THE COMPARATIVE EFFECTS OF FOREIGN AID

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By

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ABSTRACT

This thesis uses ordinary least squares fixed effects regression to estimate and compare the relative effects of economic aid, military aid, and development aid on measures of security, development, and economic growth. The model is applied to panel data—data organized by country and year—compiled from the World Bank’s World Development Indicators and Penn World Tables. Fixed effects are used in order to control for country level differences and annual changes in the data. The author finds that economic aid in the form of foreign direct investment has a large positive association with economic outcomes. This may be due to the increasingly endogenous relationship between foreign direct investment and economic growth. Contrary to common justifications for military support, the analysis finds that military aid increases the severity of conflict by increasing battle related deaths. Lastly, the model fails to find a significant impact associated with development aid. Although economic, development, and military aid continue to be used to accomplish important strategic, political, and humanitarian objectives, the ability of economic and development aid to accomplish policy goals remains unclear.
The research and writing of this thesis
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INTRODUCTION

Foreign aid is a transformative force in the global arena. Although popular opinion in the United States often disparages direct foreign assistance as a wasteful use of the nation’s resources, it serves as a powerful tool for promoting U.S. policy around the world. From its beginnings as a tool of imperialism, foreign aid in the modern era has developed into a diverse set of instruments that serve to strengthen goals ranging from building steady sources of clean water to shoring up military strength. State actors have four broad categories of foreign policy used to encourage positive change and mitigate potential risks. Diplomatic, informative, military, and economic levers—summarized as DIME—work alone or in tandem to implement a nation’s foreign policy (Jordan 2009). Additionally, each category has positive and negative actions—carrots and sticks. For example, military action can be positive in the form of military aid or negative as a military strike. The same goes for economic action, which is reflected positively in trade deals and negatively through economic sanctions.

This thesis seeks to explain the relative effectiveness of military, humanitarian, and economic aid on recipients’ stability as defined by absence of conflict, development as measured by infant mortality, and economic growth. Foreign aid or foreign assistance is broadly defined as a voluntary transfer of resources from one country to another. Today, transnational groups including non-state actors, corporations, individuals, and non-governmental organizations increasingly administer foreign aid. However, in this research, I maintain the nation-state as the recipient and the administrator of aid. States continue to be the dominant force influencing global developments, and state-sourced aid still vastly outnumbers aid provided by non-governmental organizations. I predict that humanitarian and military aid provide short-term benefits to development and political stability, respectively, and economic aid supports long-term
positive effects in all categories. This research provides key insight into the DIME paradigm and the relative importance of each category of aid in public policy.

In order to approach this problem, I outline the competing literature related to the determinants, effects, and use of aid in foreign policy in order to outline a falsifiable model of aid in the DIME system. Tarnoff (2012) provides a descriptive overview of U.S. foreign aid as an element of the economic and diplomatic categories, which fills out the diplomatic, economic, and material tools available to policy makers. Jordan (2009) provides a succinct introduction to the DIME paradigm, and describes some of the interactions between the categories. Moving from theory to analysis, much of the previous quantitative research in this area has focused on individual policy tools and their effects on target countries rather than comparative effects across time and countries. I continue to review the relevant literature, comparing quantitative approaches that analyze the impact of foreign aid, and then focus on my three chosen outcomes: stability, development, and economic growth.

My empirical model uses ordinary least squares (OLS) fixed effects regression to estimate the relative effects of each element of the DIME model. The model is then applied to panel data—data organized by country and year—compiled from the World Bank’s World Development Indicators and Penn World Tables. Fixed effects are used in order to control for country level differences and annual changes in the data. I find that economic aid in the form of foreign direct investment has a large positive association with economic outcomes. This may be due to the increasingly endogenous relationship between foreign direct investment and economic growth. Contrary to common justifications for military support, I find that military aid increases the severity of conflict by increasing deaths due to battle. Lastly, my analysis fails to find a significant impact associated with development aid. I conclude that although economic, development, and military aid continue to be used to accomplish important strategic, political,
and humanitarian objectives, the ability of economic and development aid to accomplish policy goals remains unclear.

The modern system of foreign aid is relatively new, and the next section explains how aid has developed as a tool of foreign relations.
BACKGROUND

The bilateral transfer of resources from one nation to another is not new. Patronage, gold, gifts, and other resources have been a tool of foreign policy since before the invention of the nation-state, used to secure peace treaties and alliances. Later, the age of imperialism was linked with the unprecedented transfer of capital overseas for the purpose of safeguarding colonies and extracting natural resources. However, the modern system of foreign aid is relatively new, beginning in the United States with the Marshall Plan following the Second World War.

The plan was a response to the failed international system that developed after First World War and the widespread destruction in Europe following the Second World War. The Treaty of Versailles was structured to bring a lasting peace in 1919. However, the treaty’s requirements for reparations and the collapse of support for the League of Nations sowed the seeds for the breakdown in regional stability in 1935. The collapse of the German economy and the rise of dictatorship under the Nazi party continue to serve as a cautionary tale of the dangers of separating developmental goals from security.

After the end of the second war, world leaders began forging a new system of international cooperation. The high water mark for the volume of money and resources flowing towards reconstruction in Europe and Japan occurred after the war. It continued to be the largest amount of foreign assistance provided by the United States until the wars in Iraq and Afghanistan. After the cessation of hostilities, President Truman appointed General George Marshall as U.S. Secretary of State. In a speech to the graduating class of Harvard University in 1947, Secretary Marshall explained the vital importance of providing aid abroad for the safety and security of the United States at home, “It is logical that the United States should do whatever it is able to do to assist in the return of normal economic health to the world, without which there
can be no political stability and no assured peace. Our policy is not directed against any country, but against hunger, poverty, desperation and chaos.” Marshall’s cry for support was directed at the situation in Europe, but the promise to assist foreign countries against hunger, poverty, desperation, and chaos continues to echo through the current budgets for economic, military, and development aid.

The Marshall Plan worked in conjunction with the establishment of the Bretton Woods system in 1944. Before the Second World War, there was no standard mechanism to determine or negotiate international financial cooperation. In July 1944, the allied nations convened in Bretton Woods, New Hampshire to address the problems of unstable exchange rates and protectionist trade policies that contributed to the start of the Second World War. This conference led to the creation of the International Monetary Fund (IMF) and the International Bank for Reconstruction and Development, now known as the World Bank. These institutions had the stated purpose of promoting postwar macroeconomic stability.

**Figure 1: Global official development assistance (ODA) by year**

![Graph showing ODA by year from 1960 to 2011](source: World Development Indicators and Development Assistance Committee of the OECD)
The Marshall Plan was also enacted to strengthen the European economy against the mounting pressure from the Soviet Union to the east. Meernik et al. (1998) supports this claims in their analysis of the determinants of United States foreign assistance during this time. Using a pooled, cross-sectional, time series of U.S. foreign aid from 1977 through 1994, they find that policy during the Cold War took a systematic approach to aid as a tool to draw nations within the West’s sphere of influence. This is a distinctly realist approach, where “self-interested states act first and foremost to protect their national interests including, but not limited to, the integrity of their territory, institutions, and sovereignty” (64). The differences between realism and other approaches to international relations, such as constructivism and liberalism will be discussed further within the literature review section below.

Meernik concludes that during the Cold War, nations with certain characteristics were more likely to receive U.S. foreign aid. These common characteristics include having democratic elections, being in close proximity to the U.S.S.R., maintaining alliances with the United States, using a free market economy, and supporting human rights. The United States used aid to secure existing alliances among similarly minded states in order to balance against the expansion of the Soviet Union. By the end of the Cold War, the purpose behind foreign aid changed dramatically from being used to expand U.S. influence to providing for fundamental development goals.

