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Assessing The United States Foreign Assistance Activities Impact on Violent Conflicts

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ASSESSING THE UNITED STATES FOREIGN ASSISTANCE ACTIVITIES IMPACT ON VIOLENT CONFLICTS

THESIS

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Abstract

The Global Fragility Act, H.R.2116 116th Cong. (2019), "directs the Department of State to establish the interagency Global Fragility Initiative to stabilize conflict-affected areas and prevent violence globally, and establishes funds to support such efforts". The United States Agency for International Development (USAID) has identified deteriorating economies, weak or illegitimate political institutions, and competition over natural resources as causes of violence, extremism and instability (USAID, 2021). The agency gives priority to mitigating the causes and consequences of violent conflicts, instability and extremism and funds programs and activities to accomplish that (USAID, 2021). With this study, we aim to quantitatively assess these programs effectiveness at preventing and deescalating conflicts in the short and long term. The method used in this study can also be applied to evaluate foreign assistance effectiveness at meeting other U.S. objectives. We use publicly available open-source data from 2010 to 2020. We weight the foreign aid impact as a factor on violent conflicts predictions using a logistic model that predicts with 82% accuracy a country's status the following year. The model indicates that none of the fund are significant factors in the predictions. The funds do not have an immediate impact on countries prone to violence. There are however cumulative long term positive and negative linear relationships between some funds/combinations of funds and the global conflict levels. As the total amount of five years cumulative Defense Security Cooperation Agency (DSCA) implemented funds increases, the total number of countries not in conflict (level 0) increases while the total number of the most violent countries (level 5) decrease. The total amount of five

years cumulative DSCA implemented funds is also correlated to the decline in total conflict levels during that timeframe.

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This research is dedicated to my loving wife and children, who made this possible with their motivation and understanding the past two years

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I. Problem Statement and Research Plan

According to the U.S. government foreign assistance website (2021), in 2018 foreign assistance totaled $48 billion, for 13,000 activities in 215 countries. These activities aim to: promote economic growth, reduce poverty, improve governance, expand access to health care and education, promote stability in conflict regions, counter terrorism, promote human rights, strengthen allies, and curb illicit drug production and trafficking (Lawson, *et al.*, 2020). Several studies have thoroughly assessed security cooperation' impacts on interoperability with partners and the health of the defense industrial base. Evaluating their effect on U.S. regional influences has however been proven more challenging (O'Mahony, *et al*., 2018). Our study assesses the impact of the past ten years of U.S. foreign assistance on ensuring the nation's security and promoting U.S. regional interests. Our goal is to support the development of guidelines that will quantitatively assess U.S. foreign assistance effectiveness.

One of the three strategic objectives of the 2018 National Defense Strategy is to: "Strengthen Alliances and Attract New Partners" (United States Department of Defense, 2018). Retired Lt. Gen. Charles Hooper, the former director of the Defense Security Cooperation Agency (DSCA), viewed security cooperation as a primary policy tool to strengthen alliances in the ongoing great-power competition (Hooper, 2021). Our study assesses foreign aid s' contribution to meeting this objective through conflicts prevention.

U.S. funded programs are intended to foster relationships with partners by developing their military capabilities. The U.S. in return gain: a trained and equipped partner that can defend its territory, maintain regional stability even when the U.S. is not present and fight alongside the U.S. in multi-national operations; lastly, U.S. forces gain access to strategic territories. When successfully operated, these programs contribute to stronger economic and diplomatic relationships. However, accusations of misuses suggest these programs may be ineffective at ensuring the partner nation's security.

Problem Statement: Test foreign aid impact on level of conflict.

We evaluate two types of foreign assistance programs. Programs aimed at improving the recipient country's military. The major programs in this category are: Foreign Military Financing (FMF) through the Department of State (DOS) and Title 10 Section 333 capacity building activities through the Department of Defense (DOD). The three capacity building activities of interest are: counterterrorism operations, counter-weapons of mass destruction operations and counter illicit drug trafficking operations. We also address military aid intended for stabilization operations and security sector reforms and all the funds implemented by the DSCA and the Army Corp of Engineers. The other category of U.S. funded programs that we study are those specifically geared toward improving the recipient country socioeconomic and political conditions. The different funds in this category are: economic development, good governance, democracy, human rights and rule of law. We do not address programs funded by foreign national funds.

We assess U.S. foreign assistance and the effect of factors like: nations partners' cultural similarities with the U.S, their political alignment with the U.S. on important issues at the United Nations, their level of democratization, their internal and external stability; their GDP per capital,

the types of activity. We explore partners' relationships with competitors like China and Russia and the effects of those relationship on the program's success. We also investigate cases of socio-economic conflicts drivers that can be addressed with means other than military assistance.

To successfully conduct this study, we obtained the past 10 annual reports of U.S. foreign assistance from USAID (2021). We consolidated databases on armed conflicts around the world like the UCDP/PRIO Armed Conflicts Dataset version 21.1 (Pettersson, *et al*., 2021), the Heidelberg Institute for International Conflict Research (HIIK) (2021) the Stockholm International Peace Research Institute (SIPRI) (2021) and the University of Central Florida Datasets on War, Conflicts and Terrorism (2021). We used the world Bank databases (Kaufmann, *et al*., 2021) to get socioeconomic and political information like the country's GDP per capita, its population size and governance indices.

Our study is an added resource to U.S. security cooperation organizations like the Office of the Secretary of the Air Force for International Affairs (SAF/IA) and the Defense Security Cooperation Agency (DSCA). These organizations could use our methods as a template for future evaluations or even evaluations with current data not available to the public.

II. Literature Review

This review covers two areas: specific countries and global studies.

Research on Foreign Aid to Specific Countries

Dube *et al*. (2013) studies the impact of U.S military aid on fragile states facing internal conflicts. They perform a case study on Columbia during 17 years of political violence. They show how diverted U.S. military aid can be used to aggravate internal conflicts with an increase in homicides during elections years in regions around the bases that received the aid. Their article shows the misuse of U.S. military aid can undermine the democratic process and weaken political institutions. The article is relevant for this study because it highlights the importance of taking into account the partner's internal stability when providing security assistance. Boutton (2019) also demonstrates how regime type impacts the military assistance outcome.

Shah *et al*. (2020) describe how a post-authoritarian Tunisia is using foreign military assistance from the U.S., Europe and regional partners to successfully combat terrorism, ensure its borders security and improve its military professionalization and readiness. Their article emphasizes several contributing factors: a civilian controlled military, an increasing level of democratization, cooperation with other democratic nations, and adherence to the full spectrum of the program including education, training and equipment, and exercises. Their article supports the position that under certain conditions the U.S. military assistance programs can be highly effective.

Cunningham (2015) assesses U.S. military aid's influence on one of the cornerstones of democracy: civilian control of the military in the recipient country. The study focuses on three

countries that received U.S. military assistance from the end of World War II through 2014: South Korea, Turkey and Egypt. Each country experienced over that period varying degrees of military interference into civil politics. The study presents several factors that can affect the balance of power between civilian and military elites. It also shows that those factors may generate contradictory outcomes. Some of those factors are the external and internal threats facing the recipient country, the strength of its democracy or its authoritarian leadership, the authoritarian leadership strategic role assigned to the military and the U.S. interests in the country and the region. This illustrates U.S. security cooperation's complexities that should be accounted for when assessing effectiveness.

Gurrola (2018) analyzes the increasing arms outflows from China into Latin America Countries from 2000 to 2016. The study defines China arms exports as a foreign policy tool to position themselves as a global arms leader, build relationships and gain access to natural resources and export markets. Their report also focuses on Venezuela reliance on Chinese weapons for its defense in response to the 2006 U.S. embargo on arms transfer and the threat of a possible U.S. invasion. Conteh-Morgan (2019) compares the U.S. and China militarization and securitization of Africa in the fight against terrorism and competition for natural resources and political influence. Hiro (2019) describes how China and Saudi Arabia have stepped in to assist Pakistan economically after the revocation of U.S. military assistance. These three articles put U.S. military assistance in the contexts of competition with China.

From these examples, we conclude that U.S. security cooperation's effectiveness varies by countries and conditions. This research aims to identify conditions under which military aid would be most successful at preventing or deescalating high intensity conflicts.

Global Foreign Aid Studies

We summarize several researchers that evaluated data across countries, which is the approach of our research.

Durch (2002), identifies lack of resources or skewed distribution of wealth, rapid population growth in megacities and unstable political structures as causes of armed conflict. He develops a conflict prevention timeline for four types of conflict. Our study quantifies similar sources of conflict and suggests timely intervention as a possible factor in conflict prevention.

Omelicheva *et al*. (2017) presents a time series analysis from 1995 to 2012 on the impact of several U.S. security assistance programs on the number of civilian atrocities in receiving countries. The study focuses on foreign military training and the factors taken into account are the country overall human rights situation, the GDP per capita, the country population, the United Nations regions identifier and the regime type. They use a negative binomial regression with a two-year lag between the time the assistance was received and the observations on the field. This study methodology is similar to ours because it uses a global approach, takes into account several factors and is based on negative binomial regression. Tahir (2017) also uses a negative binomial regression to show a positive correlation between military aid and terrorism incidences.

Dimant *et al*. (2019) study the impact of U.S. military aid and anti-American terrorism covering the years 1996 to 2015 on 148 countries. They also use a negative binomial regression model and account for other factors like economy and demography that can influence anti-American Terrorism. Their study relates well with our study because it takes a global approach over multiple years and accounts for multiple factors.

Savun *et al*. (2009) built a theoretical model that correlate transnational terrorism to an active foreign policy and not the aid recipient's regime type. Neumayer *et al*. (2011) and Du Bois *et al*. (2016) apply Poisson and Negative Binomial models that show alignment between military support and transnational terrorism. Boekestein (2015) predicts violent conflicts on the short term with a Negative Binomial Logistic model. All these studies were successful at relating several factors to conflict using and Negative Binomial Logistic model. Our study purpose is not to build another model but to use our model to quantify foreign assistance impact.

III. Methodology

Our study hypothesis is that the United States foreign assistance activities contribute in the short or long term to receiving nations security by preventing and or deescalating violent conflicts.

