

# Modeling Violent Acts in the Philippines

LTC Jesus Durante, William P. Fox

*Department of Defense Analysis, Naval Postgraduate School, Monterey, CA 93943, USA*

**Abstract:** We want to try to find the possible root causes for the increasing violent acts by terrorist and insurgent factions inside the Philippines. We apply several modeling tools to assist in the analysis. We used hypothesis testing and Poisson regression to gain valuable insights into possible causes. Our analysis leads us to test violence in terms of significance violent acts and measure the violence acts increases and decreases as related to levels of poverty, illiteracy, government satisfaction, and ethnicity. We found that poverty levels, illiteracy, and government satisfaction are three main contributors to significant changes in the number of violent acts.

**Keywords:** Hypothesis tests, Poisson regressions, modeling terrorist violence.

## 1. Introduction

The security situation in some parts of the Philippines has been threatened by violence and armed confrontations that have been draining the country of its resources and hampering its development. Presently, the state is seeking to resolve internal security problems especially with the three groups, specifically, the communists, secessionists, and terrorists.

The Communist Party of the Philippines (CPP) and its military arm, the New People's Army (NPA), has launched an armed struggle against the government since 1968. The organization was strongest in the 80's and has since become a social movement, with an array of above-ground groups intertwined with an underground guerrilla arm [1]. Founded by Jose Maria Sison in the late 60's, the communist's ultimate aim is to overthrow the government through armed struggle and establish a politburo under the CPP. The Communists has been utilizing socio-economic and political issues to justify their cause and to entice the populace to sympathize and support the revolutionary movement. The CPP/NPA has organized and deployed their forces throughout the country. A number of

guerrilla fronts has been established in the countryside and remains as a potent threat to the government security forces.

Aside from the communist insurgents, the Muslim secessionist movement is likewise waging a revolutionary struggle with the vision of establishing an independent Bangsamoro state. In the early 70's, Muslim grievances and sentiments against discrimination, marginalization and abuse led to the creation of the Moro National Liberation Front (MNLF). Peace negotiations between the Philippine government and the MNLF led to the creation of the Autonomous Region for Muslim Mindanao (ARMM) and the integration of some of the MNLF fighters in the ranks of the police and the military. Despite the peaceful resolution, a more radical Islamist group emerged, the Moro Islamic Liberation Front (MILF). The MILF started as a reformist group in the MNLF, and it totally parted ways with the MNLF when the latter started negotiating with the government. Since the 90's the MILF has been figured in violent armed confrontation with the government.

The third security threat that the Philippine state is addressing is the Abu Sayyaf terrorist group. The Abu Sayyaf (bearer of the sword) is an Islamist separatist group founded by Ustadz Abdurajak Abubakar Janjalani in the early 1990's. Also known as

---

**Corresponding author:** William P. Fox, Ph.D., Professor, research fields: mathematical modeling, stochastic models, game theory, optimization. E-mail: [wfox@nps.edu](mailto:wfox@nps.edu).

Al-Harakatul al Islamiya (AHAI), the ASG aims to pursue “jihad qital”, an armed struggle, to create a pure Islamic state in southern Philippines based on Salafi Wahhabism [2]. The MNLF and the MILF were already in existence when the ASG was founded. Basilan and Sulu province, where the ASG operates, is mainly influenced by the MNLF. However, several MNLF leaders, who felt sidelined or disagreed with Nur Misuari consequently joined Janjalani. The group has been suspected of having a direct link to Al Qaeda. The ASG has perpetrated several terrorist acts that include bombing, kidnapping, assassination and murder. Most of their attacks were directed at Christian churches, missionaries and non-Muslim communities. The ASG has been tagged as a terrorist by the Philippines and the United States.

Insurgency and conflict in the Philippines have withstood the test of time, despite the government’s effort in resolving them. The Philippine government has tried to resolve conflict in different ways. Counter-insurgency and counter-terrorist campaigns have been waged against communist insurgents, secessionists and terrorists. For the communist and secessionists, the government has been trying to resolve conflict through peace negotiations. For the terrorists, full police and military operations are being conducted to eliminate the ASG. However, despite several decades of government action, all of the threats still exist.

The purpose of this research is to identify and explain the determinants of armed conflict, (e.g., insurgency and terrorism) in the Philippines. Understanding the possible causal factors of conflict could lead to a better comprehension and insights on its resolution.

Four factors identified to be possible variables will be examined: ethnicity; poverty; good governance; and literacy. For example, literature on the social causes of conflict is explored such as the theory on relative deprivation, theory on political legitimacy, and theory on political control. Data on the variation of ethnicity

per province is analyzed to determine its causal relationship with conflict. In terms of poverty, data establishing the relationship of poverty and conflict are reviewed, specifically reports and research from the Chronic Poverty Research Center and Philippine Human Development Report. Studies on the role and significance of governance during conflict are also examined for the purpose of establishing the role of governance in the resolution or aggravation of conflict. And finally, previous research on the correlation of literacy in areas of conflict is analyzed to investigate its effects and influence on armed violence.

