (as % of GDP) and Imports (as % of GDP).
[18] I define "non-tropic" as a country with less than 50% of land mass lying between the Tropic of Cancer and the Tropic of Capricorn.

Ethnic Conflict Dummy	1=Yes, 0=Otherwise	Political Instability Task Force, University of Maryland
Genocide Dummy	1=Yes, 0=Otherwise	Political Instability Task Force, University of Maryland
Revolution Dummy	1=Yes, 0=Otherwise	Political Instability Task Force, University of Maryland
Landlocked Country Dummy	1=Yes, 0=Otherwise	UNCTAD
Low Development Dummy	1=Yes, 0=Otherwise	United Nations Development Programme

Data for household consumption, government expenditures, exports, imports, agricultural production, and gross capital formation were only available in share of GDP format. Since I aim to explain growth rates in GDP, however, percentage changes in the dollar amounts of each of these variables would be more appropriate. Thus, I transform these numbers into growth rates as well.[19]

3.2 Model Specification

I assume that inflows of foreign aid will continue to impact the economy for years after its initial introduction, but at a decreasing rate. It would therefore be unsuitable to use an ordinary least squares model, since it would only take into account aid inflows in the year they were received and disregard the continued impact that foreign aid has on the economy in the years after its introduction. To effectively capture this rationale, I use a geometric lag model which incorporates an infinite number of lags for each variable, but weights each lag in a geometrically declining fashion. The general form of this type of model is:

$$Y_{i,t} = \alpha + \beta_1\left[X_{i,t} + \lambda X_{i,t-1} + \lambda^2 X_{i,t-2}...\right] + \beta_2\left[Z_{i,t} + \lambda Z_{i,t-1} + \lambda^2 Z_{i,t-2}...\right] + ... + \varepsilon \qquad (1)$$

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[19] Growth rates were calculated by multiplying the share of GDP times real GDP values, which resulted in the real dollar value of each variable. The percentage change was then calculated for inclusion in this analysis.

Note that in the model a weight is attached to each lag (λ), a value between zero and one that diminishes geometrically as time passes. Mathematically, this model is the same as:[20]

$$Y_{i,t} = \alpha(1-\lambda) + \lambda Y_{i,t-1} + \beta_1 X_{i,t} + \beta_2 Z_{i,t} + \ldots + \nu \tag{2}$$

This simpler form, however, shows the dependent variable *Y* on the right side of the equation. Since *Y* is already shown to have an error component in (1), this simplification introduces a stochastic regressor into the model, requiring two-stage least squares (TSLS) regression. In order to ensure the instruments required for TSLS are non-stochastic, I lag each one period. Thus, to the observer at time *t*, values for instruments at *t-1* are fixed. In other words, these instruments are stochastic but predetermined.

3.3 Expected Results

I expect to find a positive relationship between foreign aid and economic growth on average, as indicated by most prior research on this subject. I further anticipate, however, that aid will have a detrimental effect on low-development countries since they lack efficient infrastructures and institutions which might make foreign aid donations more effective. I expect ethnic conflict, genocide and revolution to negatively influence the effectiveness of foreign aid, but leave open the possibility that ethnic conflict could positively influence aid's impact based on Easterly's study. Furthermore, I expect landlocked countries to experience additional positive gains from foreign aid, since they are at a trade disadvantage.

4. Results and Analysis

The results of the TSLS regression are shown below in Table 2:

Table 2: TSLS Regression Results

Parameter	Estimate	Std. Error	t-Statistic	Prob.
Constant Term	0.091	0.400	0.228	0.820
GDP(-1) [Lambda]	0.233	0.087	2.692	0.007
Household Consumption	6.307	2.241	2.814	0.005
Government Expenditures	4.505	1.305	3.452	0.001

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[20] Equation (2) is derived by lagging (1) one period on both sides of the equation and subtracting from (1).