Short Term (The following year)

To test our hypothesis on the short-term influence, we first apply a binary logistic regression model that predicts using current year various U.S. assistances and socioeconomic and political factors whether a country will be involved in a violent conflict the following year. We use the binary logistic regression model to identify factors that are precursors, prevent or deescalate violent conflicts. The presence of foreign assistance activities with statistically significant impact on the predictions in the model will confirm our hypothesis. In the event that foreign assistance activities do not have a major influence on the predictions, we combine all the major socioeconomic and political factors into principal components and investigate aids impact on the occurrence of violent conflicts the following year based on the principal components. Our investigation consists of:

- We compare the de-escalation or escalations rates between the countries that received a specific fund and those that did not.
- We compare the distribution of funds between stable and escalating countries.
- We build linear regression models with inputs the total amount of individual or combination of funds received during the current year and as output the total number of violent conflicts the following year.

- We investigate the linear relationship between the total amount of each fund received a specific year and the total number of countries at a specific conflict level the following year.
- We also investigate the linear relationship between the total amount of each fund received a specific year and the year over year change in violence intensity levels.
- We combine on a graph, the year over year change in country's conflict level, its current conflict level and the amount of a specific fund received. We aim to identify if they exist patterns between these 3 factors.

Long Term (5 years)

On the long term, we investigate if there is a linear relationship between the total amount spent on a specific fund during a five years period and the number of countries at a conflict level the year following the five years. We also investigate the correlation between the amount of five years cumulative fund and the total global change in conflict levels during the five years.

Dependent Variable

We use the Heidelberg Institute for International Conflict Research (HIIK) (2021) conflict barometer as the dependent variable for this study. The barometer differentiates 5 different levels of conflicts, from dispute to war and two level of violence: "Violent" and "non-Violent". The different levels are summarized in Figure 1. For this study, each country with a conflict intensity level above 2 is considered "Violent" while a country not in conflict or with a conflict intensity level of 2 or below is considered "non-Violent." Since 1993, HIIK produces annual data on hundreds of conflicts in almost two hundred countries. This study uses data from 2010 to 2020. The datasets enumerate the different conflicts in each country, whether the conflict is intrastate

or interstate, its cause (ideology, secession, national power etc..) and its intensity level. We only use the highest conflict intensity level.

Intensity Level:	Terminology	Level of Violence
0	No Conflict	Non-violent Conflicts
1	Dispute	
2	Non-violent Crisis	
3	Violent Crisis	Violent Conflicts
4	Limited War	
5	War	

Figure 1: HIIK Levels of Conflict Intensities

Socioeconomic and Political Factors

We use the World Bank's Worldwide Governance Indicators (WGI) (Kaufmann, *et al*., 2021) to get estimates for six dimensions of governance. The estimates range from -2.5 (weak) to 2.5 (strong). The six dimensions of governance are:

- Voice and Accountability: "Reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media." (Kaufmann, *et al*., 2021).
- Political Stability and the Absence of Violence/Terrorism: "measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism." (Kaufmann, *et al*., 2021).
- Government Effectiveness: "Reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the

quality of policy formulation and implementation, and the credibility of the government's commitment to such policies." (Kaufmann, *et al*., 2021).

- Regulatory Quality: "Reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development." (Kaufmann, *et al*., 2021).
- Rule of law: "Reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence." (Kaufmann, *et al*., 2021).
- Control of Corruption: "Reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests." (Kaufmann, *et al*., 2021).

We also use the following indicators from the World Bank World Development Indicators (2021):

- The recipient country surface area in square kilometer
- The recipient country total population
- The recipient country GDP and GDP per capita in current US Dollars.

We obtain the list of countries and their associated land borders from the website geodatasource (2021).

U.S. Foreign Assistance Activities

From the website ForeignAssistance.gov (2021), we combined the yearly amount of US dollars per activity type based on the following criteria:

- U.S. Government Sector Name:

    - Combating Weapons of Mass Destruction (WMD)
    - Counter-Narcotics
    - Counterterrorism Financing
    - Stabilization Operations and Security Sector Reform
    - Rule of Law and Human Rights
    - Good Governance
    - Economic Development - General
    - Democracy, Human Rights, and Governance – General
    - Political Competition and Consensus-Building
- Activity Name
    - DOD - International Military Education & Training (IMET) Program/Deliveries
    - DOD - Foreign Military Financing (FMF) Program, Payment Waived
- Implementing Subagency name:
    - DOD
        - Defense Security Cooperation Agency
        - Army Corp of Engineers

We obtain the history of the number of deployed U.S. troops from the Heritage Foundation. We compile data on 193 countries for the years 2010 to 2020 and obtain 1930 rows. Each row represents a country in a specific year. 60 of the rows are removed for missing data.

Building a binary logistic regression model

The first step in building the model is splitting the data into the training and testing sets. The split percentage used is 75% train and 25% test selected randomly. We use the training set to train the model and the testing set to validate the model accuracy. Starting with all the above-

mentioned variables (predictors) in the initial model, we use stepwise logistic regression to select variables that significantly contribute to the model. Once a model is established, we check for multicollinearity between the dependent variables. We measure the model performance by analyzing the Area Under the Curve (AUC), the Receiver Operating Characteristic (ROC) curve and the confusion matrix. The odds ratio will establish each factor impact on making the prediction.

Comparing the different funds distribution

We compare on a graph the total amount of each fund received during the ten years of the study between violent and nonviolent countries. We aim to highlight disparities in funding if they exist. We also use graphs to compare the rate of transition from one conflict category to the other between funded and unfunded countries. The expectation is that funded countries will transition to nonviolence at a higher rate than those unfunded.

The next step is to explore the patterns between the significant predictors of violence and the different funds. In order to display all the three significant factors on a two-dimensional graph, we will summarize them in two principal components. We differentiate fund recipients and non-recipients on the two-dimensional principal components graph and uncover if they exist pattern based on their respective locations. We want to know if funded countries more likely to be located in certain areas of the graphs? We build separate graphs to investigate if the location on the two-dimensional graph affects:

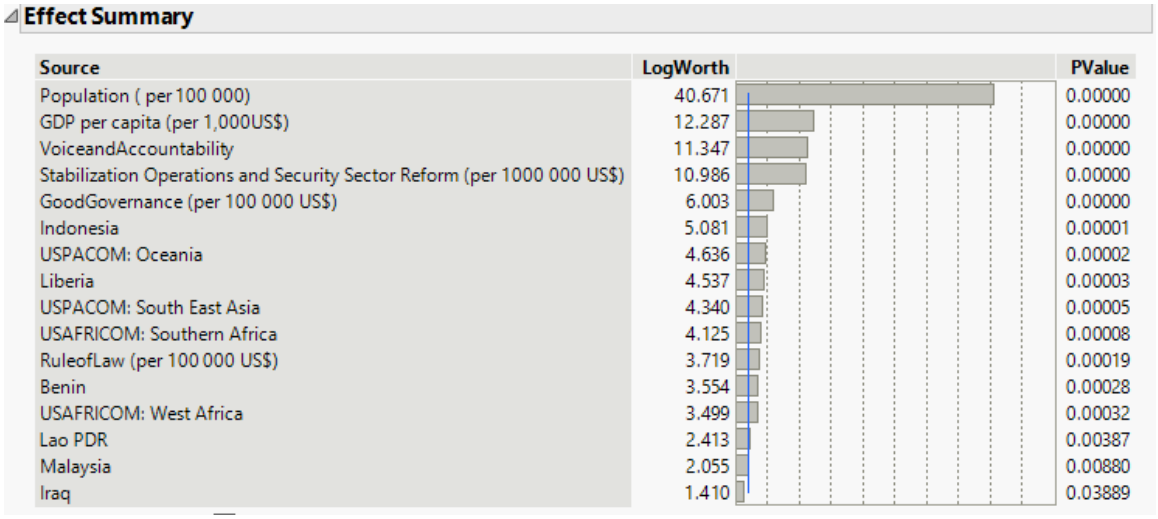
- The country status the following year (violent, nonviolent)
- The transition from one category to the other
- The amount of fund received.

IV. Results and Analysis

Our study hypothesis is that foreign military aid should improve the recipients' national security. We anticipate that foreign military aid will have a bigger impact at preventing and deescalating violence in the long term than in the short term. However, the funds can also be misused to generate or escalate violence in countries with factors precursors to violence. We use tables and graphs to display the different degrees of military aid success based on the influencing factors.

Significant factors

We construct a model to predict violent or non-violent status in the subsequent year. Figure 2 lists all the significant factors in the model. The p-value is the probability that factor is not statistically significant given the data. Hence, smaller p-values indicate factors that contribute to explaining violent/non-violent status in the following year, which is the dependent variable. With the highest p-value at 0.039, all the factors are statistically significant at alpha = 0.05 (the probability of a Type I error, which is erroneously including a factor in the model).



Effect Summary

Source	LogWorth	PValue
Population (per 100 000)	40.671	0.00000
GDP per capita (per 1,000US$)	12.287	0.00000
VoiceandAccountability	11.347	0.00000
Stabilization Operations and Security Sector Reform (per 1000 000 US$)	10.986	0.00000
GoodGovernance (per 100 000 US$)	6.003	0.00000
Indonesia	5.081	0.00001
USPACOM: Oceania	4.636	0.00002
Liberia	4.537	0.00003
USPACOM: South East Asia	4.340	0.00005
USAFRICOM: Southern Africa	4.125	0.00008
RuleofLaw (per 100 000 US$)	3.719	0.00019
Benin	3.554	0.00028
USAFRICOM: West Africa	3.499	0.00032
Lao PDR	2.413	0.00387
Malaysia	2.055	0.00880
Iraq	1.410	0.03889

Figure 2: Subsequent Year Violent versus Non-Violent Model Significant Factors

Model Performance

The validation data AUC-ROC curve (Figure 3: Validation Data AUC-ROC Curve) shows that the model is capable of correctly separating between “Violent” and “Non-Violent” conflict classes at a rate of 0.91.