## 2. Background

Armed conflicts are defined as open, armed clashes between two or more centrally organized parties, with continuity between the clashes, in disputes about power over government and territory. The cause of armed conflict varies from a place to another. Several explanations have been made on the cause of disputes. However, poor economic conditions are the most important long-term causes of intrastate armed conflict. This is due to the frustration and the sense of deprivation which permeates in the populace. Hard line political systems are also prone to armed struggle [3]. Repression of civil rights and physical abuse would make the populace loathing and hostile to the government. Ethnic diversity alone is not a cause of armed conflict, but parties to a conflict are often defined by their ethnic identities [4]. However, it may aggravate conflict and cause the escalation of violence.

### 2.1 Political Control

In any type of social environment, it is paramount that the state asserts its legitimacy to the society in order to maintain order and security. A calibrated level of authority or political control is essential to attain socio-political stability [5-6]. Such effort is imperative for the state to establish a peaceful and secure environment conducive to national development.

McCormick [7-8] asserts that there is a relationship between political control and social equilibrium such that as the equilibrium shifts towards disequilibrium, natural political control weakens. This requires government implementation of artificial controls to compensate for loss of natural political control to stave off opportunity for insurgency.

Based on Figure 1, the state requires a viable degree of political control in order to manage the social

equilibrium. A declining political control would eventually lead to a failed state wherein insurgents can expand their influence and operations up to the point where the state would cease to function. The viable area for state and insurgents is the arena where both entities would clash for control of power and resources. The state's ultimate goal is to achieve the break point where it would have the utmost control of the society leaving no room of maneuver for the insurgents.

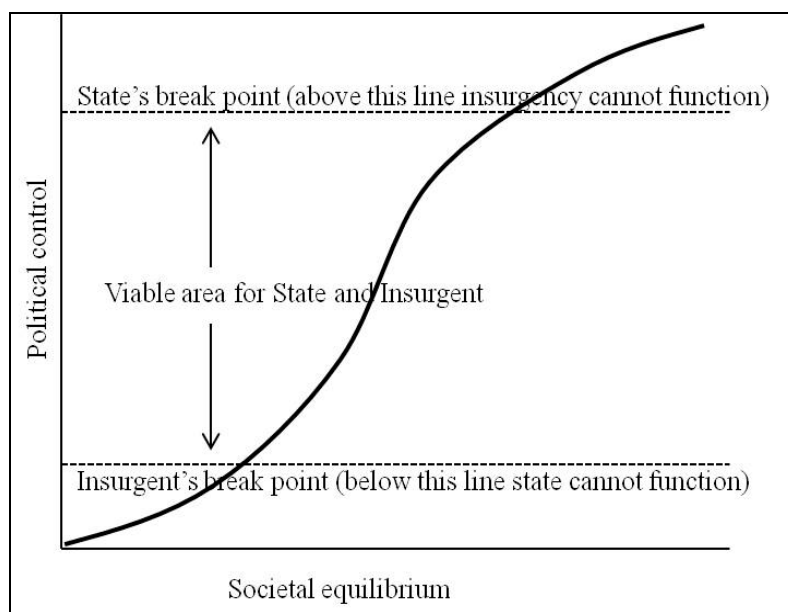


Fig. 1 Political control and societal equilibrium model from McCormick [7-8].

2.2 Determinants of Conflict

In the National Unification Commission (NUC) Report to President Fidel V. Ramos in 1993, the result of nationwide consultation identified the root causes of Philippine internal armed conflicts as follows [9]:

- (1) Massive and abject poverty and economic inequity, particularly in the distribution of wealth and control over the resource base for livelihood;
- (2) Poor governance, including lack of basic social services, absenteeism of elected local officials, corruption and inefficiency in government bureaucracy, and poor implementation of laws, including those that should protect the environment;

(3) Injustice, abuse of those in authority and power, violations of human rights, and inequity, corruption and delays in the administration of justice;

(4) Structural inequities in the political system, including control by an elite minority, traditional politicians and political dynasties, and enforcement of such control through private armies;

(5) Exploitation and marginalization of indigenous cultural communities, including lack of respect and recognition of ancestral domain and indigenous legal and political systems.

Other causes were ideological differences between conflicting parties; perceived foreign and

intervention in domestic affairs; and degeneration of moral values. It likewise includes among others the destruction of the natural environment; the conduct of the counter-insurgency campaign; and the continuing hardships of communities trapped in the armed conflict [10].