In the time since the Cold War, aid from the U.S. and other nations has become less focused on realist security goals and more aligned with the liberalist ideals of reducing poverty and promoting development. Meernik’s analysis continues after 1991, and finds the earlier determinants of U.S. aid are no longer significant. Bandyopadhyay (2007) renews this research and explores the contemporary determinants of aid from all donors around the world. He finds that the decision for donors to provide aid has been negatively correlated with per capita income and positively correlated with infant mortality, human rights, and government effectiveness.
Much of the past research has similarly focused on exploring which factors determine whether a nation receives aid. My analysis moves beyond this to consider whether aid is effective at accomplishing its stated goals. The next section summarizes the literature needed to explain my model and compares contrasting methods of evaluating foreign aid.
Situating Foreign Aid in Foreign Policy

The theory behind foreign aid stems from the three primary approaches to foreign policy: realism, constructivism, and liberalism. Each conceptual framework offers an explanation in broad terms of how states interact with each other and how foreign aid serves as a tool to facilitate these interactions.

Realism is an international relations theory that assumes that state-to-state relations take place in an anarchic system. The system itself incites each country to protect its national interest above all else. Under this model, states are primarily concerned with the balance of power and compete either to gain standing or protect against losing power. Realists consider developmental aid as insignificant except as an element of state power (Knorr 1973; Mearsheimer 2006).

Liberalism is an international relations theory that assumes that rules and institutions based on state sovereignty incentivize cooperation between states. This school of thought established democratic peace theory, which finds that nations with representative governments maintain higher amounts of international trade and cooperation with international institutions. This helps to promote peace with other nations who have similar democratic institutions. Within liberalism, foreign aid is delivered for the purpose of promoting economic and political practices that lead to more secure trade and cooperation in international institutions. Much of contemporary aid is based upon the liberalist goal of development and the belief that monetary aid can help to establish a stable economy and thriving civil society (Keohane 2002).

Constructivism is an international relations theory that moves beyond the “black box” of the state and considers society and individuals to lie at the center of international relations. The connections between foreign aid and constructivism have only recently been explored, but the
body of research primarily considers aid in its ability to establish social norms and spread ideas (Knorr 1973; Ravenhill 2009).

Duffield (2001) examines how the perception of development has been “radicalized” to become the key to conflict resolution. The author argues that conflict arises when development fails, and therefore the modern system of global governance—comprising of nation-states, non-governmental organizations, and intergovernmental institutions—have a responsibility to promote development in order to provide lasting security. He does not, however, consider aid to be a silver bullet, capable of producing solutions to all security problems. Instead he argues, “the main consequence of aid of any form… is to change and reinforce the dominant relations and forms of discourse that it encounters and through which it flows” (2001, 235). Duffield’s analysis provides a framework that draws from all three schools of thought, and ultimately creates a coherent picture in how realism, liberalism, and constructivism shape the system of foreign aid.

**International Political Economy**

The quantitative analysis of aid is grounded in the field of international political economy. Broadly, international political economy is defined by its subject matter. It encompasses “all work for which international economic factors are an important cause or consequence” (Frieden and Martin 2003, 118). The study of foreign aid, therefore, has gone hand in hand with the advance of international political economy as a field of study. Ravenhill (2009) provides an overview of the development of the relatively new arena. In the early 1970s, the transition from U.S. fiscal policy under the Bretton Woods system to the relative chaos of free floating currency renewed interest in examining political economy in the international system. International relations were traditionally ill-equipped to address the complexity of an economically interconnected world, but theorists such as Robert Keohane and Joseph S. Nye
(1975) stepped forward to lay the conceptual foundation for approaching international economic interactions.

Later studies have expanded international political economy beyond the original sole focus of economics. The consequences following the First World War compared with the relative stability after the Second World War serves as a potent reminder of how economic development and stability are interconnected. Researchers such as Jervis (1998) have argued to include security within international political economy due to the “mutual causation between economic intercourse and peaceful relations” (1998, 989). Jervis concludes that although development may have liberal goals of raising the relative quality of life in other countries, this aid also benefits the security of donor countries and achieves the realist goal of expanding the state’s sphere of influence.

**Modeling Economic Growth**

International aid is largely meant to compensate for differences in economic development—transferring from the haves to the have-nots. There exist staggering differences in per capita income across the world, and the poorest countries have per capita incomes that are less than one twentieth the size of incomes in developed nations. Modeling how these differences arise over time is essential to understanding the underlying purpose of aid. Jones and Volrath (2013) provide a comprehensive summary of the neoclassical models of economic growth first explored by Solow (1956) and Romer (1990). Their models help to explain how countries such as South Korea, Hong Kong, Singapore, and Taiwan have exceeded expectations due to improvements in a number of factors: increases in investment in physical capital and education, increases in labor force participation, and technological shifts from traditional agrarian economies to manufacturing (p. 54). The Romer model emphasizes technology as the primary
engine of growth. Social institutions and government policies that protect inventors and incentive research lead to long-term economic growth in his model. I attempt in my model to control or these factors of economic growth in order to isolate the effects of international aid.

**Moral Hazards and Economic Foundations**

Svensson (1999) examines the important question of circumstances in which foreign aid policy is credible by creating a quantitative model that describes the moral hazard problem in humanitarian aid. Specifically, the research examines how foreign aid is guided by the needs of the poor, but recipient governments often do not have the incentive structure to provide resources to those most in need or engage in structural reform. The research describes a model, but does not reach a conclusion. Instead, he provides insights into how conditionality, or establishing strict requirement for the disbursement of aid, can help to alleviate the moral hazard problem. Following this foundation, subsequent quantitative research has typically controlled for structural reforms and political systems.

**The Determinants of Aid**

Two previous studies have established influential quantitative models of how donors decide where to distribute aid. Bandyopadhyay (2007) describes the determinants of aid and focuses on aid structured to alleviate poverty, which I describe as development aid. He finds that aid has a negative relationship with per capita income in the recipient country and is positively related to infant mortality, rights, and government effectiveness. This research into the determinants of aid provides a useful indication as to which controls must be included in order to separate the key inputs from the resulting impact.

Collier and Hoefler (2002, 2004, 2009) have operationalized a model that examines the end effects of aid and policy on the risk of conflict and civil war. Their most recent analysis
includes over 1,000 observations of civil war from 1950 to 2004. They find that political and social variables that are commonly used to explain the origins of conflict have little explanatory power for determining whether violence will occur. By contrast, economic variables including the level, growth, and structure of income provide considerably more explanatory power. They hypothesize that civil war will occur where it is economically and geographically feasible, and political motivation is indeterminate.

**The Effects of Aid**

Transitioning from the determinants of aid to the effects of aid, Minoiu and Reddy (2007) focus on the long-term impacts of development aid on GDP measured at lagged intervals. First they separate development aid from other types of bilateral aid, and consider the lagged effects of the transfer. They find statistically significant effects of aid on GDP over long periods of time. Additionally, they discuss the key problem of endogeneity of aid with respect to growth. It is difficult to determine the causal relationship as the level of aid is determined by previous lack of growth, and the effectiveness is measured by later economic increases. Minoiu and Reddy compensate for this by lagging their measure of impact. I follow this approach by lagging my measure of dependent variables one year compared to the independent variables.

Chong, Gradstein, and Calderon (2009) similarly examine the effects of foreign aid on income inequality. They use panel data and fixed effects to account for potential simultaneity and heterogeneity problems. Their results are inconclusive, which corresponds with other research (Easterly 2003; Easterly et al. 2004; Brautigam and Knack 2004). They find that “aid by itself does not appear to have a statistically significant effect on inequality and poverty reduction” (p. 79). However, by controlling for institutional quality in the model, they are able to find a correlation between aid and income inequality.
Previous authors have defined the failure of static—and the need for dynamic—approaches to international relations, describing “the very constituents of what we mean by the term ‘power’ may be in the process of transformation. With domestic constraints on military action increasing, it may be that time horizons have begun to shift from short to long” (Rosecrance, 2008). Rosecrance demonstrates how the balance of power between the four parts of DIME may be changing.

**Unique Contributions**

Previous studies have not sought to compare different types of aid, and have commonly focused on determinants of foreign assistance rather than the effects. Building from these studies, my model will incorporate how economic, military, and humanitarian aid influence separate security and development variables. My quantitative model controls for the elements of growth as explained by the Solow growth model in order to isolate the effects of aid. Following the example set by Chong, Gradstein, and Calderon (2009), the model uses ordinary least squares (OLS) fixed effects regression to estimate the relative effects when applied to panel data—data organized by country and year. I use fixed effects in order to control for country level differences and annual changes in the data. The following sections elaborate on the conceptual framework, data, and methods used in the analysis.
CONCEPTUAL FRAMEWORK AND HYPOTHESIS

Below, I outline three models using the monetary amount of development, economic, and military aid as the primary independent variables and three primary dependent variables of economic growth, development goals, and stability. Economic growth is measured by gross domestic product (GDP) per capita at purchasing power parity (PPP). Development goals are measured with statistics on infant mortality. Lastly, stability is measured by battle related deaths. The determinants of different types of aid are controlled for in order to isolate the effect of the monetary transfers and attempt to control for the initial reasons for countries to provide the assistance. I have lagged the dependent variable to compare it to the independent measures of the previous year.