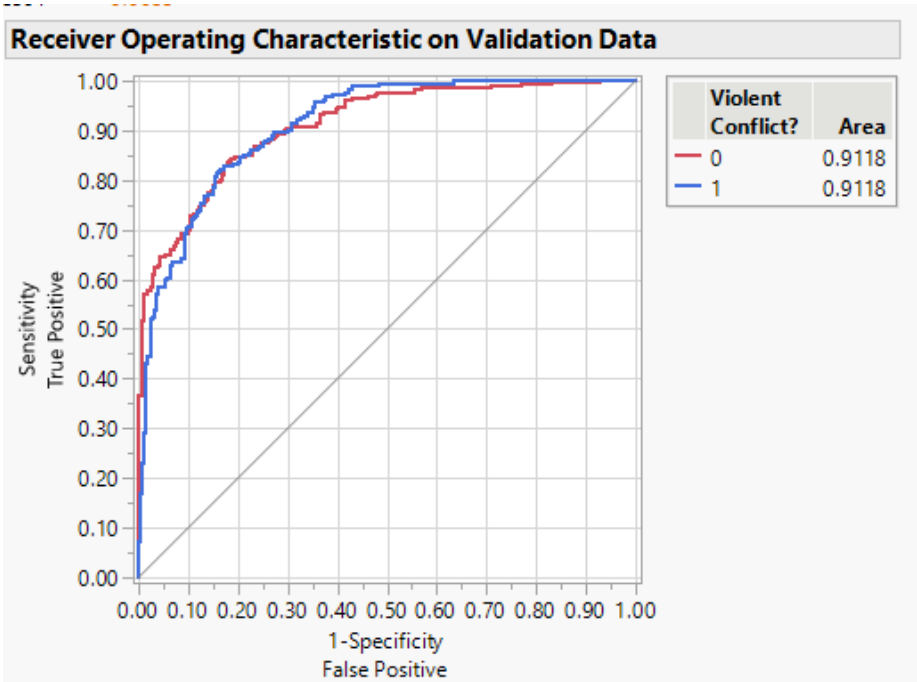


Figure 3: Validation Data AUC-ROC Curve

Prediction Accuracy

The validation data confusion matrix (Figure 4) shows that the model accurately predicts the level of violence in the subsequent year with a frequency of (235+164) / (235 + 35 + 164 + 51) = 82.3%. The true positive rates is (164) / (164 + 51) = 76.3%, and true negative rate is (235) / (235 + 35) = 87.0%.

Validation

Actual Violent Conflict?	Predicted Count 0	1
0	235	35
1	51	164

Figure 4: Validation Data Confusion Matrix

Odds Ratios

The continuous variables odds ratios in Figure 5 can be interpreted the following ways:

For Violent Conflict? odds of 0 versus 1

Unit Odds Ratios

Per unit change in regressor

Term	Odds Ratio	Lower 95%	Upper 95%	Reciprocal
GoodGovernance (per 100 000 US$)	0.98892	0.983453	0.994417	1.0112041
Stabilization Operations and Security Sector Reform (per 1000 000 US$)	0.997488	0.994713	1.000271	1.0025179
Population (per 100 000)	0.996591	0.995857	0.997325	1.0034208
VoiceandAccountability	1.890748	1.576973	2.266957	0.5288911
GDP per capita (per 1,000US$)	1.045337	1.029928	1.060976	0.9566295
RuleofLaw (per 100 000 US$)	0.995889	0.992891	0.998895	1.0041284

Figure 5: Odds Ratios on Continuous Factors: Voice and Accountability rating is the most significant factor

- An increase of 100,000 US $ in Good Governance funding corresponds to an increase in the odds of violent conflicts by (1-0.98892) X100 = 1.1%. Good Governance aid is often given to violent countries, and those countries are almost always categorized violent the next year.
- An increase of 1000,000 US $ in Stabilization Operations and Security Sector Reform funding correlates with an increase in the odds of violent conflicts by (1-0.997488) X100 = 0.25%. Stabilization Operations are conducted in violent countries, and those countries remain violent in the subsequent year.
- A 1000,000 increase in population size increases the odds of violent conflicts by 10X(1-0.996591) X100 = 3.4%. Countries with larger populations are more likely to be categorized as violent the following year. Durch (2002) also identified rapid population as a source of armed conflict.

- A 1 unit increase in Voice and Accountability rating decreases the odds of violent conflicts by (1.8907-1) X100 = 89.07%. Improved voice and accountability reduce violence.
- An increase of 1,000 US $ in GDP per Capita decreases the odds of violent conflicts by (1.045337-1) X100 = 4.5%. Statistically, poorer countries are more likely to be violent.
- An increase of 100,000 US $ in Rule of Law and Human Rights funding corresponds to an increase in the odds of violent conflicts by (1-0.995889) X100 = 0.41%. Again, funds are often provided to violent countries, and those countries continue to be violent in the subsequent year.

The odds ratio indicated that improving socioeconomic conditions (higher GDP per Capita, higher Voice and Accountability rating and smaller population size) are the major indicators of the absence of violent conflicts the following year. The different funds included in the model (Good Governance, Stabilization Operations and Security Sector Reform, Rule of Law and Human Rights) are marginal indicators of the presence of violent conflicts. Although the funds effects are minimal, the odds ratio however shows that the higher the amount of funds, the higher the likelihood of violent conflicts continuing. This is contrary to the funds' objectives; some possible explanations are:

- The funds are misused due poor socioeconomic and political conditions leading to escalation or continuation of violence.
- The funds are allocated to countries on the brink of, or already involved in violent conflicts. The funds do not arrive soon enough or are not sufficient to prevent continued violent conflicts.

Overall distribution of funds

Figure 6 is the distribution of the different aids between violent and nonviolent countries.

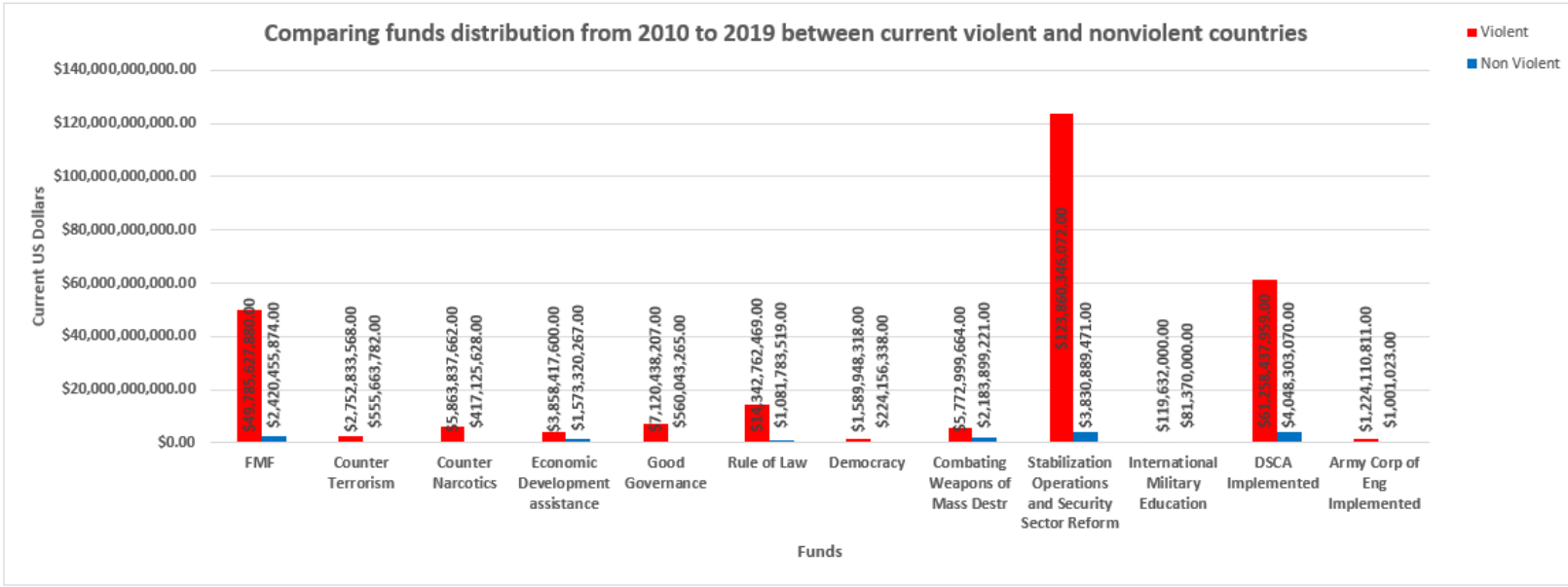


Figure 6:Countries involved in violent conflicts receive most funding

The graph shows that countries currently involved in violent conflicts get significantly more aid. The graph also indicates that FMF, stabilization operations and security sector reform and DSCA implemented aids have accounted for most of the aid. The disparity between violent and nonviolent countries on all the different dollars amount of aid is an indication of the priority given to resolving conflicts by most the U.S. foreign assistance programs.

The question then becomes why doesn't this disparity have a significant impact on violent conflicts predictions in our model? Do the funds given to violent countries play any part in conflict resolution? How are the funds distributed between the violent conflicts?

We use Figure 8 and Figure 9 to assess if being a recipient of any of the studied funds contributes to preventing, resolving or escalating conflicts. In Figure 8, we compare the rates of transition to violent conflict the following year of nonviolent countries that received funds to those that were not funded. We compare the rates at a 95% significance level. The graph indicates that funded nonviolent countries have a significantly higher rate of transition to violent conflict that those countries that did not receive funds. The rates are statistically significant for all funds. Figure 8 may imply two things:

- The nonviolent countries that received funds were already bound to violent conflicts and the aid did not have an impact (too little, too late or both).
- The nonviolent countries that received funds used the aid to escalate conflicts.