A study applying multivariate statistical techniques to draw up a vulnerability index of the country's 75 provinces to CPP-NPA insurgency, the main components, in effect factors or causes for the insurgency includes endemic poverty, educational deprivation, ill health, social injustice, and socio-economic deprivation, and geographic isolation [11].

### *2.3. Social Instability—Heterogeneous Society*

It has been argued by some analysts that conflicts of the future will occur along cultural fault lines separating civilizations from one another [12]. Civilizations have their own distinct history, language, culture, tradition and religion. Difference in views and beliefs may lead to misunderstanding and disagreement between groups. Moreover, the entitlements granted to a certain group may be viewed as unfair and bias. Such frustrations could lead to aggression and violence. Countries such as the former Yugoslavia and Rwanda have experienced violent armed clashes between warring ethnic groups that showed criminals, insurgents, and military are involved in violent acts [10].

Every nation has its own distinct social environment. The more heterogeneous the society is, the more likely that potential social fault lines could fracture [11]. In a heterogeneous society such as the Philippines, it has been asserted that struggle among classes is most likely due to societal differences. In a homogenous society, lesser struggle is expected among the social classes due to common language, norms and beliefs. A heterogeneous society may enhance understanding of the other's perspective thus increasing the level of perceived freedom. Normative theorists and empirical

researchers assert that heterogeneity may contribute to effective democracy by broadening the range of collective problem solving [10]. Nonetheless, it would still depend on the capability of the system of governance: its ability to mitigate inter-ethnic conflict, and its ability to enable the peaceful management and eventual resolution of inter-ethnic conflict [13].

## **3. Data**

The research utilizes primarily empirical data. The in-country variation within the Philippines enables testing key variables that are thought to be related to armed conflict. Quantitative data on ethnicity, poverty, literacy and good governance have been obtained mainly from the National Statistics Office and the National Statistics Coordination Board of the Philippines. Data on insurgency and terrorism related activities have been extracted from the archives of the Armed Forces of the Philippines and the Core Lab of the Naval Postgraduate School. The datasets used were based on its availability for assessment periods made by NSCB and NSO varies in each variable. For example, poverty incidence is measured every three years. As such, selected years for poverty are 2003 and 2006. For good governance available data are for the years 2005 and 2008. For literacy, available data is for 2003 and 2008.

Several studies have been conducted based on qualitative data to analyze and assess the determinants of conflict in the Philippines. However, studies have not been done to compare conflict and its possible causes though geospatial analysis and descriptive statistics specifically on the variables ethnicity, poverty, literacy and governance.

## **4. Methodology**

### *4.1 Statistical Analysis*

Quantitative facts and information were gathered to test and analyze the hypothesis. Descriptive statistics is

the principal analytical tool to be used to infer relationships between the independent and dependent variables. The value of the dependent variable of conflict shall be observed and analyzed as values of the independent variables vary.

Initially, a quantitative approach with a non-experimental correlational research design was used to determine whether there were relationships between the variables under study. Secondly, we will look for statistically significant differences between variables. Statistical analysis on the data was made in two steps. For the first step, scatter plots of the data were projected with the linear regression equation line showing the slopes and correlations of the plot. The correlation of variables could be visually observed through the linear trend of the scatter plot but we need its value. For correlation values,  $\rho$ , between -1 and 1, we will use the following to make our analysis of the relationships of our variables. If  $|\rho| > 0.8$  there is a strong linear relationship,  $0.5 < |\rho| < 0.8$  there is a moderate linear relations and  $|\rho| < 0.5$  there is a weak linear relationship. For the second step, each dataset were separated in two groups somewhat arbitrarily. The mean and standard deviation of each group were then determined. Since the intent is to compare the means and sample  $n$  is large, the Central Limit Theorem allows the Z-test in hypothesis testing. Test statistics to compare the groups were calculated using the following formula:

$$z = \frac{\bar{x} - \bar{y}}{\sqrt{\left(\frac{\sigma_x^2}{m}\right) + \left(\frac{\sigma_y^2}{n}\right)}}$$

where

$\bar{x} =$	mean of x
$\bar{y} =$	mean of y
$\sigma_x^2 =$	sample variance of x

$\sigma_y^2 =$	sample variance of y
$m =$	nr of samples of x
$n =$	nr of samples of y

Upon determining the value of  $z$ , it would then be subjected to a one-tailed test to establish the validity of the null hypotheses.

In partitioning the data, several trials were made to validate if there would be changes in the value of  $z$ . Changes in the value of  $z$  might yield conflicting results when subjected to a one-tailed test. The partition that yields statistically significant results, was the one chosen to represent the partitioned data. The separation was made based on the variables' effect to be statistically significant if the probability (p-value) that it could have occurred by random chance falls below a particular threshold which is usually 0.05. If the  $p$ -value of the variable's coefficient falls below 0.05 ( $p < 0.05$ ), then the probability that the result could occur by random chance is less than 5%. The partitioned data with the p-value of less than 0.05 was selected to be processed and analyzed.