Exports*Petroleum Exporter	9.825	1.866	5.266	0.000
Imports	-3.746	0.963	-3.891	0.000
Agricultural Production	10.976	1.992	5.510	0.000
Gross Capital Formation	7.262	0.834	8.703	0.000
Inflation	-0.001	0.000	-2.282	0.023
Openness to Trade	0.020	0.005	4.301	0.000
Energy Consumption	-0.013	0.004	-3.212	0.001
Energy Cons.*Low Dev.	-0.052	0.014	-3.822	0.000
Less than Half of Land in Tropics (1=Yes)	0.742	0.326	2.275	0.023
Foreign Direct Investment	0.000	0.000	2.124	0.034
Foreign Aid	0.001	0.000	3.233	0.001
Foreign Aid*Ethnic Conflict	0.001	0.000	2.202	0.028
Foreign Aid*Genocide*Low Dev.	-0.017	0.009	-1.948	0.052
Foreign Aid*Revolution	-0.001	0.000	-2.731	0.006
Foreign Aid*Landlocked	0.002	0.001	1.847	0.065
Foreign Aid*Landlocked*Low Dev.	-0.003	0.001	-2.320	0.021
R-squared	0.415	S.E. of regression		4.535
Adjusted R-squared	0.408	Durbin-Watson stat		2.069

The model can be written as in general terms as follows:

$$GDP_{i,t} = 0.091 + 0.233 GDP_{i,t-1} + 0.001 ODA_{i,t} + \beta_1 ODA_{i,t} * DUMMY_{i,t} + \beta_2 Z_{i,t} \qquad (3)$$

Where:

GDP = Gross Domestic Product Growth Rate (for country i *at time* t*)*
ODA = Official Development Assistance (for country i *at time* t*)*
DUMMY = Vector for Dummy Variables (for country i *at time* t*)*
Z = Vector for All Other Variables (for country i *at time* t*)*

The results of the regression indicate that approximately 42% of the variation in GDP growth rates is explained by the variables included in the model, as evidenced by the R-squared value. Further, each coefficient estimate is significant at the 0.05 level, with the exception of a few borderline cases and the constant term. These coefficients are also consistent with my expectations, however the coefficient for the ethnic conflict dummy did turn out to be in harmony with Easterly's study of ethnic fractionalization.

The Durbin-Watson statistic fails to conclusively determine the presence of serial correlation. Further analysis of the residuals, however, indicates that it is not a statistically

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significant problem.[21] The model was also tested for the presence of heteroskedasticity, both

across time and cross sections using the Breusch-Pagan Test. The results of this test fail to show

statistically significant evidence of heteroskedasticity.[22] Multicollinearity was investigated using

a correlation matrix of the regressors, but no major evidence of this anomaly was detected,

either.[23]

The results provide insight as to foreign aid's effectiveness in a number of ways. Most

obvious is that it is has a positive, though modest effect on economic growth, significant at the

0.01 level. Increasing foreign aid by $1 million US will result in an increase in GDP of

approximately 0.001%, ceteris paribus. According to the data, the average annual amount of

official development assistance received over all years and countries is approximately $570

million US. In this case, aid is estimated to increase growth in GDP by approximately 0.6%.

As shown in Table 3, however, this impact can be greatly diminished by other factors, in

some cases to the point where aid actually becomes detrimental to growth. Using the baseline

case of a country with no ethnic conflict, revolution, or genocide, which is not landlocked, and

does not suffer from low development, I estimate the additional impacts of any of those

circumstances on economic growth. Those factors with N/A listed under "Impact" were not

statistically significant at the 0.05 level.[24]

Table 3: Factors Influencing Aid Effectiveness

Factor	Impact	Overall Impact of Aid + Additional Factor(s) on GDP
Ethnic Conflict	0.001	0.002
Ethnic Conflict in Low Development Countries	N/A	N/A
Genocide/Politicide	N/A	N/A
Genocide/Politicide in Low Development Countries	-0.017	-0.016
Revolution	-0.001	0.000
Revolution in Low Development Countries	N/A	N/A
Landlocked Country	0.002	0.003