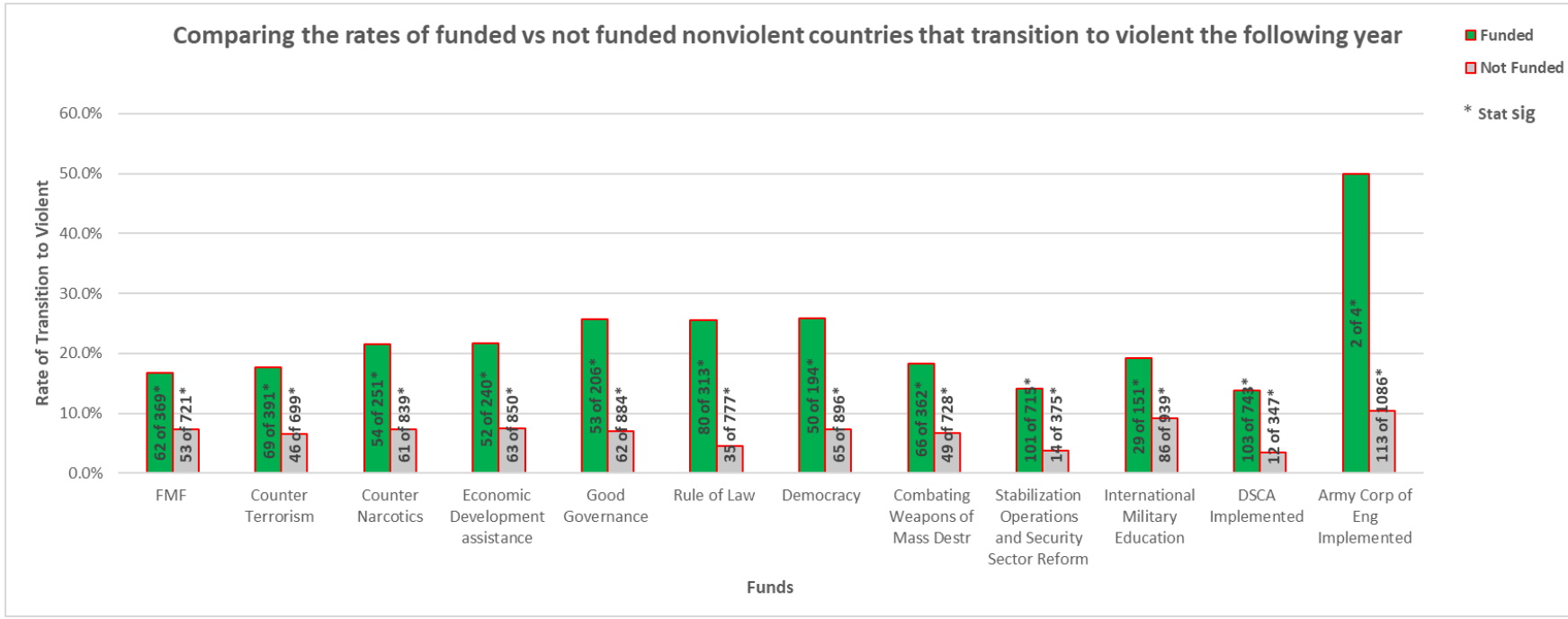


Figure 8: Funded nonviolent countries transition into violent conflicts at a statistically higher rate for all funds

In Figure 9, we compare the rates of transition to nonviolent conflict the following year of violent countries that received funds to those that were not funded. We compare the rates at a 95% significance level. The graph indicates that funded violent countries have lower rates of transition to nonviolent conflict levels that those countries that did not receive funds. Those rates, were statistically significant for four funds: Economic Development assistance, Good Governance, Rule of Law and Democracy. Figure 9 implies one of two things:

- The aid was not significant enough to deescalate conflicts for violent countries that received funds (too little, too late or both), or
- The violent countries that received funds used the aid to prolong conflicts.

  Both graphs show that being a recipient of any of the funds does not prevent or resolve violent conflicts.

This data indicates quite the opposite. Nonviolent fund recipients are statistically more prone to escalate into violent conflicts, and violent fund recipient are less likely to deescalate in to nonviolent conflicts.

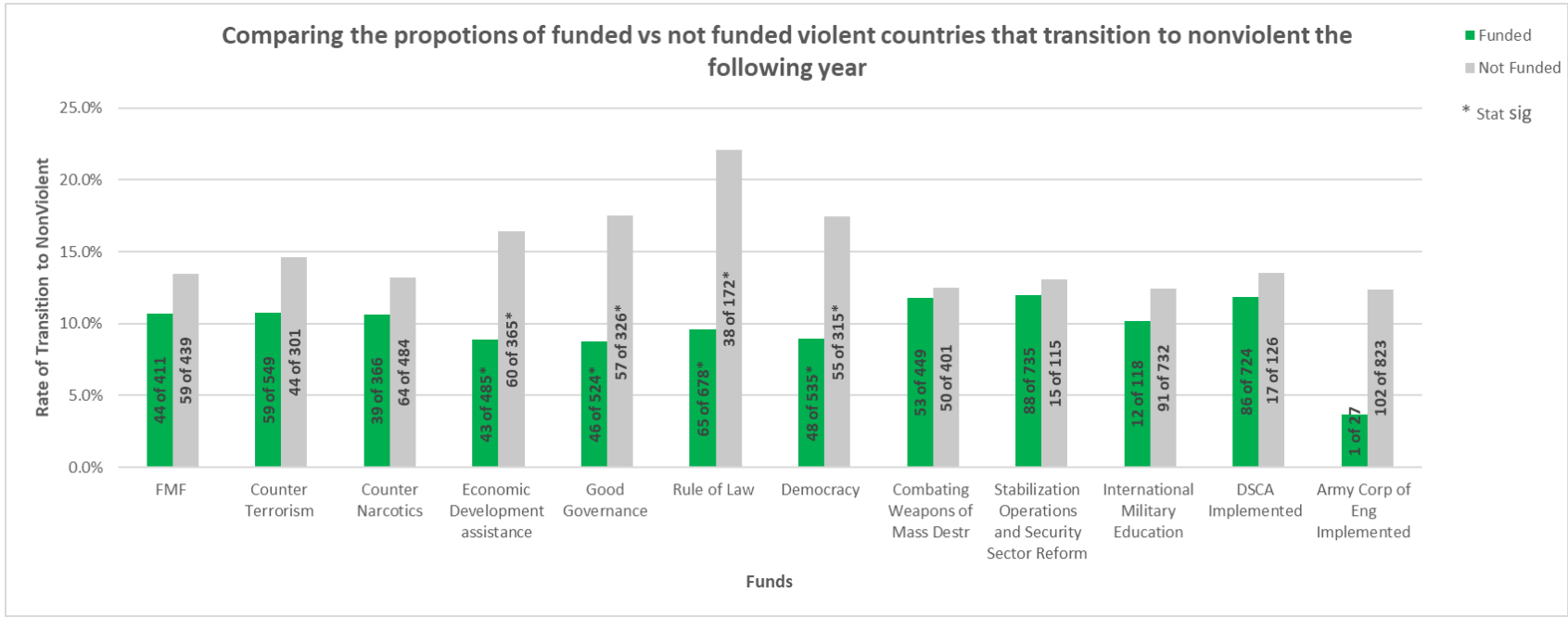


Figure 9: Funded violent countries transition to nonviolent categorization at a lower rate in all funds. The rates are statistically significant for 4 funds

We need further analysis to establish the characteristics of the countries receiving funds based on the impactful factors in the logistic model. We transform the three most significant factors (Population, GDP per Capita and Voice and Accountability rating) on violent conflicts into two principal components. The first principal component (PC1) accounts for 51.0% of the variance in the data while the second accounts for 31.5%. They combine for 82.5% of the variance. The loading matrix is represented in Figure 10. The population size has a 92.3% correlation with PC2 while the GDP per capita and Voice and Accountability rating have correlations of 83.0 % and 83.4% respectively with PC1.

	PC1	PC2
Population (100 000)	-0.383429	0.923454
GDP per capita (current 1,000US$)	0.829520	0.226818
VoiceandAccountability	0.834348	0.198873

Figure 10: Loading matrix

Figure 11 indicates that the principal components are an accurate representation of the highest level of conflict intensity. As we move from left to the right of the graph, the highest level of conflict intensity increases.

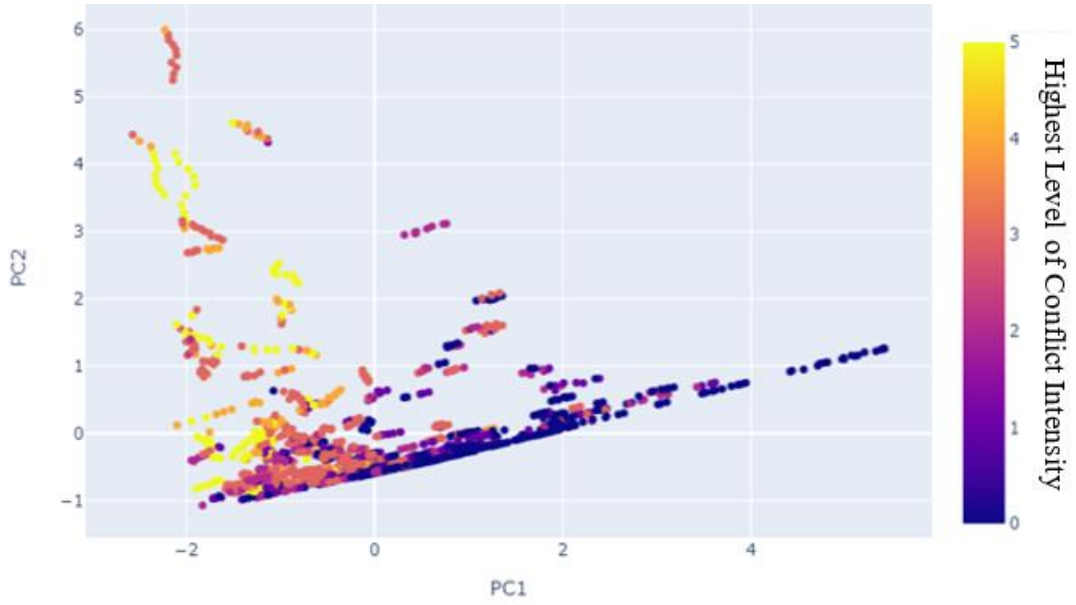


Figure 11: Distribution of highest level of violent conflict intensity based on principal components (GDP per Capita, Population size, Voice and accountability rating)

We then create one graph for each fund that displays the recipient countries in green and nonrecipient in gray. From Figure 12 for example which addresses the DSCA implemented funds, most recipients are on the left side of the graph with a PC1 value less than 2. This is a trend for all the different funds. This confirms once again that funds are mostly given to countries either already involved in violent conflicts or that are prone to them. We cannot then make a lateral comparison between countries that received and those that did not receive aid.