Data on the levels of poverty, good governance, and literacy were extracted from the archives of NSCB and plotted directly with the Sigacts. However, for ethnic diversity, ethnic groups per province were recorded and measured through the index of ethno-linguistic fractionalization (ELF). Considering a society composed of  $K \geq 2$  different ethnic groups, and letting  $P_k$  indicate the share of group  $k$  in the total population, the value of the ELF index [13] is given by

$$1 - \sum_{k=1}^k P_k^2$$

The ELF index is known to be simple to compute for all that it needs is the vector of shares of the various groups in the population. Moreover, the ELF measures

the probability that two randomly drawn individuals from the population belong to different ethnic groups.

#### 4.2 Hypothesis Testing

A number of assertions have been made on the relationships of conflict with the other variables. Is conflict caused by poverty, and lack of good governance, clash of civilizations due to societal and ethnical differences, and the lack of literacy? For this thesis four independent variables shall be considered: ethnicity, poverty, literacy, and governance. They give rise to the following hypotheses.

Hypothesis 1: Areas with a high level of ethnic diversity are likely to support insurgent groups and show high levels of armed conflict.

A heterogeneous environment has been asserted to have an effect on the political and social stability of the state. The more diverse the society, such as ethnicity and language, the more it is prone to conflict. Ethnic diversity is measured through the index of ethno-linguistic factionalization (ELF). As ethnic diversity increase conflict also increase.

Hypothesis 2: Areas with high levels of poverty are likely to support insurgent groups and show high levels of armed conflict.

Poverty has always been related to conflict and violence. In the Philippines, poverty stricken provinces are known to have active insurgent activities. Insurgent groups tend to exploit the populace with a promise of a better system for the betterment of the society. For this thesis, poverty shall be compared with the number of violent incidents and determine its correlation. Statistical data as presented by the NSCB shall be mainly used. The poverty statistics consist of the food and poverty thresholds, the subsistence and poverty incidence, the income gap, the poverty gap, and the severity of poverty index. The estimates of subsistence and poverty incidence are expressed in terms of proportion of families and of the population.

Hypothesis 3: Areas with a perception of weak governance are likely to support insurgent groups and show high levels of armed conflict.

The polity is mandated to govern the state. It has been vested of powers to protect the state and provide services to the people. Failure to deliver basic services (specifically social opportunities, security, justice, law and order) leads to the negative perception of the populace towards the state. For this thesis, governance shall be analyzed and compared with the status of insurgency. It shall be determined through the quantified good governance index and its effect on the levels of conflict.

This research shall utilize the NSCB measure of good governance and its component indices through the following dimensions: (a) sustainable management of resources through generation of adequate financial resources and responsiveness to/alleviation of poverty; (b) rule of law through improvement of internal and external security, law enforcement and administration of justice; (c) efficiency of the delivery of services on health, education, and power supply; and (d) people's empowerment and participation.

Hypothesis 4: Areas with low levels of literacy are likely to support insurgent groups and show high levels of armed conflict.

Every person has the right to be literate. It is a means for development enabling access to opportunities and to participate in society in new ways. In conflict, the illiterates are claimed to be vulnerable to recruitment and exploitation by armed groups. For this thesis, literacy shall be analyzed with the varying degree of conflict in the Philippines. The data provided by the National Statistics Coordination Board of the Philippines and the National Statistics Office shall be utilized to assess the comparative effect of literacy with armed conflict.

### 5. Poisson Regression

In statistical modeling and within our modeling context, Poisson regression [14] is a form of regression analysis that should be utilized to model count data that follow a Poisson distribution. Poisson regression assumes the response variable Y has a Poisson distribution, and assumes the logarithm of its expected value can be modeled by a linear combination of unknown parameters. A Poisson regression model is sometimes known as a log-linear model. In our analysis, we will examine the dependent variable, Sigacts, and perform a Poisson goodness of fit test. After showing the dependent variables is Poisson we build the Poisson regression model and examine both the coefficient and odds-ratios to gain insights into the model. We use the model form and software developed for class work [14].

### 6 Modeling Results and Analysis

#### 6.1 Ethnic Diversity-Statistical Analysis

To determine any relationships between conflict and ethnic diversity, the data was divided into two samples based from the lowest to the highest ethnic diversity score. Descriptive statistics shows that the group with higher ethnic diversity has a mean of 0.6607 and a median of 0.6732, while the number of violence activities, called Sigacts, has a mean of 23.22 and a median of 9.