Equation 1
\[ stability = f(\text{foreign aid (three types)}, \text{security}) \]  (1)

Equation 2
\[ \text{economic growth} = f(\text{economic aid (three types)}, \text{economic policy, trade}) \]  (2)

Equation 3
\[ \text{development goals} = f(\text{foreign aid (three types)}, \text{health, economy}) \]  (3)

These three elements are interconnected—hence the inclusion of all types of aid in each equation. I will be able to compare the relative effects of aid by including each measure of aid in every model. My hypothesis is that development aid will have large significant effects towards improving development goals, economic aid will have positive effects on economic growth, and military aid will have significant effects towards reducing conflict and improving stability when compared to the other types of aid in each model.
**DATA AND METHODS**

Data are from the World Bank’s World Development Indicators (WDI) and the Penn World Table (PWT). WDI is the primary World Bank database for development data from officially recognized international sources, and serves as my primary dataset for variables associated with military, economic and development aid. The WDI dataset is comprised of over 252 countries and 1,300 variables measured from 1960 through 2012. WDI has gathered data from multiple sources, and is therefore a secondary source for many variables. Missing data are a common problem across many variables, and I discuss how I have adjusted for missing data within each variable in the section on data transformations below.

PWT provides an unparalleled source for data on real gross domestic product (GDP) per capita to compare measures of living standards across countries and across time. It provides purchasing power parity (PPP) and national income accounts for 189 countries for the years of 1950 to 2011. To obtain the real GDP per capita, PWT utilizes the nominal GDP per capita and PPPs in order to correct for differences in prices of essential goods across countries. The dataset uses national accounts statistics for data on nominal GDP and historical price survey data to calculate PPPs over time.

For my regressions, I use measurements taken from 1990 through 2010. As discussed in the section on background, the end of the Cold War resulted in a measurable shift in the purpose of providing aid. I focus on the purpose of aid within the current system by restricting the time period to the beginning of the collapse of the Soviet Union. I also use two groups of countries for my analysis: one restricted to recipients of official development assistance and the other a full set of countries for which data are available. The primary group is limited to nations listed as recipients of ODA by the Organization for Economic Cooperation and Development (OECD).
Development Assistance Committee (DAC) for the period between 1990 and 2010. The second group includes all countries. This allows me to focus on the effects of aid in recipient nations and eliminates bias presented by advanced and developed donor nations. Some countries are not included in either model due to combining data from PWT and WDI and incomplete data. My method for dropping data is described in the section on data transformations below.

An index such as the UN’s Human Development Index might provide a good comprehensive as a dependent variable. However, most indices are comprised of data that will be provided as controls, and would introduce additional problems of endogeneity. Therefore, I will focus on three discrete measures for the primary dependent variables with one for each model: GDP per capita at PPP, infant mortality rate, and battle related deaths.

**Variable Definitions**

**GDP per capita at purchasing power parity (constant 2005 US$)**

GDP at purchasing power parity is the annual sum total of all output value created by producers in the economy plus any product taxes. It is calculated without making deductions for depreciation of capital assets or for depletion of natural resources. Data are in constant 2005 U.S. dollars. Comparing GDP across countries requires controls for the relative prices across these countries. The guide to the PWT explains, “spending patterns tend to be very different, especially when comparing rich and poor countries… For instance, people in poor countries tend to spend much more of their income on food…, so that food prices are much more important for living standards than in rich countries. An estimate of relative living standards needs to take both sets of spending patterns into account, which is an inherently imperfect endeavor” (7).
Figure 2: Mean GDP per capita at PPP among recipients of official development aid (ODA)

Mortality rate, infant (per 1,000 live births)

The infant mortality rate is a measure of the number of infants dying before reaching one year of age, measured per 1,000 live births in a given year. Mortality rates for different age groups—infants, children, and adults—and overall mortality indicators such as life expectancy at birth are important indicators of health in a country. Data are from the World Development Indicators database. Due to the WDI’s scarce information on the incidence and prevalence of diseases, mortality rates are more often used to identify vulnerable populations. The World Bank collects mortality data from vital registration systems and direct or indirect estimates based on sample surveys or census. Because complete information on deaths is not common in developing countries, this measure depends upon sample surveys and indirect modeling.
**Battle-related deaths (number of people)**

Battle-related deaths are deaths in battle-related conflicts between warring parties in the conflict. Most often, these deaths occur in warfare involving the armed forces of the warring parties. Armed conflicts are defined as the use of armed force between two parties that results in at least 25 battle related deaths in a year. The measure includes traditional battlefield fighting, guerrilla activities, and all kinds of bombardments of military units, cities, and villages. Although the targets are usually members of the military, all deaths including military as well as civilian are counted as battle-related deaths. Data are from the WDI database, which compiles data from the Uppsala Conflict Data Program (UCDP) Battle-Related Deaths Dataset.

**Figure 3: Total battle related deaths by year among recipients of official development assistance (ODA)**

![Graph showing battle-related deaths by year among recipients of official development assistance (ODA)](source)

**Net official development assistance and official aid received (constant 2005 US$)**

Net official development assistance (ODA) consists of disbursements of loans and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients. These data also include
net official aid, comprising of aid flows from official donors to more advanced countries of Central and Eastern Europe and the countries of the former Soviet Union. Data are from WDT.

**Arms imports (constant 2005 US$)**

The measure of arms imports includes the supply of military weapons through sales, aid, gifts, and those made through manufacturing licenses. Data cover major conventional weapons such as aircraft, armored vehicles, artillery, radar systems, missiles, and ships designed for military use, and it excludes transfers of other military equipment such as small arms and light weapons, trucks, small artillery, ammunition, support equipment, technology transfers, and other services. Data are from WDI, which compiled information from the Stockholm International Peace Research Institute (SIPRI)'s Arms Transfers Program. SIPRI estimates the transfer of military resources using an evaluation of the technical characteristics of the arms. Since the data depend upon open sources, and the amount of money spent is often not disclosed, weapons for which an exact price is unknown are compared with similar weapons where the price is available.

**Foreign direct investment, net inflows (percent of GDP)**

The measure of foreign direct investment is comprised of the net inflows of investment to acquire a lasting management interest in an enterprise operating in the economy, defined as ten percent or more of voting stock. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. The number is calculated though new investment inflows less disinvestment and is divided by GDP. FDI data do not include capital raised locally. Data is from WDI which uses the IMF’s Balance of Payments Manual for data after 2005.
**Capital stock per capita (constant 2005 US$)**

The variable of capital stock reports the total capital assets in current prices for that year. Capital stock here refers to non-financial durable goods that are used in the production of goods or services. Capital depreciation is not included in the model, and the model assumes that capital stocks are exogenous and do not depend on the other independent variables such as human capital or GDP per capita. Capital stock per capita is the quotient of capital stock divided by the population for that country and year. Data are from PWT.

**Labor participation rate, percent of the labor force**

The labor participation rate is devised from the total number of persons engaged in the economy divided by the population of working aged adults, which is 15 to 64 in most countries. Data are from PWT.

**Human capital index**

The amount of human capital per worker is related to the average years of schooling and the return to education. Data are from PWT’s calculations using average years of schooling from Barro and Lee (2013), which use rates on return for completing different years of education. The data ignore any variation in returns over time and across countries, which likely underestimates labor input in richer countries compared to poorer countries.

**Armed forces as a percent of labor force**

Armed forces personnel are active duty military personnel, including paramilitary forces if the training, organization, equipment, and control suggest they may be used to support or replace regular military forces. Labor force comprises all people who meet the International Labour Organization's definition of the economically active population. Data are from WDI.
**Annual population growth, percent growth**

Annual population growth is the exponential rate of growth expressed as a percentage. Data is from WDI which counts all residents regardless of legal status or citizenship minus impermanent refugees. The percent growth is calculated from the WDI’s measure of total population.