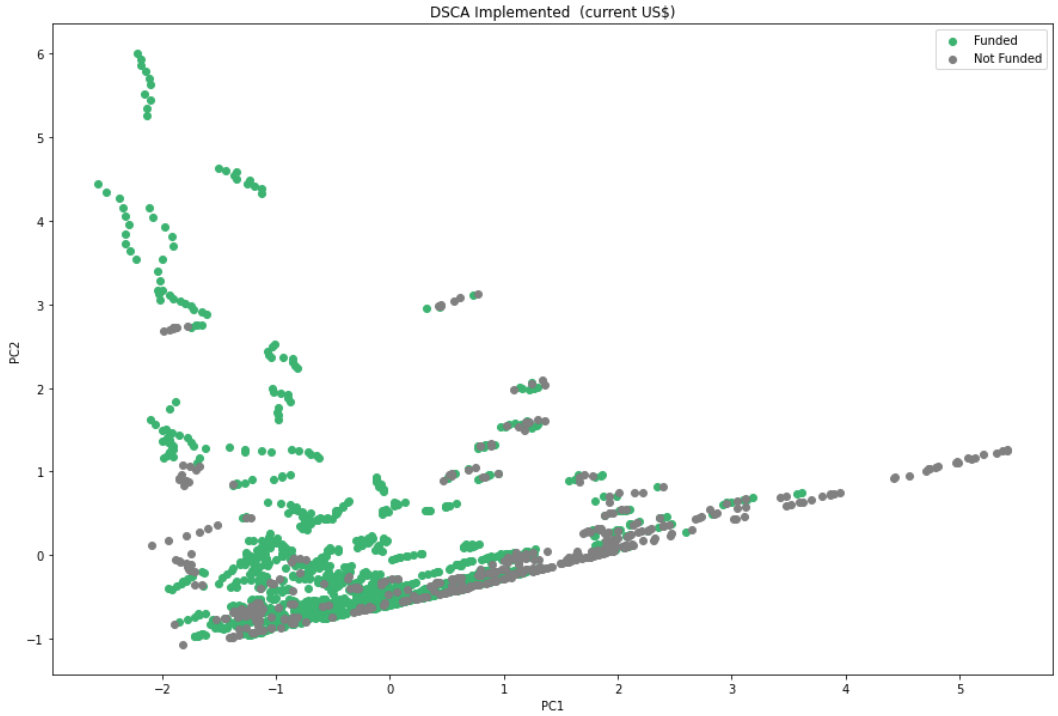


Figure 12:Distribution of DSCA Implemented funds based on principal components (GDP per Capita, Population size, Voice and accountability rating)

Figure 13 shows the countries' status the following year. The red dots represent countries in a violent conflict status the following year while the nonviolent are in blue. The left-hand side of the graph is dominated with violent countries while the right-hand side is dominated by nonviolent countries. This is also an indication that aid did not have an immediate dissuasive impact on those countries prone to violent conflicts.

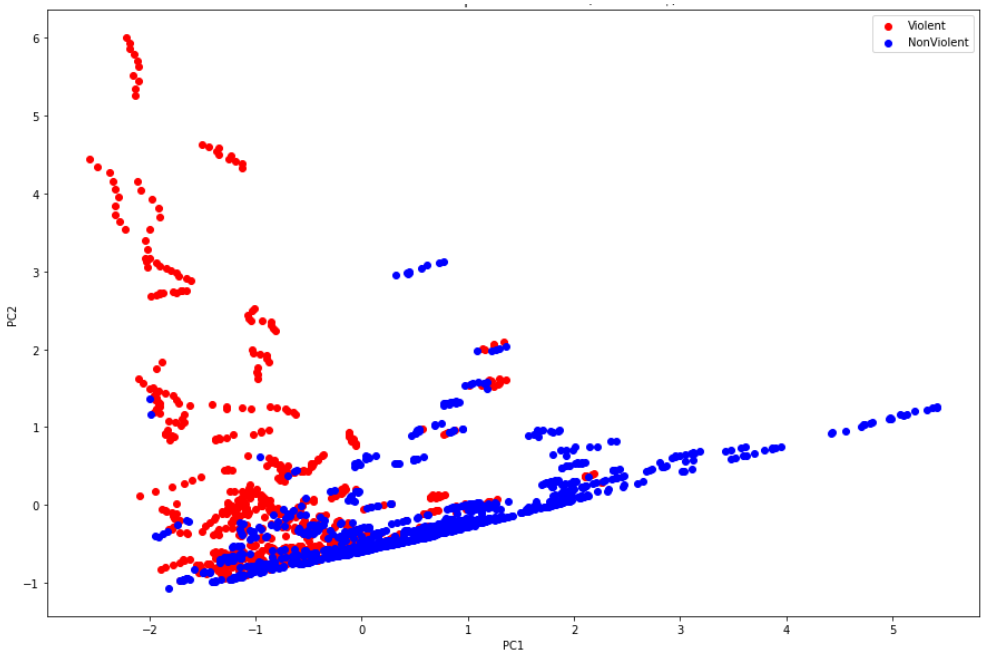


Figure 13: Distribution of Violent conflicts the following year based on principal components (GDP per Capita, Population size, Voice and accountability rating)

We display in Figure 14 the dollar amounts of DSCA implemented funds received by each country. The country color represents the amount of DSCA implemented fund received. The greener the country the larger the amount. We see from the graph that only a few countries (Israel, Egypt, Iraq) receiving significantly larger amount of DSCA implemented funds than the vast majority of the countries. The graph does not show a noticeable difference between the rest of the countries whether they are rated violent or not. This could contribute to further the argument that although most violent countries received DSCA implemented funds, the amounts received are not enough to have an immediate impact on the level of conflict intensity.

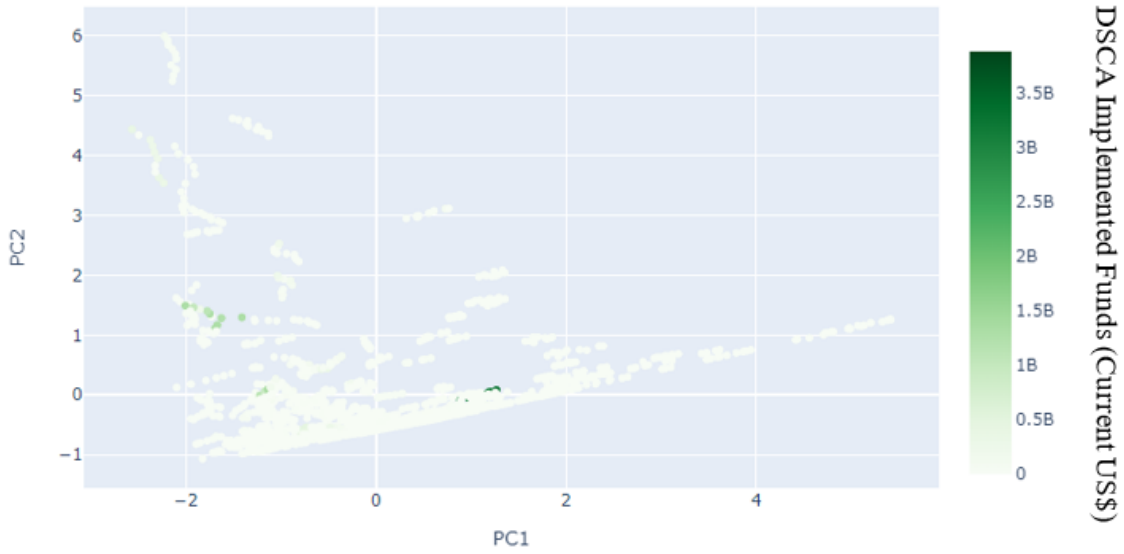


Figure 14: Selected countries get the bulk of DSCA implemented funds

Short-term (next year) Fund impact on current conflict level

We next investigate the relationship between the amount of fund received, the current conflict level and change in conflict level the following year. To do this, we plot the different year over year changes in conflict intensity level versus the amount of a specific fund received and the current conflict level. Figure 15 shows that most countries at level 0 (conflict free) remain at level 0 the following year independent of the amount DSCA implemented fund. There is also a significant number of level 0 countries that increase their conflict intensity level despite receiving DSCA implemented funds. This is a pattern for most funds, as illustrated in Figure 16. From Figure 15 and Figure 16 we see that there were 640 instances of countries at level 0 (with no conflict) during the 10 years studied. Of those, 43 (6.7%) increased their conflict intensity levels the following year with some becoming "Violent." At least 36 out of the 43 level 0 countries that increased their conflict intensity level received at least one form of funding. The

graphs finally show that funded level 0 countries increased their level of conflict intensity at a statistically higher than those not funded for most funds.

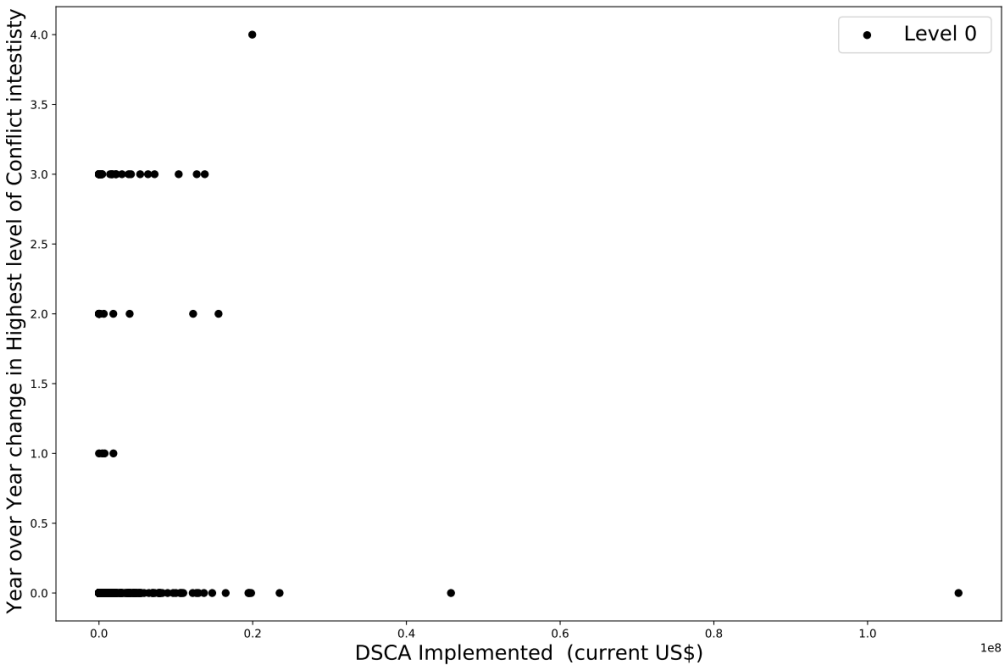


Figure 15: Most level 0 countries remain without conflict regardless of the amount of DSCA implemented funds; however, some increased their level of violence