In applying inferential statistics, ethnicity data for 2003 was partitioned into two groups: one group with an ethnic diversity score of less than 0.49, and the second group with more than 0.49. The hypotheses for a two-sample group to compare means of the two groups were formulated as follows:

$$H_o : \mu_1 - \mu_2 = 0$$

$$H_a : \mu_1 < \mu_2$$

The null hypotheses (Ho) would state that both groups would have the same number of Sigacts with  $\mu_1$  being the group with lower ethnic diversity. Meanwhile,

the alternate hypotheses would state that the group with higher ethnic diversity has higher number of Sigacts. Descriptive statistics reveals for our two groups are displayed in the following values

$\bar{x} =$	10.33333333	mean of x
$\bar{y} =$	23.2195122	mean of y
$\sigma_x^2 =$	178.0175439	sample variance of x
$\sigma_y^2 =$	2244.72561	sample variance of y
$m =$	39	nr of samples of x
$n =$	41	nr of samples of y

Test statistics shows that the value of  $z = -1.673$ . For a one-tailed test at 5% significance level the value of z reveals that it is within the rejection region.

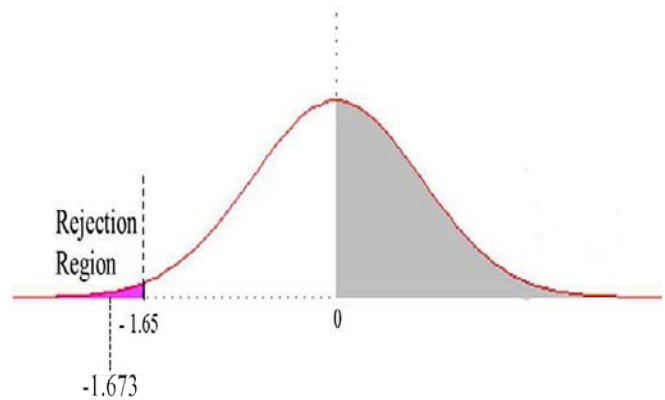


Fig. 2 One-tailed test for ethnic diversity and Sigacts 2003.

As shown in Figure 2,  $-1.673 < -1.65$  falls within the rejection region ( $p = 0.0479$ ), the null hypothesis is rejected and therefore conclude that the mean for sample 2 is greater than the mean of sample 1 at  $\alpha = 0.05$ . As such, it is asserted that for 2003 as ethnic diversity increase Sigacts also increase.

6.2 Poverty-Statistical Analysis

Poverty is one of a number of factors that may contribute to violent conflict. It has been asserted that poverty is one of the main causes of insurgency. To analyze conflict and poverty in the Philippines, datasets on poverty and significant acts (Sigacts) were projected in a scatter plot. For 2003, 1,355 violent incidents were recorded ranging from armed clashes, assassination, murder, kidnapping, arson, ambush, raid, bombing, shooting and harassments. Descriptive statistics shows that poverty has a mean of 31.77 and a median of 33.5, while Sigacts have a mean of 16.7 and a median of 8.

For inferential statistics, poverty index data for 2006 was again partitioned into two groups. One group with a poverty index score of less than 37, and the second group with more than 37 (see Appendix E). The hypotheses were formulated as follows:

$$H_o : u1 - u2 = 0$$

$$H_a : u2 > u1$$

The null hypotheses ( $H_0$ ) would state that both groups of that of the partitioned poverty index would have the same number of Sigacts. Meanwhile, the alternate hypotheses would state that the group with higher rate of poverty has higher number of Sigacts. Descriptive statistics reveals the following values,

$\bar{x} =$	9.5	mean of x
$\bar{y} =$	17.34146341	mean of y
$\sigma_x^2 =$	115.7435897	sample variance of x
$\sigma_y^2 =$	338.8804878	sample variance of y
$m =$	40	nr of samples of x

$n =$	41	nr of samples of y
-------	----	--------------------

Test statistics shows that the value of  $z = 2.35$ . For a one-tailed test at 5% significance level the value of  $z$  reveals that it is within the rejection region.

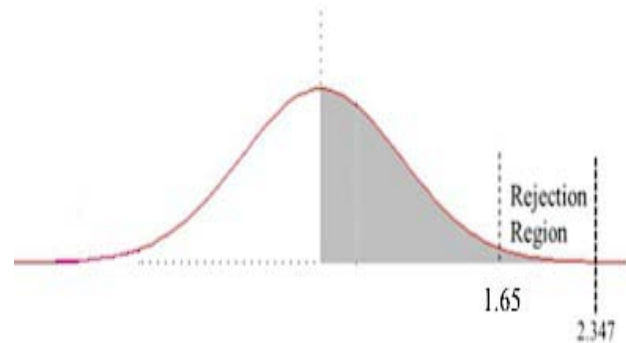


Fig. 3 One-tailed test of poverty and Sigacts 2006.