**Data Transformations**

I have made a series of transformation to the original PWT and WDI datasets in an effort to combine the datasets, impute missing values, and standardize across variables. The final dataset is comprised of 170 countries in the full version and 146 countries in the limited dataset restricted to recipients of official development assistance. Both PWT and WDI have additional countries that were not included in the dataset. The removed countries include small island states such as the Caymans and French Polynesia which are outliers due to the small population sizes. Other larger countries including Afghanistan, Cuba, Myanmar, and Somalia have been removed due to poor data during the time period largely because of war and inconsistent government reporting.

Data have been imputed for missing values for foreign direct investment, official development aid, battle-related deaths, and arms imports. I assume missing values to be zero for development aid, battle-related deaths, and arms imports. The alternative of using the national annual mean or median would make the assumption that (1) aid was given but not reported; (2) that deaths occurred but were not observed; or (3) that arms were imported covertly. Although these conditions are possible, I make the assumption that a zero value is nearer to the truth. It is possible that assuming a zero value biases any related coefficient towards zero and slightly decreases the distribution for any given year. I do not assume a similar case for foreign direct
investment because it less likely to be zero in the absence of reporting. Instead, I set any missing amounts of foreign direct investment as a percentage of GDP equal to the previous known value. Thirty-seven countries had at least one missing year of data for foreign direct investment (FDI) as a percent of GDP, and fifteen had more than five years missing. Imputing in this fashion is likely to bias measures of FDI towards the country’s mean for the time period examined. Lastly, I use the log of GDP per capita to compensate for the non-linear distribution of GDP per capita.

Lastly, I converted the base years for the dollar measures of arms imports and official development assistance. WDI includes measures of arms imports in 1990 U.S. dollars and official development assistance in 2011 U.S. dollars. In order to align with the PWT’s base year of 2005 U.S. dollars, I converted 1990 U.S. dollars with the inflation multiplier of 1.37618 and 2011 dollars by 0.870. These conversions were taken from comparing consumer price indices of U.S. dollars across those time periods. However, they do not account for cross-country variation in consumer price or purchasing power, and so create an amount of measurement error when used to evaluate GDP per capita by PPP. I do not have the data, but this error could be mitigated using year-country level data on conversion rates.

Each regression examines the effect of the three primary independent variables—the three types of aid—on a select dependent variable. The restricted models, Models (a, b, d, e, g, h) use panel data for 146 countries from 1990 to 2010, where constant effects on the year and country level differences are held fixed. The first model in each table, Models (a, d, g) include only the primary dependent and independent variables. The third model in each table, Models (c, f, i) present information for the full, unrestricted set of countries, including both recipients and providers of official development assistance. These “full” models are included to compare the values to that of the restricted model among recipients of ODA. The main model for each table is the second model in each table, Models (b, e, h), which restrict the analysis amongst countries that
are recipients of official development aid (ODA) and uses a full set of controls. Restricting the model to recipients of ODA will more clearly demonstrate the effects of aid when compared to the unrestricted model. This model controls for the other types of aid as well as the primary dependent variables from the other tables. Each table shares controls of capital stock per capita, labor participation rate, population growth, and armed forces personnel as a percent of the total labor force.
**Descriptive Statistics**

Table 1 presents the descriptive statistics for the restricted model of 146 recipients of official development aid from 1990 to 2010. The table does not account for differences across time or geography. Compared to the unrestricted set of 170 countries, the restricted set has lower mean values of GDP per capita at PPP ($7,396 vs. $10,469) and arms imports ($139 million vs. $174 million) and higher mean values of infant mortality (44.5 vs 39.0) and ODA per capita ($77.52 vs $66.48). Descriptive statistics for the unrestricted dataset is included in Appendix A.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Units</th>
<th>Obs</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variables:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log of GDP per capita at PPP</td>
<td>natural log</td>
<td>3024</td>
<td>8.27</td>
<td>1.18</td>
<td>5.02</td>
<td>11.64</td>
</tr>
<tr>
<td>Infant mortality</td>
<td>per 1,000 live births</td>
<td>2982</td>
<td>44.52</td>
<td>34.88</td>
<td>2.2</td>
<td>165.5</td>
</tr>
<tr>
<td>Battle related deaths</td>
<td>number of people</td>
<td>3066</td>
<td>200.64</td>
<td>1506.28</td>
<td>0</td>
<td>50293</td>
</tr>
<tr>
<td>Primary independent variables:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arms imports</td>
<td>constant 2005 $million</td>
<td>3066</td>
<td>1.39</td>
<td>4.51</td>
<td>0</td>
<td>48.70</td>
</tr>
<tr>
<td>FDI, net inflows</td>
<td>percent of GDP</td>
<td>3031</td>
<td>4.28</td>
<td>7.41</td>
<td>-82.89</td>
<td>145.20</td>
</tr>
<tr>
<td>ODA per capita</td>
<td>constant 2005 US$</td>
<td>3042</td>
<td>77.50</td>
<td>370.20</td>
<td>-242.58</td>
<td>14771.10</td>
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<td>Secondary independent variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP per capita at PPP</td>
<td>constant 2005 US$</td>
<td>3024</td>
<td>7396.09</td>
<td>9592.75</td>
<td>151.83</td>
<td>113672.1</td>
</tr>
<tr>
<td>Capital stock per capita</td>
<td>constant 2005 US$</td>
<td>3024</td>
<td>20254.49</td>
<td>27471.88</td>
<td>284.92</td>
<td>287038.9</td>
</tr>
<tr>
<td>Labor participation</td>
<td>percent of population</td>
<td>2954</td>
<td>39.1</td>
<td>7.9</td>
<td>15.8</td>
<td>74.3</td>
</tr>
<tr>
<td>Human capital index</td>
<td>no units, continuous</td>
<td>2331</td>
<td>2.292</td>
<td>0.547</td>
<td>1.129</td>
<td>3.536</td>
</tr>
<tr>
<td>Armed forces</td>
<td>percent of labor force</td>
<td>2612</td>
<td>1.82</td>
<td>2.16</td>
<td>0.07</td>
<td>36.83</td>
</tr>
<tr>
<td>Annual population growth</td>
<td>percent growth</td>
<td>3041</td>
<td>1.65</td>
<td>1.53</td>
<td>-7.60</td>
<td>17.48</td>
</tr>
<tr>
<td>Panel data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Countries:</td>
<td>146</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Years</td>
<td>1990 to 2010</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: FDI: foreign direct investment; ODA: official development aid.
**Regression Model**

Building from previous analyses such as Minoiu and Reddy (2007), I use fixed effects based on data gathered at the country and year level in order to estimate regression coefficients for the set of primary independent variables representing different types of aid. Year is represented by \( t \) in the equations below and \( i \) represents country. The fixed effects in the model are represented by \( \alpha_i \), and the error term is represented by \( e \).

**Equation 4: Economic Aid**

\[
\log GDP_{\text{per capita}} = \beta_0 + \beta_1 (\text{foreign direct investment})_{it} + \beta_2 (\text{arms sales})_{it} + \beta_3 (\text{development aid})_{it} + \beta_4 [\text{development controls}]_{it} + \beta_k [\text{military controls}]_{it} + \beta_l [\text{trade controls}]_{it} + \alpha_i + e
\]

**Equation 5: Development Aid**

\[
\text{Infant mortality} = \gamma_0 + \gamma_1 (\text{development aid})_{it} + \gamma_2 (\text{arms sales})_{it} + \gamma_3 (\text{foreign direct investment})_{it} + \gamma_4 [\text{development controls}]_{it} + \gamma_k [\text{military controls}]_{it} + \gamma_l [\text{trade controls}]_{it} + \alpha_i + e
\]

**Equation 6: Military Aid**

\[
\text{Battle related deaths} = \delta_0 + \delta_1 (\text{arms sales})_{it} + \delta_2 (\text{foreign direct investment})_{it} + \delta_3 (\text{development aid})_{it} + \delta_4 [\text{development controls}]_{it} + \delta_k [\text{military controls}]_{it} + \delta_l [\text{trade controls}]_{it} + \alpha_i + e
\]

The intercepts for the models \( (\beta_0, \gamma_0, \delta_0) \) represent the estimate for the dependent variable if all independent variables are zero. The coefficients for each independent variable \( (\beta_j, \gamma_j, \delta_j) \) report the change in the dependent variable associated with a one unit increase in the independent variable.