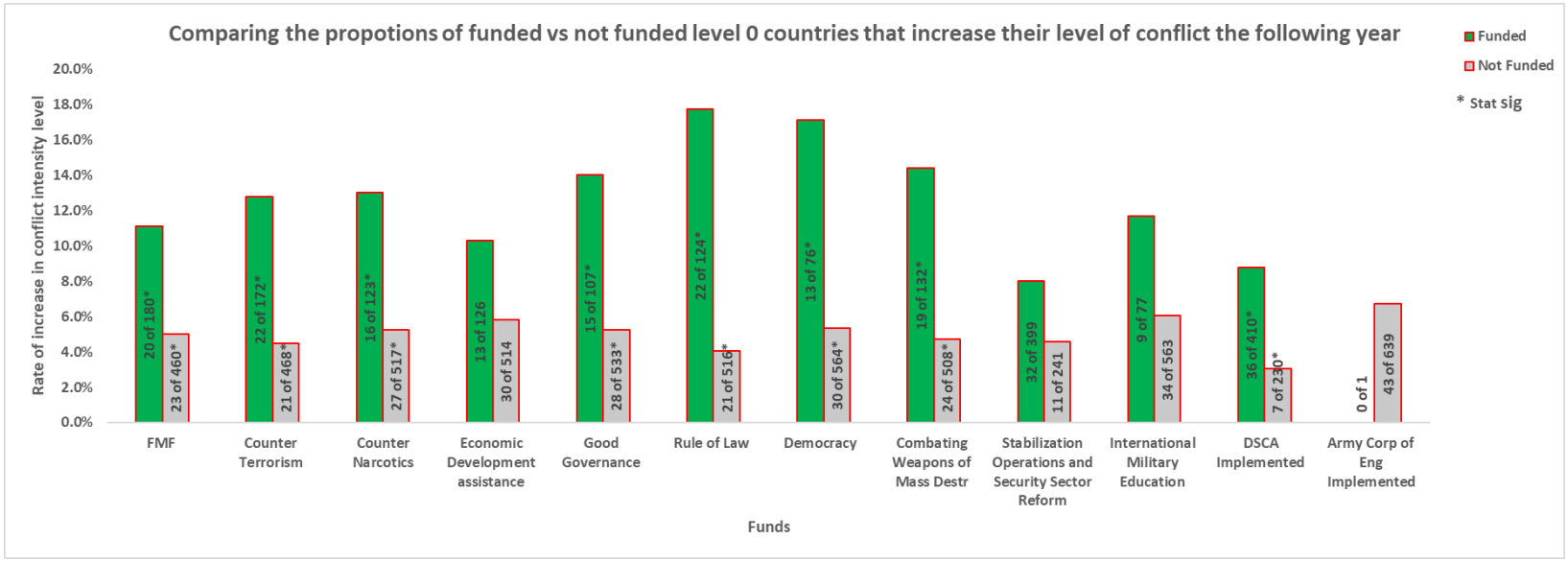


Figure 16: Funded level 0 countries increase their level of conflict at a statistically higher rate for most funds

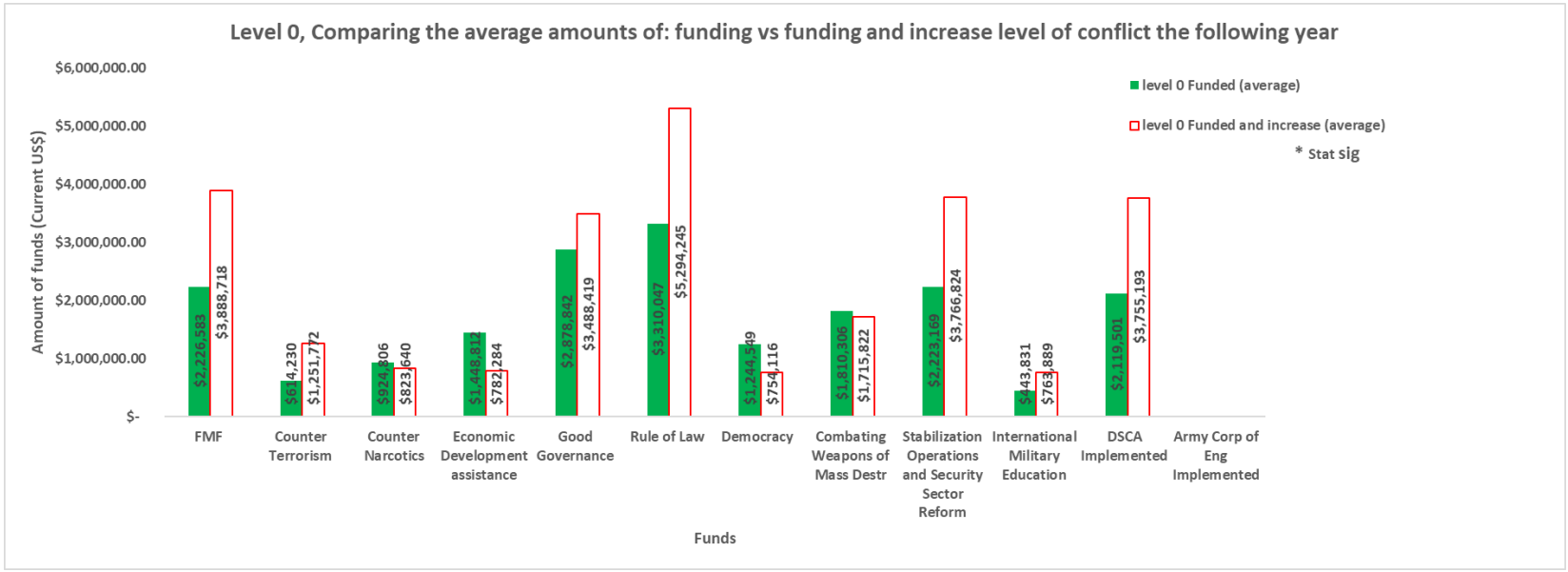


Figure 17: Of Level 0 countries that received aid, those that increase their level conflict the following year received a higher average amount of aid for most funds

The analysis so far indicates that in the short term, level 0 countries that do not receive aid are less likely to escalate into conflict. We now investigate how the amount of aid impacts the increase in conflict intensity level. Figure 17 compares the average amounts of the different funds received by the level 0 countries that increased their conflict intensity level the following year to the average amounts of all the other level 0 countries that received funds. The graph indicates that countries that increased their conflict level received in average more funds for seven of the twelve funds. However, because of the variability of funds received among the individual countries in the two populations, the differences in amounts are not statistically significant.

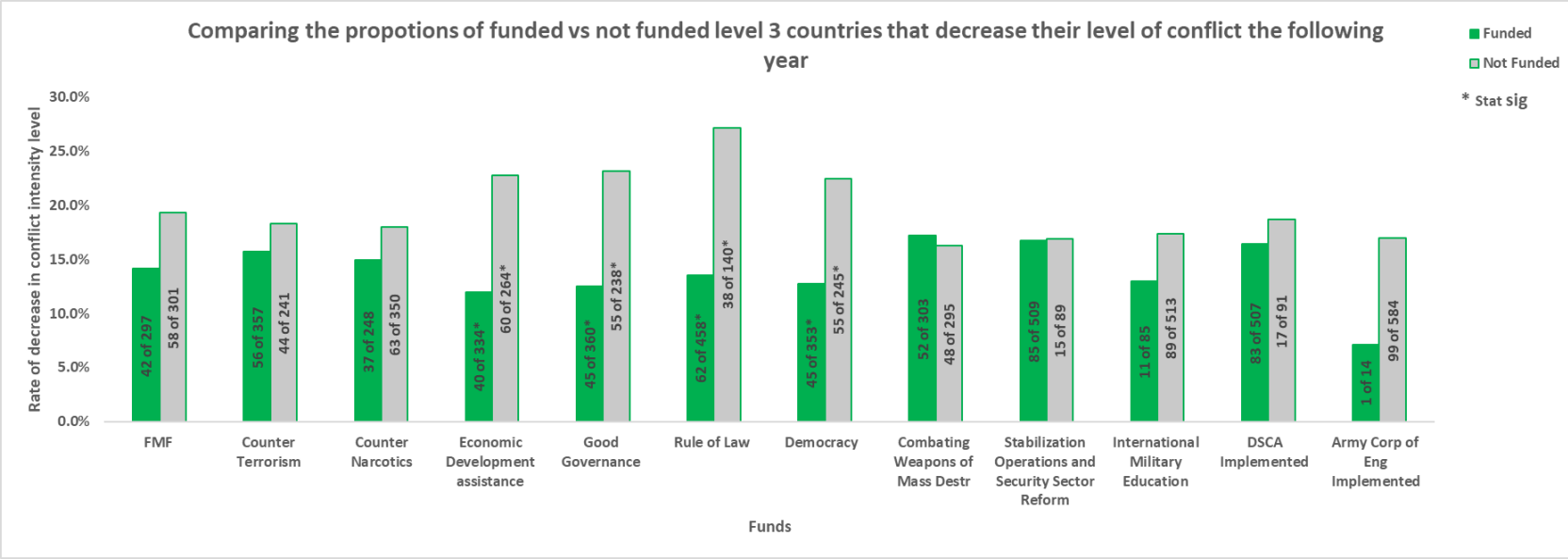


Figure 18: Funded level 3 countries decrease their level of conflict at a lower rate for most fund

The observations made for level 0 countries were similarly made for countries at the other levels of conflicts. Level 3 countries for example had a higher rate of decrease in conflict level for countries that were not funded for ten out of the twelve funds (Figure 18) (four of these differences are statistically significant). Funded level 3 countries that deescalated had a lower average amount of aid than all the other funded level 3 countries for eleven of the twelve funds (five statistically significant, Figure 19).

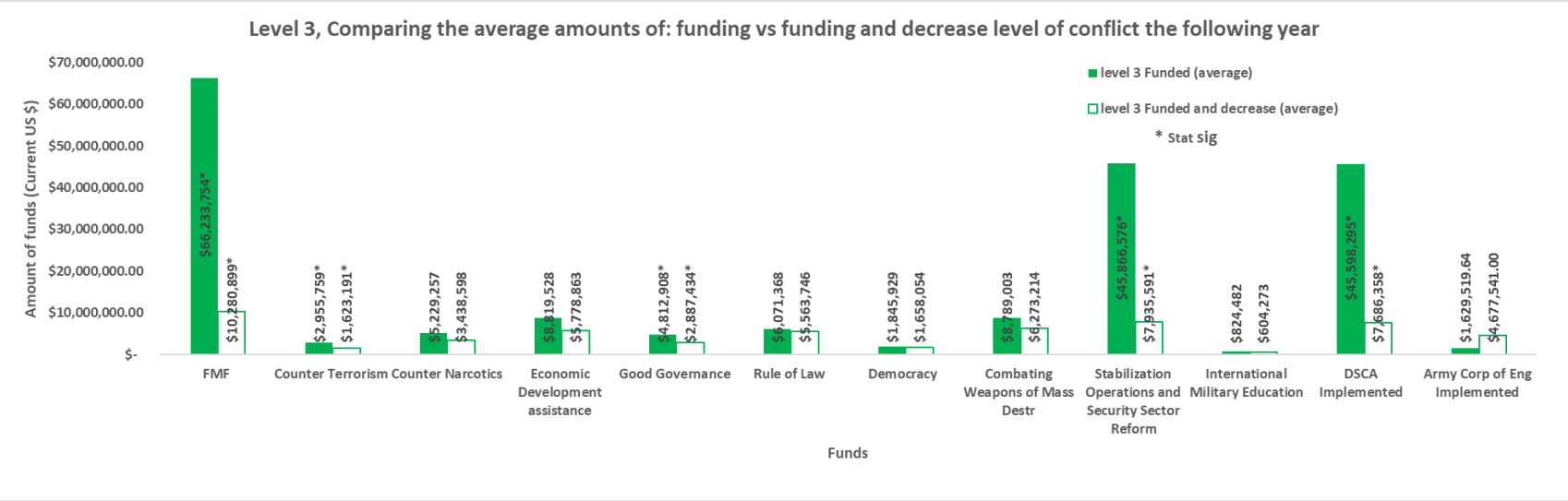


Figure 19: Funded level 3 countries that decrease in conflict intensity level receive in average less funds

We finally study the short-term global impact of the different funds. We attempt linear regressions that show a relationship between:

- The combination of the amounts all the different funds (input) and the number of countries at each conflict level the following year (output).
- The total amount of each fund (input) and the number of countries at each conflict level the following year (output).
- The amount of each fund, the current conflict level (inputs) and the year over year change in conflict level (output).
- The amount of each fund, the combination of principal components (inputs) and the year over year change (output).