From Figure 3, since  $2.347 > 1.65$  and is within the rejection region, the null hypothesis is rejected and therefore conclude that the mean for sample 2 is greater than the mean sample 1 at  $\alpha = 0.05$ . As such, it is asserted that as poverty increases then number of Sigacts also increases.

6.3 Good Governance-Statistical Analysis

In analyzing through inferential statistics, GGI for 2005 was partitioned into two groups. One group with an index of less than 112 and the second group equal or higher than 112. The hypotheses were formulated as follows:

$$H_o : u1 - u2 = 0$$

$$H_a : u1 < u2$$

The null hypotheses ( $H_0$ ) would state that both groups of the partitioned GGI would have the same number of Sigacts with  $u1$  being the group with a higher GGI score. Meanwhile, the alternate hypotheses would state that the group with lower GGI score would have



higher number of Sigacts. Descriptive statistics reveals the following values:

$\bar{x} =$	6.56097561	mean of x
$\bar{y} =$	18.56410256	mean of y
$\sigma_x^2 =$	61.65243902	sample variance of x
$\sigma_y^2 =$	319.831309	sample variance of y
$m =$	41	nr of samples of x
$n =$	39	nr of samples of y

Test statistics shows that the value of  $z = -3.85$ . For a one-tailed test at 5% significance level, the value of  $z$  shows that it is within the rejection region.

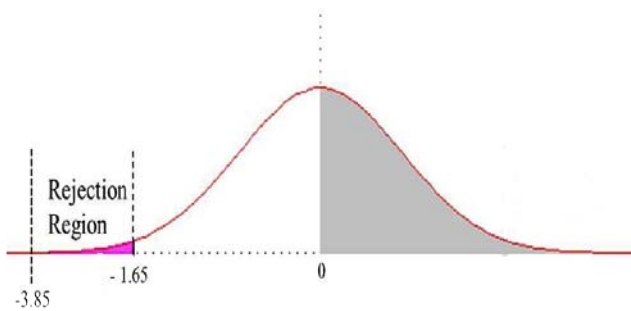


Fig. 4 One-tailed test of GGI and Sigacts 2005.

From Figure 4, since  $-3.85 < -1.65$  and is within the rejection region, the null hypothesis is rejected and therefore conclude that the mean for sample 2 is greater than sample 1 at  $\alpha = 0.05$ . As such, it is asserted that Sigacts decrease as GGI increase.

For inferential statistics, GGI data for 2008 was divided into two groups. One group with a GGI score of less than 120, and the second group with more than 120. The hypotheses were formulated as follows:

$$H_o : u1 - u2 = 0$$

$$H_a : u1 < u2$$

The null hypotheses ( $H_o$ ) would state that both groups would have the same number of Sigacts. Meanwhile, the alternate hypotheses would state that the group with a higher GGI score would have lower number of Sigacts. Descriptive statistics shows the following calculated values:

$\bar{x} =$	10.85365854	mean of x
$\bar{y} =$	22.79487179	mean of y
$\sigma_x^2 =$	512.7280488	sample variance of x
$\sigma_y^2 =$	861.5883941	sample variance of y
$m =$	41	nr of samples of x
$n =$	39	nr of samples of y

Test statistics illustrates that the value of  $z$  is  $-2.03$ . For a one-tailed test at 5% significance level the value of  $z$  reveals that it is within the rejection region.

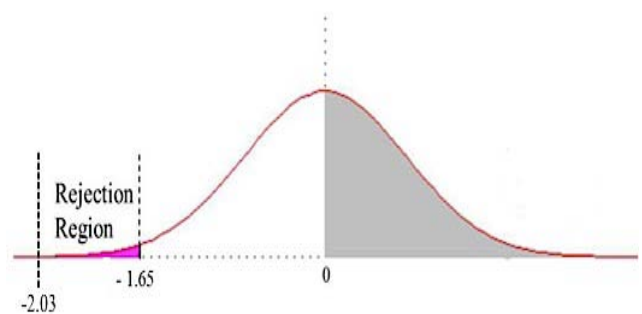


Fig. 5 One-tailed test of GGI and Sigacts 2008.

Figure 5 shows  $-2.03 < -1.65$  and is within the rejection region, the null hypothesis is rejected and therefore conclude that the mean for sample 2 is greater

than sample 1 at  $\alpha=0.05$ .As such, it is asserted that Sigacts decrease as GGI increase.

6.4 Literacy-Statistical Analysis

The data was divided into two groups based from the lowest to the highest functional literacy index score: one group with a score of less than 82, and the second group with a score more than 82. Descriptive statistics shows that the group with higher literacy index has a mean of 86.15 and a median of 85.4, while Sigacts have a mean of 7.82 and a median of 6.