I use the Stata statistical software to fit the regression models to the combined balanced panel data from PWT and WDI holding country and time level variation as fixed and allowing
for robust standard errors. Fixed effects with robust standard errors produces estimates by running ordinary least squares (OLS) on the following model:

**Equation 7: Stata Fixed Effects Estimation**

\[ (y_{it} - \bar{y}_i + \bar{y}) = \alpha + (x_{it} - \bar{x}_i + \bar{x})\beta + (\epsilon_{it} - \bar{\epsilon}_i + \bar{\epsilon}) + \bar{\epsilon} \]

where \( \bar{y}_i \) is the sum of the dependent variable \( y \) for each year, \( t \), and country, \( i \), divided by the total number of years, \( T_i \). And \( \bar{y} \) is the sum of \( y \) for each \( i \) and \( t \) divided by the total number of years and countries. OLS finds a “best-fit” line using these data points to estimate the coefficient for the linear regression model. The standard error for each coefficient provides a measure of the distribution of the estimate. A smaller standard error reflects less variability, and its used to compute a \( p \)-value. The \( p \)-value provides the percent chance that a coefficient is different from zero. For my analysis, I report \( p \)-values of less than 0.10 as statistically significant and the conventional \( p \)-value of less than 0.05 as highly statistically significant. I chose a less stringent measure of statistical significance due to the macroeconomic scope of international development and the difficulty of missing observations. This means that a statistically significant coefficient has less than a ten percent chance of being zero (Stata Reference Manual, 2012, p 470).
RESULTS

Table 2 shows the pairwise correlation coefficients between the dependent and primary independent variables in all three models, not accounting for fixed effects among country or time level data. Foreign direct investment has a statistically significant positive correlation with GDP per capita, which supports my hypothesis. It is also negatively correlated with battle related deaths and infant mortality. Arms imports have a statistically significant positive correlation with increases in battle related deaths, which directly contradicts my hypothesis. Arms imports also have a significant positive correlation with GDP per capita and a negative significant correlation with infant mortality. Official development assistance is negatively correlated with all three dependent variables, but only the correlation with the natural log of GDP per capita is statistically significant. The small negative correlation between infant mortality and ODA suggests an opposite relationship than my hypothesis, but it is not statistically significant.

Table 2: Pairwise correlations of aid and dependent variables

<table>
<thead>
<tr>
<th></th>
<th>Battle deaths</th>
<th>Ln GDP per capita</th>
<th>Infant mortality</th>
<th>FDI</th>
<th>Arms imports</th>
<th>ODA per capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battle deaths</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln GDP per capita</td>
<td>-0.1074*</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infant mortality</td>
<td>0.0840*</td>
<td>-0.8149*</td>
<td>1.0000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FDI</td>
<td>-0.0271</td>
<td>0.0908*</td>
<td>-0.0700*</td>
<td>1.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arms imports</td>
<td>0.0576*</td>
<td>0.1265*</td>
<td>-0.1068*</td>
<td>-0.0628*</td>
<td>1.0000</td>
<td></td>
</tr>
<tr>
<td>ODA</td>
<td>-0.0130</td>
<td>-0.1106*</td>
<td>-0.0251</td>
<td>0.0216</td>
<td>-0.0458*</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

Note: FDI: foreign direct investment; ODA: official development aid
* statistically significant (p < 0.01)
Table 3: Regression results of FDI on log of GDP per capita

<table>
<thead>
<tr>
<th>Variables</th>
<th>(a) ODA Recipients</th>
<th>(b) ODA w/ controls</th>
<th>(c) All countries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Log of GDP per capita</td>
<td>Log of GDP per capita</td>
<td>Log of GDP per capita</td>
</tr>
<tr>
<td>Foreign Direct Investment</td>
<td>0.00214</td>
<td>0.00315***</td>
<td>0.00291***</td>
</tr>
<tr>
<td>net inflows (% of GDP)</td>
<td>(0.00249)</td>
<td>(0.00110)</td>
<td>(0.000965)</td>
</tr>
<tr>
<td>Arms imports ($100M)</td>
<td>0.00435</td>
<td>0.00412*</td>
<td>0.00426**</td>
</tr>
<tr>
<td>constant 2005USD</td>
<td>(0.00332)</td>
<td>(0.00210)</td>
<td>(0.00171)</td>
</tr>
<tr>
<td>Development aid ($1000)</td>
<td>-0.130</td>
<td>0.205</td>
<td>0.107</td>
</tr>
<tr>
<td>per capita 2005USD</td>
<td>(0.254)</td>
<td>(0.135)</td>
<td>(0.126)</td>
</tr>
<tr>
<td>Infant mortality rate</td>
<td>-0.0132***</td>
<td>-0.00564***</td>
<td>-0.00570***</td>
</tr>
<tr>
<td>per 1000 live births</td>
<td>(0.00241)</td>
<td>(0.00163)</td>
<td>(0.00164)</td>
</tr>
<tr>
<td>Deaths from battle (1000 deaths)</td>
<td>-0.00499</td>
<td>-0.0259***</td>
<td>-0.0255***</td>
</tr>
<tr>
<td>Capital stock ($1000) per capita 2005USD</td>
<td>0.00807***</td>
<td>0.00581***</td>
<td>0.00682***</td>
</tr>
<tr>
<td>Labor participation rate % of persons engaged</td>
<td>0.00227</td>
<td>0.00472</td>
<td>(0.00640)</td>
</tr>
<tr>
<td>Human capital index</td>
<td>0.464***</td>
<td>0.494***</td>
<td>(0.142)</td>
</tr>
<tr>
<td>Armed forces personnel % of total labor force</td>
<td>-0.0402***</td>
<td>-0.0426***</td>
<td>(0.0102)</td>
</tr>
<tr>
<td>Population growth Annual %</td>
<td>-0.0106</td>
<td>0.00314</td>
<td>(0.0118)</td>
</tr>
<tr>
<td>Constant</td>
<td>8.810***</td>
<td>7.260***</td>
<td>7.301***</td>
</tr>
<tr>
<td></td>
<td>(0.122)</td>
<td>(0.373)</td>
<td>(0.336)</td>
</tr>
<tr>
<td>Observations</td>
<td>2,783</td>
<td>2,036</td>
<td>2,482</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.212</td>
<td>0.522</td>
<td>0.521</td>
</tr>
<tr>
<td>Number of Countries</td>
<td>140</td>
<td>107</td>
<td>130</td>
</tr>
<tr>
<td>F-test</td>
<td>13.41***</td>
<td>26.20***</td>
<td>43.22***</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

The regression results in Tables 3 through 5 reveal the effects of including additional controls in order to improve the coefficient estimates. Table 3 examines the relationship between foreign direct investment (FDI) and the log of GDP per capita at purchasing power parity. The model examines 107 countries from 1990 to 2010, with an $r^2$ of 0.522, which means that roughly 48 percent of the variation of the log GDP per capita is not explained by the model.
However, the F-test is highly significant, which indicates that the combined effect of all the coefficients in the model is different from zero.

Of the primary independent variables in Table 3, Model (b)—foreign direct investment, official development aid, and arms imports—FDI and arms imports have statistically significant correlations with GDP per capita. A one percentage point increase in FDI as a percent of GDP is associated with a 0.32 percent increase in GDP per capita controlling for the other variables in the model. This is highly statistically significant with a \( p \)-value of less than 0.01. At the mean GDP per capita of $7,396, 0.32 percent translates to an increase of $24 in 2005 U.S. dollars. Additionally, a standard deviation increase in FDI of 7.4 percentage points represents a 2.37 percent increase in GDP per capita, which is $199.69 at the mean GDP per capita. As demonstrated by Li and Liu (2004), foreign direct investment and economic growth have become increasingly endogenous since the 1980s. This suggests that changes in GDP and investment inflows may be reciprocal, which restricts conclusions about causation that may be drawn from this result.