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[21] See Appendix for additional information regarding serial correlation tests.
[22] See Appendix for methodology and results of the Breusch-Pagan Test.
[23] See Appendix for correlation matrix.
[24] Other factors were tested but failed to show statistical significance, including dummies for Low Development, Sub-Saharan Africa, Openness to Trade, Afrotropic Climate, Tropical Geography, and Major Petroleum Exporters.

| Landlocked Country with Low Development | -0.003 | -0.002 |

The model indicates that foreign assistance actually becomes detrimental to growth in situations where there is genocide or politicide in low development nations, as predicted. I attribute this to the fact that resources are typically controlled by the dominant party in genocidal conflicts, and it is likely that aid dollars are siphoned off and used for their own benefit instead of productive and efficient activities. Revolutionary conflict eliminates entirely the impact aid has on the economy, resulting a net effect of about zero. I argue that this is the case because the institutions required to effectively utilize foreign assistance are in jeopardy during a major transfer of power, reducing their ability to act efficiently and distribute aid dollars according to the country's best interests. Interestingly, ethnic conflict actually increases the effectiveness of aid. This finding is consistent with Easterly's study of ethnic fractionalization and its impact on economic growth.

In landlocked countries, aid is particularly effective, tripling the extent to which it impacts economic growth. As Sachs and Warner pointed out, landlocked countries are limited in their ability to engage in global trade. Thus, it seems reasonable that foreign aid positively impacts growth in these areas since their capacity to engage in trade is restricted. However, in low-development countries that are landlocked, this relationship no longer holds. This indicates that whatever benefits aid has in landlocked countries is reversed in low-development countries, possibly due to poor institutional quality, corruption, or other factors.

As for other variables besides foreign aid, the model shows the effect of foreign direct investment (FDI) on economic growth is surprisingly small; an increase of only 0.00003% in GDP for every $1 million US invested. In contrast, foreign aid boosts GDP by 0.001% with the same amount of money. This indicates that foreign aid has a substantially greater impact on growth than foreign direct investment, all else equal. According to the model, being open to trade seems to be a much more effective strategy in growing the economy, even more so than

foreign aid and FDI. It is important to note, however, that since openness to trade is measured as a share of GDP, the impact is not directly comparable that of foreign aid or FDI, since economies included in this study vary greatly in size.

To quantify how quickly foreign aid impacts the economic growth of a country, I calculate the median lag as outlined by Davies and Quinlivian (2006).[25] This measure estimates how quickly half of the impact of foreign assistance is felt, and is calculated as follows:

$$\text{Median Lag} = \frac{\ln(0.5)}{\ln(\lambda)} = 0.477 \qquad\qquad (4)$$

A median lag of 0.477 indicates that in approximately 5.7 months, half of the entire impact of foreign aid on GDP growth will be realized. Half of the remaining impact is then felt in another 5.7 months, and so on, as the cumulative impact of the aid asymptotically approaches 100%. This phenomenon is illustrated in Chart 1 below.