The hypothesis was formulated as follows:

$$H_o : u1 - u2 = 0$$

$$H_a : u1 < u2$$

The null hypotheses (Ho) would state that both groups would have the same number of Sigacts with  $u1$  being the group with lower functional literacy index. Meanwhile, the alternate hypotheses would state that the group with higher ethnic diversity has higher number of Sigacts. Descriptive statistics reveals the following values:

$\bar{x} =$	7.815789474	mean of x
$\bar{y} =$	24.60465116	mean of y
$\sigma_x^2 =$	130.0462304	sample variance of x
$\sigma_y^2 =$	2134.72093	sample variance of y
$m =$	38	nr of samples of x
$n =$	43	nr of samples of y

Test statistics shows that the value of  $z = -2.305$ . For a one-tailed test at 5% significance level the value of  $z$  shows that it is within the rejection region.

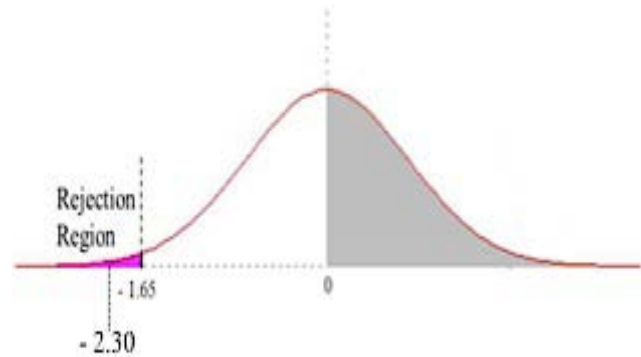


Fig. 6 One-tailed test of literacy and Sigacts 2003.

Figure 6 shows  $-2.30 < -1.65$  and is within the rejection region, the null hypothesis is rejected and therefore conclude that the mean for sample 2 is greater than the mean of sample 1 at  $\alpha = 0.05$ .As such, it is asserted that for 2003 as functional literacy increase Sigacts decrease.

For inferential statistics, functional data for 2008 was again partitioned into two groups; one group with a functional literacy score of less than 85, and the second group with more than 85. The hypotheses test was formulated as follows:

$$H_o : u1 - u2 = 0$$

$$H_a : u1 < u2$$

The null hypotheses (Ho) would state that both groups would have the same number of Sigacts. Meanwhile, the alternate hypotheses would state that the group with higher functional literacy index score would have lesser number of Sigacts. Descriptive statistics reveals the following values:

$\bar{x} =$	7.595238095	mean of x
$\bar{y} =$	26.05128205	mean of y
$\sigma_x^2 =$	138.0516841	sample variance of x
$\sigma_y^2 =$	1152.470985	sample variance of y
$m =$	42	nr of samples of x
$n =$	39	nr of samples of y

Test statistics shows that the value of  $z = -3.22$ . For a one-tailed test at 5% significance level the value of  $z$  shows that it is within the accepted region.

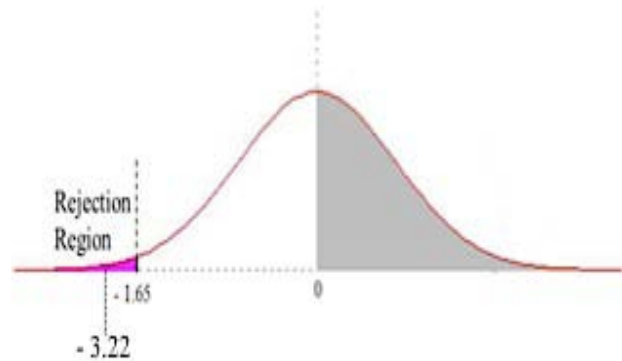


Fig. 7 One-tailed Test of Literacy and Sigacts 2008.

We see in Figure 7 that since  $-3.22 < -1.65$  and is within the rejection region, the null hypothesis is rejected and therefore conclude that the mean for sample 2 is greater than the mean of sample 1 at  $\alpha = 0.05$ . As such, it is asserted that for 2008 as functional literacy increase Sigacts decrease. A summary of the hypothesis tests is provided in Table 1.

Table 1 Hypothesis test summary.

Test	P-value	Significant ( $\alpha = 0.05$ )	Significant ( $\alpha = 0.01$ )
Violence vs Ethnicity, 2003	0.04719	Yes	No
Violence vs Ethnicity, 2005	0.42701	No	No
Violence vs Poverty, 2003	0.1169	No	No
Violence vs Poverty, 2005	0.00965	Yes	Yes
Violence vs. Governance, 2008	0.0147	Yes	No
Violence vs. Governance, 2005	0.0000	Yes	Yes
Violence vs. Literacy, 2003	0.01061	Yes	No
Violence vs. Literacy, 2008	0.0064	Yes	Yes

### 7. Poisson Regression

Since the number of violence acts, SIGACTS, are counts. We examine the histogram in figure 8 noticing it appears to follow a Poisson distribution. A goodness of fit test for the Poisson distribution confirms it follows a Poisson distribution ( $\chi^2 = 933.11, p = 0.000$ ).