Similarly, a $100 million increase in arms imported to a country is associated with a 0.41 percent increase in log GDP per capita. This is statistically significant at less than the 0.10 level. The magnitude is roughly on par with FDI, and a standard deviation increase in arms exports of $450 million is associated with a 1.85 percent increase in GDP per capita ($136.46 at the mean). The effect of ODA per capita on GDP per capita is not statistically significant, but a standard deviation increase in ODA per capita of $370 is correlated with a 7.6 percent increase in GDP per capita.

Among the controls in Model (b), the coefficients for armed forces personnel, human capital index, and capital stock are highly statistically significant, as expected. A $1,000 increase in capital stock per capita is associated with a 0.8 percent increase in GDP per capita. A one unit
increase in the human capital index is associated with a 46.4 percent increase in GDP per capita. This translates to a one standard deviation increase of 0.547 units is correlated with a 25.4 percent increase in GDP per capita at PPP. Lastly, a one percentage point increase in the number of armed forces personnel as a ratio of the total labor force is associated with a 4.0 percent decrease in GDP per capita. Adding these three controls from Model (1) to Model (2) vastly increase the statistical significance for the key coefficients for FDI, deaths from battle, and arms imports.

Table 4 below reports the results of the regression of arms imports on deaths due to battle. The primary model reported under Model (e) considers the effects among 107 countries with an $r^2$ of 0.179 and a highly statistically significant F-test with a $p$-value of less than 0.01. This indicates that the model explains roughly 17.9 percent of the variation in battle related deaths.

Only two variables are statistically significant in this analysis, arms imports and armed forces as a percent of the total labor force. An increase in arms imports of $100 million is correlated with an increase of 17.11 battle related deaths. This is statistically significant with $p$ of 0.1. A standard deviation increase of $450 million in arms imports is associated with an increase of 77 battle related deaths per year holding all other variables in the model constant. This is somewhat smaller magnitude when compared to a standard deviation increase in armed forces personnel as a component of the total labor force of 2.16 percentage points. This increase is correlated with an increase of 685.6 battle related deaths and is statistically significant with a $p$-value of less than 0.10.
Table 4: Regression results of arms imports on deaths due to battle

<table>
<thead>
<tr>
<th>Variables</th>
<th>(d) ODA recipients</th>
<th>(e) ODA w/ controls</th>
<th>(f) All countries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Deaths from battle</td>
<td>Deaths from battle</td>
<td>Deaths from battle</td>
</tr>
<tr>
<td>Foreign Direct Investment</td>
<td>-2.324*</td>
<td>-1.623</td>
<td>-1.428</td>
</tr>
<tr>
<td>% of GDP, net inflows</td>
<td>(1.257)</td>
<td>(2.153)</td>
<td>(1.596)</td>
</tr>
<tr>
<td>Arms imports ($100 million)</td>
<td>27.80*</td>
<td>17.11*</td>
<td>12.83*</td>
</tr>
<tr>
<td>constant 2005USD</td>
<td>(16.02)</td>
<td>(9.905)</td>
<td>(7.173)</td>
</tr>
<tr>
<td>Development aid ($)</td>
<td>-0.670</td>
<td>0.104</td>
<td>0.113</td>
</tr>
<tr>
<td>per capita 2005USD</td>
<td>(0.429)</td>
<td>(1.245)</td>
<td>(1.219)</td>
</tr>
<tr>
<td>Log of GDP PPP</td>
<td>-24.65</td>
<td>206.0</td>
<td>219.9</td>
</tr>
<tr>
<td>per capita 2005USD</td>
<td>(111.7)</td>
<td>(264.8)</td>
<td>(255.6)</td>
</tr>
<tr>
<td>Infant mortality rate</td>
<td>4.637</td>
<td>0.692</td>
<td>1.241</td>
</tr>
<tr>
<td>per 1000 live births</td>
<td>(2.892)</td>
<td>(2.018)</td>
<td>(1.906)</td>
</tr>
<tr>
<td>Capital stock ($1000)</td>
<td>2.32</td>
<td>1.66</td>
<td></td>
</tr>
<tr>
<td>per capita 2005USD</td>
<td>(3.24)</td>
<td>(1.92)</td>
<td></td>
</tr>
<tr>
<td>Labor participation rate</td>
<td>3.849</td>
<td>3.039</td>
<td></td>
</tr>
<tr>
<td>% of persons engaged</td>
<td>(6.669)</td>
<td>(5.603)</td>
<td></td>
</tr>
<tr>
<td>Human capital index</td>
<td>-120.9</td>
<td>-46.51</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(296.2)</td>
<td>(244.8)</td>
<td></td>
</tr>
<tr>
<td>Armed forces personnel</td>
<td>317.4*</td>
<td>313.4*</td>
<td></td>
</tr>
<tr>
<td>% of total labor force</td>
<td>(166.3)</td>
<td>(166.2)</td>
<td></td>
</tr>
<tr>
<td>Population growth</td>
<td>-34.79</td>
<td>-31.97</td>
<td></td>
</tr>
<tr>
<td>% annual</td>
<td>(29.45)</td>
<td>(24.22)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>175.2</td>
<td>-2.003</td>
<td>-2.353</td>
</tr>
<tr>
<td></td>
<td>(1,021)</td>
<td>(2,481)</td>
<td>(2,447)</td>
</tr>
<tr>
<td>Observations</td>
<td>2,783</td>
<td>2,036</td>
<td>2,482</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.011</td>
<td>0.179</td>
<td>0.175</td>
</tr>
<tr>
<td>Number of countries</td>
<td>140</td>
<td>107</td>
<td>130</td>
</tr>
<tr>
<td>F-test</td>
<td>2.529**</td>
<td>2.661***</td>
<td>2.655***</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

The association of FDI and deaths or development aid and deaths are not statistically significant. A one-percentage point increase in FDI is associated with a small decrease in battle related deaths. A one-dollar increase in ODA per capita is associated with a small increase in battle related deaths, but again this is not statistically significant. The results suggest that foreign assistance has limited positive effects on violent conflicts, and arms imports have a significant negative impact of escalating violence in the following year.
The additional controls in the model are not statistically significant at any level. Increases in GDP per capita at PPP, infant mortality, capital stock, and labor participation rates have small positive associations with death from battle. Increases in the human capital index and population growth have small negative correlations with the dependent variable.