None of the generated models were significant. A short-term linear relationship cannot be established between the amount of funding and the level of conflicts the next year.

Long-term (five years) cumulative Fund impact

We now investigate the five-years cumulative global impact of the funds. We test for linear relationships between the total funding during five years and the number countries at a specific level of conflict the year following the five years. Some funds showed a significant positive linear relationship with the number of countries free of conflict (level 0) and a negative linear relationship with the countries at war (level 5). Figure 20 displays the linear regression between the 5 years cumulative DSCA implemented funds and the number of level 5 countries the following year. The 95 percent confidence interval is highlighted in blue. From the graph, as the funds increase, the number of level 5 countries decreases. DSCA implemented funds have the opposite relationship with the number of level 0 countries.

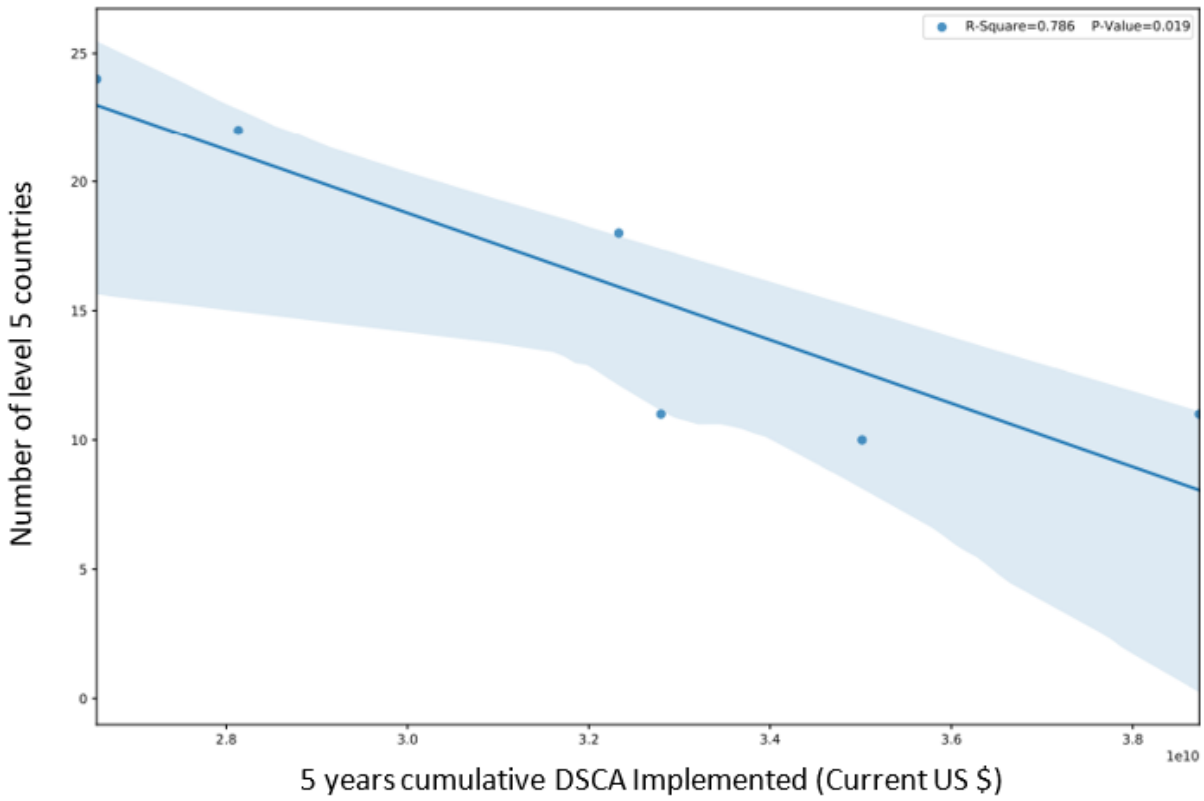


Figure 20: There is a negative correlation between the five years cumulative DSCA implemented funds and the number of countries at war globally the following year

Some funds on the other hand showed a significant negative linear relationship with the number of countries free of conflict (level 0) and a positive linear relationship with the countries at war (level 5). Figure 21 displays the linear regression between the 5 years cumulative funds allocated to Stabilization Operations and Security Sector Reforms and the number of level 5 countries the following year. The 95 percent confidence interval is highlighted in blue. From the graph, as the funds increase, the number of level 5 countries also increases. The funds have the opposite relationship with the number of level 0 countries. We made similar observations with the following funds: Good Governance, Rule of law, Democracy and Combatting Weapons of Mass destruction.

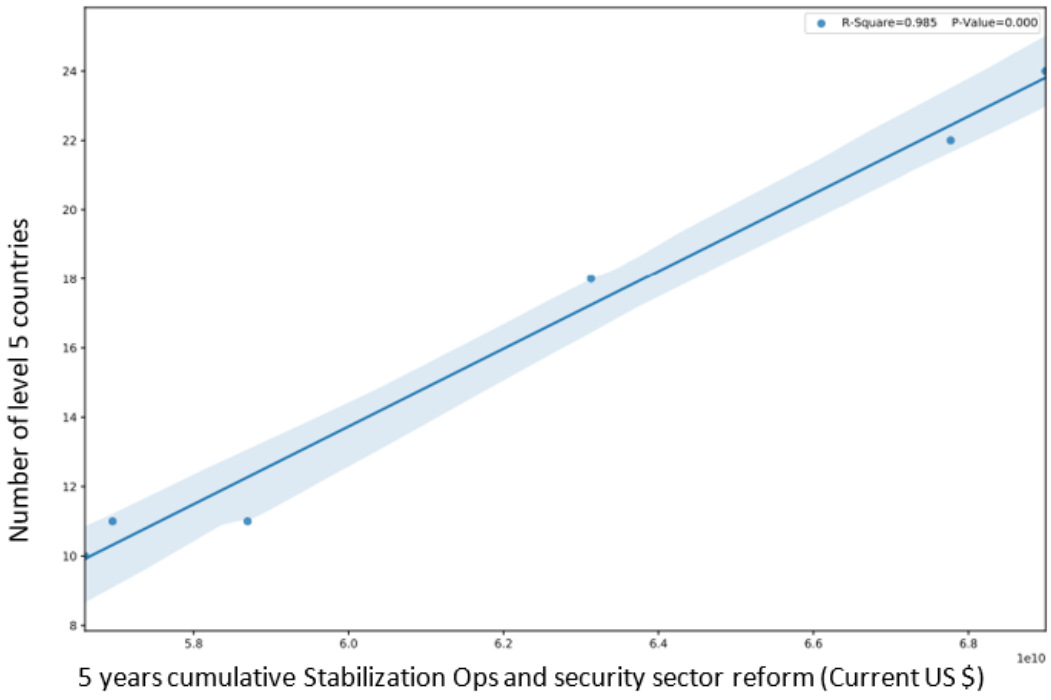


Figure 21:There is a positive correlation between the five years cumulative Stabilization Operations and security sector reform funds and the number of countries at war globally the following year

The previous test addressed the five years cumulative funds and the number level 0 and level 5 countries the following year. We now address the linear relationship between the five years cumulative funds and the total change in conflict intensity throughout the five years. Figure 22 displays the linear regression between the five years cumulative DSCA implemented funds and the total change in conflict intensity throughout the five years. The 95 percent confidence

interval is highlighted in blue. From the graph, as the funds increase, the total conflict intensity decreases.

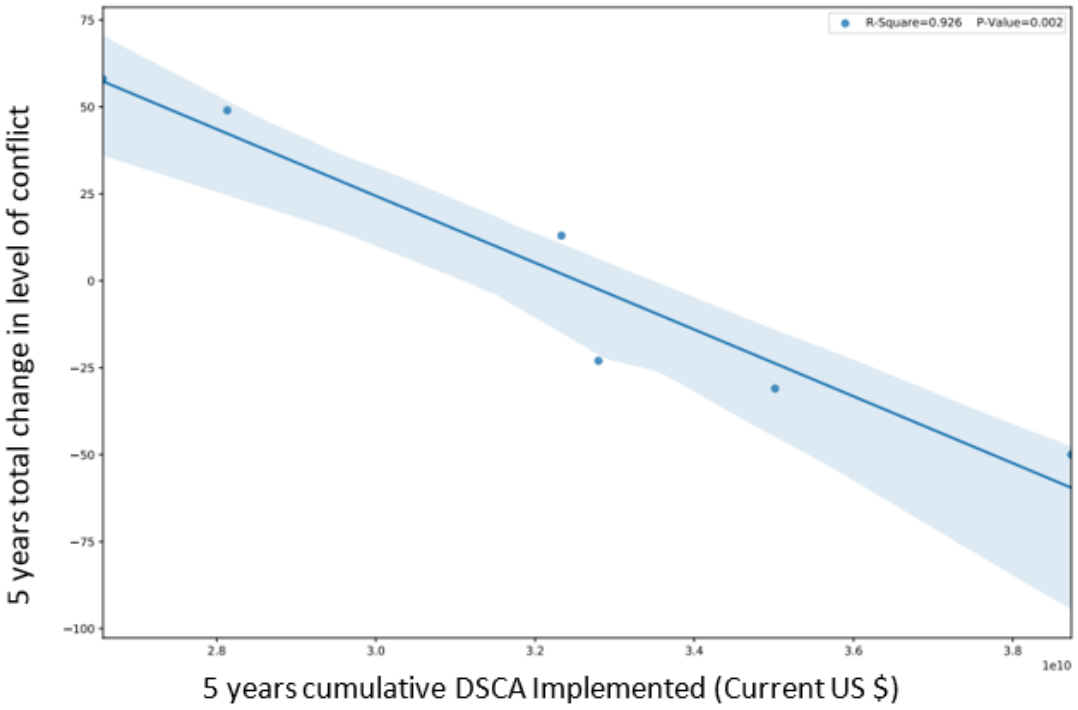


Figure 22: There is a negative correlation between the five years cumulative DSCA implemented funds and the 5 years total change in level of conflict

Other funds show a positive linear relationship between the five years cumulative funds and the total change in conflict intensity throughout the five years. Figure 23 for example displays that as the funds allocated to combat weapons of mass destruction increase, the total conflict intensity increases. We made similar observations with the following funds: Good Governance, Rule of law, Stabilization Operations and Security Sector Reforms.