Graph 1: Cumulative Impact of Foreign Aid on Growth
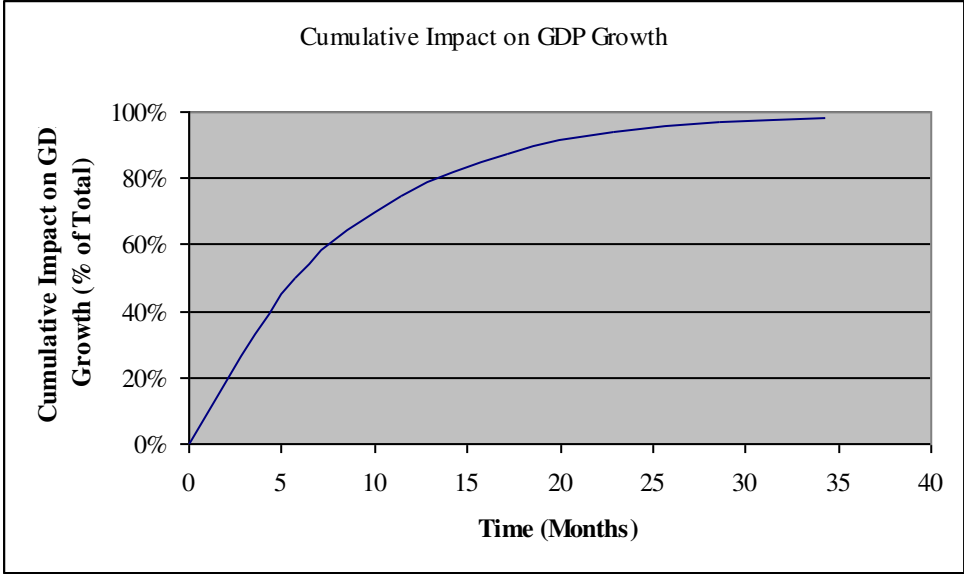
The median lag indicates that aid can quickly impact an economy, but for a relatively short amount of time. After only two years of circulation in the recipient economy, over 95% of the total impact of foreign aid is experienced.

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[25] Antony Davies and Gary Quinlivan, "A Panel Data Analysis of the Impact of Trade on Human Development," *Journal of Socioeconomics* (2006).

5. Conclusions and Suggestions for Future Research

The purpose of this analysis was to determine the effects of development assistance on economic growth. The model developed in this paper provides evidence supporting the contention that foreign aid positively impacts economic growth in the developing world. Therefore, it is not in the interest of developed countries and international bodies to discontinue aid programs. Moreover, as Gunning (2004) points out, it would be extremely difficult for a donor country to stop aid since it would be seen by both the domestic and foreign populations as punishing an already poor country.[26]

The model also shows, however, that the effects of aid on economic growth are modest, and "buying" economic growth through foreign aid would be incredibly inefficient and expensive. For instance, using foreign aid alone to increase GDP by 1% in a country would require a foreign aid package of approximately $1 billion US. With almost 120 countries identified as low- and medium-development, spurring economic growth in developing world to desirable levels would be an enormous expenditure. This also assumes that the negative effects of conflict and geography shown to be significant in the model do not apply, and ignores the potential problems of aid dependence, corruption, and bureaucratic erosion that research has associated with high levels of foreign aid.

The aforementioned studies by Burnside and Dollar (1997) and others have shown aid to be more effective in sound economic policy environments. Thus, donor governments and multilateral institutions should continue to push economic reforms and trade liberalization on recipient governments. Not only will this improve the effectiveness of foreign aid according to these studies, but it will also result in less aid being required.

The armed conflict dummies indicate, with the exception of ethnic conflict, that state failure and political instability reverse the positive effect of aid, even making it detrimental to

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[26] Jan Willem Gunning, "Why Give Aid," Presented to the 2nd Annual AFD-EUDN Conference *Development Aid: Why and How*, Paris, 25 November 2004.

economic growth in some cases. Therefore, donor governments should be aware of the political situation in recipient countries, and work with international bodies to ensure as much stability as possible. Further, since geography is essentially fixed, foreign aid donations to landlocked countries should be designed to facilitate improvements in transportation infrastructures, which increase their capacity to engage in trade.

Future research should further explore the role of sound economic policies and good governance in aid effectiveness. Scholars should also explore other ways of quantifying climate, tropical geography, and governance to provide for additional testing of potential impacts on the effectiveness of foreign aid. Finally, future study of foreign aid should also investigate its effects on economic development, instead of growth. Doing so will shed light on the question of whether aid actually improves the quality of life in lesser developed countries.

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