**Table 5: Regression results of official development aid on infant mortality**

<table>
<thead>
<tr>
<th>Variables</th>
<th>(g) ODA recipients</th>
<th>(h) ODA w/ controls</th>
<th>(i) All countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant mortality rate</td>
<td>-0.239***</td>
<td>-0.0922***</td>
<td>-0.0741**</td>
</tr>
<tr>
<td>Foreign Direct Investment</td>
<td>0.0641</td>
<td>0.0538</td>
<td>0.00633</td>
</tr>
<tr>
<td>% of GDP, net inflows</td>
<td>(0.115)</td>
<td>(0.0681)</td>
<td>(0.0475)</td>
</tr>
<tr>
<td>Arms imports ($100 million)</td>
<td>0.00567</td>
<td>-0.0109</td>
<td>-0.00834</td>
</tr>
<tr>
<td>constant 2005USD</td>
<td>(0.00488)</td>
<td>(0.00785)</td>
<td>(0.00729)</td>
</tr>
<tr>
<td>Development aid ($)</td>
<td>0.0580</td>
<td>(0.0419)</td>
<td>(0.0290)</td>
</tr>
<tr>
<td>per capita 2005USD</td>
<td>0.0081</td>
<td>0.0741</td>
<td>0.00633</td>
</tr>
<tr>
<td>Log of GDP PPP</td>
<td>-12.90***</td>
<td>-8.898***</td>
<td>-8.461***</td>
</tr>
<tr>
<td>per capita 2005USD</td>
<td>(1.704)</td>
<td>(2.983)</td>
<td>(2.840)</td>
</tr>
<tr>
<td>Deaths from battle</td>
<td>0.540***</td>
<td>0.107</td>
<td>0.166</td>
</tr>
<tr>
<td>(1000 deaths)</td>
<td>(0.187)</td>
<td>(0.322)</td>
<td>(0.335)</td>
</tr>
<tr>
<td>Capital stock ($1000)</td>
<td>0.240***</td>
<td>0.203***</td>
<td>0.203***</td>
</tr>
<tr>
<td>per capita 2005USD</td>
<td>(0.0501)</td>
<td>(0.0350)</td>
<td>(0.0350)</td>
</tr>
<tr>
<td>Labor participation rate</td>
<td>-0.06009</td>
<td>-0.02744</td>
<td></td>
</tr>
<tr>
<td>% of persons engaged</td>
<td>(0.1938)</td>
<td>(0.1643)</td>
<td></td>
</tr>
<tr>
<td>Human capital index</td>
<td>-55.24***</td>
<td>-48.28***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(7.279)</td>
<td>(6.937)</td>
<td></td>
</tr>
<tr>
<td>Armed forces personnel</td>
<td>0.170</td>
<td>0.155</td>
<td></td>
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<tr>
<td>% of total labor force</td>
<td>(0.315)</td>
<td>(0.275)</td>
<td></td>
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<tr>
<td>Population growth</td>
<td>-1.197*</td>
<td>-0.937*</td>
<td></td>
</tr>
<tr>
<td>% annual</td>
<td>(0.635)</td>
<td>(0.533)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>150.3***</td>
<td>240.8***</td>
<td>220.0***</td>
</tr>
<tr>
<td></td>
<td>(14.01)</td>
<td>(25.16)</td>
<td>(23.04)</td>
</tr>
<tr>
<td>Observations</td>
<td>2,783</td>
<td>2,036</td>
<td>2,482</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.178</td>
<td>0.449</td>
<td>0.405</td>
</tr>
<tr>
<td>Number of countries</td>
<td>140</td>
<td>107</td>
<td>130</td>
</tr>
<tr>
<td>F-test</td>
<td>15.57***</td>
<td>13.30***</td>
<td>12.39***</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Regression results from ODA on infant mortality are reported within Table 5. By including the additional controls from Model (1) to Model (2), the primary independent variable of
Official development aid has a relatively high magnitude negative association with infant mortality, but it is not statistically significant. A standard deviation increase in ODA per capita of $370 is associated with a 4.0 unit drop in infant mortality. Since the measure of ODA is lagged only one year, further research may show whether there is a long-term statistically significant effect of development aid.

Foreign direct investment has the most statistically significant relationships. An increase in FDI of one percentage point of GDP is associated with a 0.092 unit decrease in the measure of infant mortality per one thousand live births, controlling for GDP per capita as well as other variables in the model. Although this is statistically significant ($p < 0.05$), the magnitude is relatively small. A standard deviation increase of 7.4 percentage points in FDI as percent of GDP corresponds with a 0.7 unit decrease in infant mortality per one thousand live births. As an independent variable, a 1.0 percent increase in GDP per capita is associated with an 8.9 unit drop in infant mortality. This is also highly statistically significant ($p < 0.01$).

Arms imports and deaths from battle are not significantly associated with infant mortality. A standard deviation increase in arms imports of $451 million is associated with a 0.24 unit decrease in the infant mortality rate. A standard deviation increase in deaths from battle of 1506 deaths is correlated with a 0.16 unit increase in the infant mortality rate. The additional controls of labor participation and armed forces personnel have small negative and positive associations with increases in infant mortality and are not statistically significant.
Table 6: Summary of regression results of aid on dependent variables

<table>
<thead>
<tr>
<th>Aid</th>
<th>St. Dev.</th>
<th>GDP per capita</th>
<th>Battle deaths</th>
<th>Infant mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source:</td>
<td>Model (b)</td>
<td>Model (e)</td>
<td>Model (h)</td>
<td></td>
</tr>
<tr>
<td>FDI as a percent of GDP</td>
<td>7.41 pp</td>
<td>+2.33%***</td>
<td>–12.0</td>
<td>–0.68**</td>
</tr>
<tr>
<td>Arms Imports const. 2005USD</td>
<td>$451 million</td>
<td>+1.86%*</td>
<td>+77.2*</td>
<td>+0.24</td>
</tr>
<tr>
<td>ODA per capita const. 2005USD</td>
<td>$370</td>
<td>+7.59%</td>
<td>+38.5</td>
<td>–4.03</td>
</tr>
</tbody>
</table>

*** p<0.01, ** p<0.05, * p<0.1

Table 6 compiles the estimated coefficients for the primary independent variables for the regressions in the primary models of Tables 3, 4, and 5, Models (b, e, h) and reports the correlation of a standard deviation increase in the measures of aid on the dependent variables. In the next section, I draw conclusions from these results and apply them to recent international efforts to promote policy.
CONCLUSIONS AND POLICY DISCUSSION

My hypothesis predicts that (1) economic aid represented by FDI as a percent of GDP has a positive effect on GDP per capita; (2) military aid in the form of arms imports has a negative effect on battle related deaths; and (3) development aid demonstrated by ODA per capita has a negative effect on infant mortality. These predictions are only weakly supported by the regression results.

Table 3, Model (b) shows a positive, highly statistically significant ($p<0.01$) association between FDI as a percent of GDP and GDP per capita. This supports my hypothesis. However, as mentioned above, FDI and GDP have had an increasingly endogenous relationship since the mid-1980s, and the causal effects are difficult to determine (Li and Liu, 2004). Therefore, I am unable to conclude that the regression coefficient is causal and it remains unclear whether economic aid leads to an increase in GDP per capita.

Table 4, Model (e) reports a statistically significant relationship between arms imports and battle related deaths, but the relationship is opposite of that of my prediction. The model, the magnitude of the coefficient, and the statistical significance are sufficient to conclude that an increase in military aid increases battle related deaths. This is a logical result. It is expected that an increase in weapons will lead to an increase in deaths. The statistical significance of the total explanatory power of this model (the F-statistic) is low but remains statistically significant.

Lastly, the regression results of official development aid on infant mortality in Table 5, Model (h) report a negative relationship between ODA per capita and infant mortality. Though this result supports my hypothesis, it is not statistically significant. Therefore, I am unable to conclude that development aid has an effect—positive or negative—on infant mortality. This may be explained by previous research. Svensson (1999) finds that development aid is ineffectual
due to dependence and conditionality. To summarize his conclusion, recipient government of ODA often reduce support for domestic poverty programs because international aid provides the necessary resources. This leads to no net gain in development outcomes. Alternatively, Birdsa ll and Kharas (2010) cite similar research by Sachs (2005) and Easterly (2003) that fail to find significant impacts of development aid. They conclude that more resources must be devoted to collecting data in order to evaluate the quality and outcomes of ODA.

Beyond my hypotheses, the regression results provide additional insights into the impact of aid. The regression results presented in Table 3, Model (b) show that an increase in arms imports has a statistically significant positive correlation with GDP per capita. On the surface, this appears counterintuitive. Gross domestic product (GDP) is calculated by summing consumption, capital investment, government expenditures, and net exports. Imports, including arms imports, have a direct negative relationship with GDP in this calculation. However, the regression results show that these negative effects are overtaken by other positive outcomes. I surmise that this positive relationship between arms imports and GDP per capita is caused by arms imports increasing conflict in the country, which destroys both capital stock and labor supply. The labor supply drops due to conflict-related deaths and refugees fleeing the country. Also, the Solow growth model shows that a reduction in capital stock due to war would lead to production increases in the following years as the country returns to maximum potential growth of GDP per capita. My analysis does not conclusively determine these relationships, and more research into the effect of arms imports is necessary.

Additionally, Table 5, Model (b) reports a small but statistically significant relationship between foreign direct investment and infant mortality. An increase in FDI as a component of GDP of around seven-and-a-half percentage points is associated with a less than one unit drop in infant mortality. This drop is very small at only around two percent of the average mean, so
although increasing economic support in a country does reduce infant mortality, the effect is so small that FDI would be a highly inefficient lever for any significant change in development outcomes.