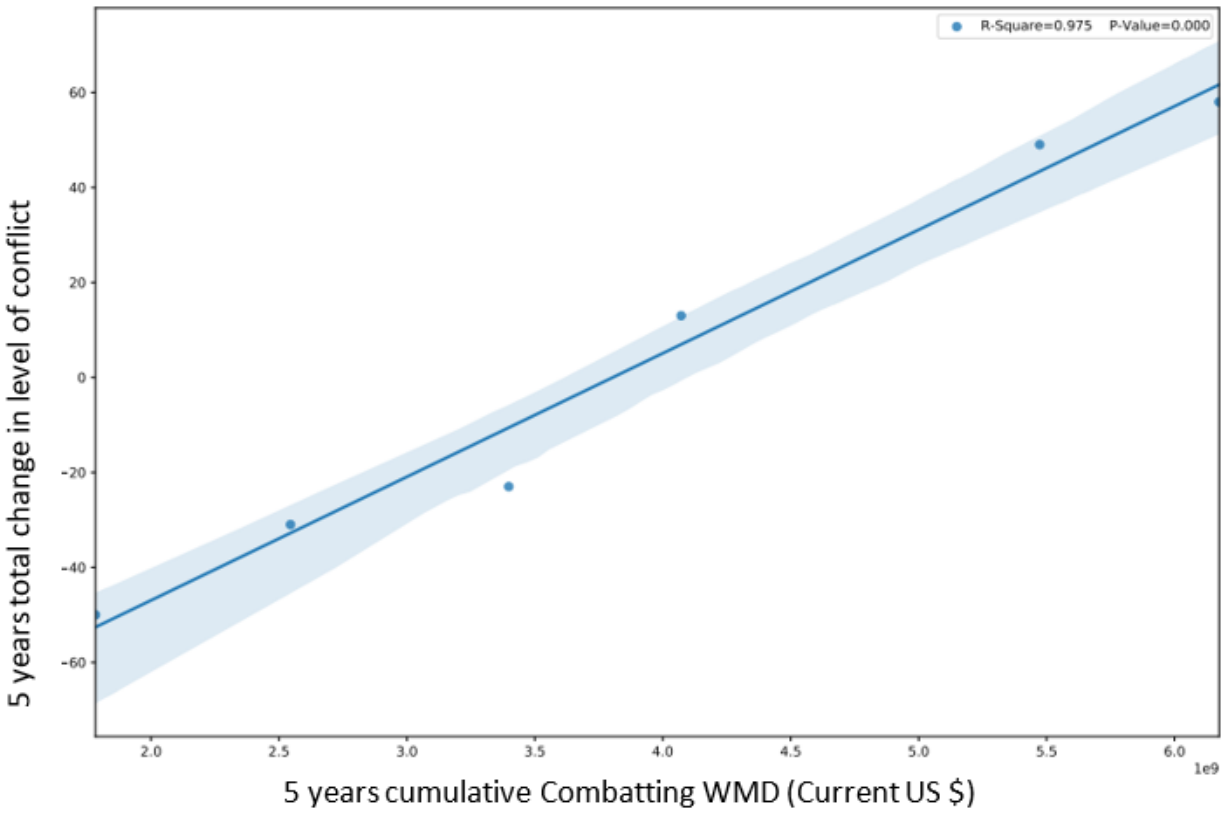


Figure 23: There is a positive correlation between the five years cumulative Combatting WMD funds and the 5 years total change in level of conflict

V. Conclusion

With this study, we aimed to produce a method of quantitatively evaluating U.S. foreign assistance activities. We use our method to evaluate U.S. foreign assistance activities' short- and long-term impact on local and global conflict prevention. We used stepwise regression to build a logistic regression model that predicts "Violent" or "non-Violent" conflicts. The generated logistic model has a validation data accuracy of 82%, the significant factors are:
The recipient country's population size, its GDP per capita and its Voice and accountability index. None of the funds were a significant factor in the studied model.

We then analyzed and compared the global distribution of funds based on whether or not a country was in a violent conflict and the funds impact on preventing or deescalating the violence. We observed that: FMF, stabilization operations and security sector reform and DSCA implemented funds accounted for most of the aid. Violent countries received statistically more funds than nonviolent countries. Nonviolent countries receiving funds were more likely to escalate into violence, while the violent countries recipients of funds were least likely to deescalate.

We transformed the three significant factors in the logistic model in two principal components accounting for 79% of the variance. Plotting the principal components versus: the current level of conflict, funds recipients, the amount of fund received and the level of violence the following year. We observed the following: countries on certain parts of the graphs were more likely to be currently in violent conflict, they were more likely to receive funding and more likely to remain in violent conflicts the following year. The distribution of funds per countries shows that only a few select countries get the bulk of funding (Israel, Egypt, Iraq for DSCA implemented funds).

We studied the funds short term impact at different conflict levels. Observations were similar throughout all the levels: countries were most likely to remain at a conflict level the following year regardless of the amount of fund. For the few countries that escalate or deescalate, funds either impacted negatively or did not have an impact. Level 0 countries recipient of funds escalated at a statistically higher rate than nonrecipient. Those countries also had a statistically higher average amount of funding than the all the funded level 0 countries.
Most countries that escalate received more funding, however it is possible that the funding was given to countries already prone to violence and the funds were not sufficient or timely to prevent the conflict's escalation.

We finally studied the funds five years global cumulative impact. The cumulative amount of five years DSCA implemented fund had a negative linear relationship with the number of countries at war (level 5) the following year and the total change in conflict intensity throughout the five years. This fund also had a positive linear relationship with the number of conflict free countries (level 0) the following year. Funds like: Stabilization Operations and Security Sector Reforms, Good Governance, Rule of law, Democracy and Combatting Weapons of Mass destruction showed the opposite effect.

It is important to remember that foreign assistance activities have varied and complex objectives. This study only presents a methodology to quantify their impact on a single objective. Results from this methodology should be regarded as an additional insight for decision makers and not as a "silver bullet"

Appendix A: Python Code for linear regressions

```
#Import the necessary libraries
import pandas as pd # to read and manipulate the dataframe
import seaborn as sns # to generate the regression plot
import matplotlib.pyplot as plt # to create graph
from statsmodels.stats.proportion import proportions_ztest
import matplotlib as mpl # to create graph
from scipy import stats# to generate regression values: slope p-value R-square
import statsmodels.api as sm # to generate regression values: slope p-value R-square
from matplotlib.backends.backend_pdf import PdfPages# to save graphs as pdf files


# read the data 5 years cumulative data
data=pd.read_excel('5 years Cumulative.xlsx')

# create the variable Levels for the different Levels and Activities for the different activities
Levels = [ 'Level 0', 'Level 1', 'Level 2', 'Level 3', 'Level 4',
       'Level 5', '5 Years Total change in levels of  Conflict']
Activities = ['FMF__current_US', 'CounterTerrorism__current_US',
       'CounterNarcotics_current_US',
       'Economic_Development_assistance__current_US',
       'GoodGovernance__current_US', 'RuleofLaw__current_US',
       'Democracy___current_US',
       'Combating_Weapons_of_Mass_Destr___current_US',
       'Stabilization_Operations_and_Security_Sector_Reform___current_US',
       'International_Military_Education___current_US',
       'DSCA_Implemented___current_US',
       'Army_Corp_of_Eng_Implemented___current_US']

#Save the regression graph in a pdf file
with PdfPages('5 Years Cumultive Regression.pdf') as pdf:
    #use a loop to make a linear regression between each activity and each level
    for l in Levels:
        for f in Activities:
            fig =plt.figure(figsize=(15,10))
            fund_total=data[f]
            count_level=data[l]
            slope, intercept, r_value, p_value, std_err = stats.linregress(fund_total, count_level)
            R2= r_value**2
            #make the regressions plot using the calculated values and display R-square and the p-value
            sns.regplot(fund_total, count_level,label="R-Square={0:.3f}    P-Value={1:.3f}".format( R2, p_value)).legend(loc="best")
            plt.ylabel('Number of '+l+ ' countries', fontsize=16)
            plt.xlabel("5 years cumulative "  +f+ " funding",fontsize=16)
            pdf.savefig(fig)

#create the regression summary ans save as an html file
with open('regression summary.html', 'w') as fh:
    from statsmodels.api import add_constant
    import statsmodels.api as sm
    for l in Levels:
            for f in Activities:
                X=data[f]
                y=data[l]
                X1 = add_constant(X)
                result = sm.OLS(y, X1).fit()
                fig=result.summary()
                print (result.summary())
                #print (result.rsquared, result.rsquared_adj)
                #pdf.savefig(fig)
                fh.write(result.summary().as_html())
```

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14. ABSTRACT
We aim to quantitatively assess foreign aid programs effectiveness at preventing/deescalating conflicts in the short (1 year) and long term (5 years). Using publicly available data, (2010 to 2020) we measure factors that predict a country's status the following year . We statistically compare 1 year deescalation/escalation rates based on the funds receive. we using linear regression to measure 5 years cumulative aid impact. All the aids show 1 year negative correlation with the deescalation rates. There are however cumulative 5 years positive and negative linear relationships between some funds and the global conflict levels. The method developed can also be applied to evaluate aid effectiveness at meeting other U.S. goals.

15. SUBJECT TERMS
Foreign assistance analysis, linear regression, Logistic regression

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