From the reported findings, I conclude that foreign direct investment and arms imports have statistically significant effects on the outcomes of aid. In the United States, military aid to foreign countries is justified as having a stabilizing effect. My research disputes this common reasoning and finds that an increase in arms sales will exacerbate conflict in the short term. This finding is especially important in the current debates over the policy response to the ongoing crises in Syria and Ukraine. Prior to the use of chemical weapons in Syria in August 2013, the Senate Foreign Relations Committee under Chairman Robert Menendez (D-NJ) approved S. 960, the Syria Transition Support Act on July 24, 2013. The bill makes it the policy of the United States that

*It is vital to the national security interests of the United States to ensure that the United States planning and programs, specifically those conducted under the authorities or funding provided in or authorized under this Act, are focused on ensuring a stable and appropriate political transition in Syria and limiting the threats posed by extremist groups, weapons proliferation, sectarian and ethnic violence, and refugee flows in the aftermath of the current conflict.* -Sec. 3 (10)

Title V of that bill also authorized the president to provide heavy weapons—barring anti-aircraft systems—to the opposition in Syria. My analysis demonstrates that these two provisions are in conflict, and that providing weapons to the country is likely to increase battle-related deaths and destabilize the region further. Following the attacks, reports indicate that the Obama Administration began sending small arms to rebel forces in Syria (Washington Post, September 11, 2013). The increase in hostilities in Syria since that time supports my thesis. Although there are additional political goals of military aid that this finding does not evaluate, U.S. policy makers should not engage in the sale of arms to areas of conflict to support short-term stability.
For the last measure of foreign aid, my regressions do not demonstrate a significant relationship between ODA and development outcomes. Similar to previous research, my analysis found no relationship between ODA and development outcomes, which has significant policy implications. Around one percent of the federal budget is devoted to the administration and sum of foreign aid. Although these programs have political aims, which this research does not evaluate, they also often have stated developmental purposes. Legislation such as the Foreign Aid Transparency and Accountability Act introduced by Senators Cardin (D-MD) and Rubio (R-FL) aims to address this issue. The proposal would direct the president of the United States to use up to five percent of U.S. foreign development assistance funds to establish measurable goals, performance metrics, and monitoring and evaluation plans for U.S. foreign assistance. Devoting resources to the establishment of metrics will provide valuable data that can be used to better evaluate impacts and future resource allocation.

Economic aid, development aid, and military aid continue to serve important political and humanitarian objectives. However, the effectiveness of aid and its ability to accomplish policy goals remains unclear as my analysis and previous studies have shown. Future research should focus on improving data collection in order compare different metrics and the effectiveness of each one in measuring the impact of aid. Foreign aid will remain a significant component of government expenditures and an important tool in international policy. Policy makers must work to insure that the money is spent wisely.
## APPENDIX

Table 7: Descriptive statistics of unrestricted dataset

<table>
<thead>
<tr>
<th>Variable</th>
<th>Units</th>
<th>Obs</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Min</th>
<th>Max</th>
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</thead>
<tbody>
<tr>
<td><strong>Dependent variables:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Log of GDP per capita at PPP</td>
<td>natural log</td>
<td>3507</td>
<td>8.55</td>
<td>1.30</td>
<td>5.02</td>
<td>11.64</td>
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<tr>
<td>Infant mortality</td>
<td>per 1,000 live births</td>
<td>3465</td>
<td>39.02</td>
<td>35.13</td>
<td>1.9</td>
<td>165.5</td>
</tr>
<tr>
<td>Battle related deaths</td>
<td>number of people</td>
<td>3570</td>
<td>172.43</td>
<td>1397.62</td>
<td>0</td>
<td>50293</td>
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<tr>
<td><strong>Primary independent variables:</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arms imports</td>
<td>constant 2005 $million</td>
<td>3570</td>
<td>1.74</td>
<td>4.72</td>
<td>0</td>
<td>48.70</td>
</tr>
<tr>
<td>FDI, net inflows</td>
<td>percent of GDP</td>
<td>3508</td>
<td>4.26</td>
<td>7.45</td>
<td>-82.89</td>
<td>145.20</td>
</tr>
<tr>
<td>ODA per capita</td>
<td>constant 2005 US$</td>
<td>3546</td>
<td>66.48</td>
<td>343.95</td>
<td>-242.58</td>
<td>14771.10</td>
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<tr>
<td><strong>Secondary independent variables</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP per capita at PPP</td>
<td>constant 2005 US$</td>
<td>3507</td>
<td>10469.79</td>
<td>12263.28</td>
<td>151.83</td>
<td>113672.1</td>
</tr>
<tr>
<td>Capital stock per capita</td>
<td>constant 2005 US$</td>
<td>3507</td>
<td>30561.91</td>
<td>38096.42</td>
<td>284.92</td>
<td>287038.9</td>
</tr>
<tr>
<td>Labor participation</td>
<td>percent of population</td>
<td>3437</td>
<td>40.3</td>
<td>8.2</td>
<td>15.8</td>
<td>74.3</td>
</tr>
<tr>
<td>Human capital index</td>
<td>no units, continuous</td>
<td>2814</td>
<td>2.407</td>
<td>0.571</td>
<td>1.129</td>
<td>3.619</td>
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<tr>
<td>Armed forces</td>
<td>percent of labor force</td>
<td>3088</td>
<td>1.71</td>
<td>2.03</td>
<td>0.06</td>
<td>36.83</td>
</tr>
<tr>
<td>Annual population growth</td>
<td>percent growth</td>
<td>3544</td>
<td>1.52</td>
<td>1.47</td>
<td>-7.60</td>
<td>17.48</td>
</tr>
<tr>
<td><strong>Panel Data</strong></td>
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<tr>
<td>Countries</td>
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<td>170</td>
<td>--</td>
<td>--</td>
<td>--</td>
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</tr>
<tr>
<td>Years</td>
<td></td>
<td>1990 to 2010</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

*Note: FDI: foreign direct investment; ODA: official development aid.*
Table 8: Countries dropped to merge Penn World Table and World Development Indicators

<table>
<thead>
<tr>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aruba</td>
</tr>
<tr>
<td>Andorra</td>
</tr>
<tr>
<td>Afghanistan</td>
</tr>
<tr>
<td>United Arab Emirates</td>
</tr>
<tr>
<td>Channel Islands</td>
</tr>
<tr>
<td>Cuba</td>
</tr>
<tr>
<td>Curacao</td>
</tr>
<tr>
<td>Cayman Islands</td>
</tr>
<tr>
<td>Algeria</td>
</tr>
<tr>
<td>Faeroe Islands</td>
</tr>
<tr>
<td>Greenland</td>
</tr>
<tr>
<td>Guyana</td>
</tr>
<tr>
<td>Haiti</td>
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<tr>
<td>Isle of Man</td>
</tr>
<tr>
<td>Kiribati</td>
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<td>Kosovo</td>
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<td>Libya</td>
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<tr>
<td>Lichtenstein</td>
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<tr>
<td>St. Martin</td>
</tr>
<tr>
<td>Marshall Islands</td>
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<tr>
<td>Monaco</td>
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<tr>
<td>Myanmar</td>
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<tr>
<td>New Caledonia</td>
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<td>Nicaragua</td>
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<tr>
<td>Papua New Guinea</td>
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<td>Korea, Dem. Rep.</td>
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<td>French Polynesia</td>
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<tr>
<td>Solomon Islands</td>
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<td>Samoa</td>
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<td>San Marino</td>
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<tr>
<td>Somalia</td>
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<tr>
<td>South Sudan</td>
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<td>Seychelles</td>
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<tr>
<td>Turks and Caicos Islands</td>
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<td>Timor-Leste</td>
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<td>Tonga</td>
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<tr>
<td>Tuvalu</td>
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<tr>
<td>U.S. Territories*</td>
</tr>
<tr>
<td>Vanuatu</td>
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<tr>
<td>West Bank and Gaza</td>
</tr>
</tbody>
</table>

*American Samoa, Guam, Northern Mariana Islands, Puerto Rico, Virgin Islands

Table 9: Donor countries that received no official development aid from 1990-2010

<table>
<thead>
<tr>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
</tr>
<tr>
<td>Austria</td>
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<td>United Kingdom</td>
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<tr>
<td>United States</td>
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</table>


BIBLIOGRAPHY


Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer (2013), "The Next Generation of the Penn World Table" available for download at [www.ggdc.net/pwt](http://www.ggdc.net/pwt)