A Poisson regression was run yielding the model:

$$y = \exp(7.828 - 0.034x_1 - 0.01799x_2 + 0.00400x_3)$$

where

$y$  = Counts of violent activities;

$x_1$  = Government satisfaction level;

$x_2$  = Literacy level;

$x_3$  = Poverty level.

The regression output is displayed below Figure 8.

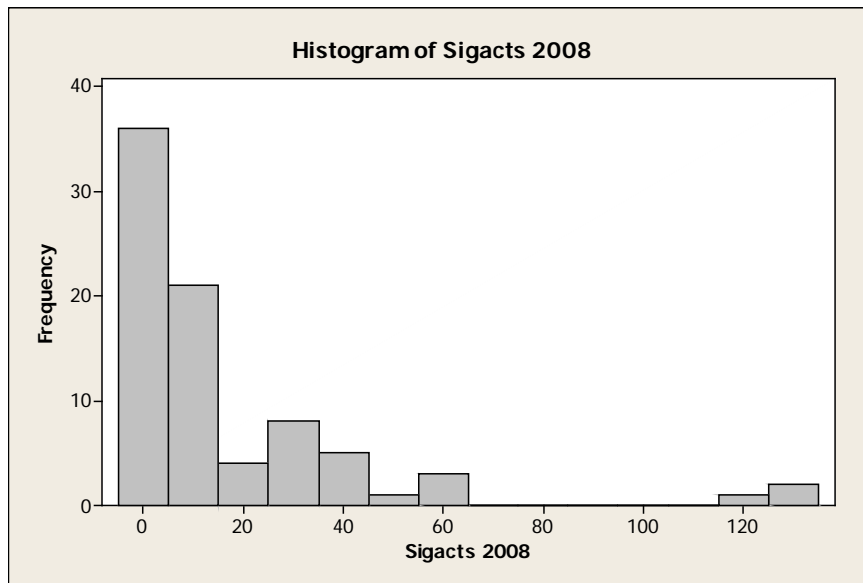


Fig. 8 Histogram of SIGACTS 2008.

Table 1					
Coefficients	Estimates	se	t*	P-Value	
bo	7.8281417	0.535	14.63204056	0.002319158	
b1	-0.0341572	0.002	-17.07862043	0.001705446	
b2	-0.0179907	0.006	-2.998447403	0.047775567	
b3	0.00400015	0.003	1.333383431	0.156996007	
Table 2					
	df	Deviance	Mean Dev	Ratio	
Regression	3	2214.064499	738.0214997	738.02	
Residual	77	169.8891451	2.206352534		
Total	80	2383.953644	29.79942055		

We interpret the odds ratio for the coefficients to help explain our case.

(1)  $\text{Exp}(-0.0342) = 0.96647$ . This means for 1 more value of Government Satisfaction that Violence goes down slightly about 3.4%.

(2)  $\text{Exp}(-0.01799) = 0.9812$ . This means for every 1 unit increase in literacy that Violence goes down slightly, 1.2%.

(3)  $\text{Exp}(0.004) = 1.004$ . This means that as Poverty increases Violence increases slightly, 0.400%.

## 8. Conclusion

Based on the findings of this research poverty, good governance and literacy are the ones that are most strongly related to violent conflict in the Philippines. For governance, the poor delivery of basic social services, corruption and inefficiency in the bureaucracy, and poor implementation of laws instigates frustration that could eventually lead to aggression. A calibrated level of authority or political control is required to attain social and political stability. For literacy, the findings correspond to the claim that conflict and aggression is influenced by literacy.

Consistency in quantitative analysis among separate datasets indicates that good governance and literacy may be causal factors of conflict. Although the presence of correlations or relationship is present with the variables this does not necessarily prove a causal link. Conflict is rarely caused by a single factor. It is usually caused by the interplay of long-term structural conditions with short-term proximate issues.

Insurgency has been an enduring problem in the Philippines. The government's Whole of the Nation Approach should be appropriately implemented with the full cooperation of the stakeholders. Insurgency is mainly driven by structural problems in the Philippine society that is beyond the scope of the military [15-16]. The local governments units should take the lead in resolving the conflict with the military and police as

support. The military and police should only handle security concerns while the local government units address the socio-economic factors of the conflict.

Among the variables, good governance is considered to be the primordial factor in the resolution of conflict. Failure in governance can lead to the escalation of conflict that could further result in the breakdown in delivery of critical political goods such as security, rule of law and social services. Good governance would eventually have a causal effect that leads to the eradication of poverty through the creation of jobs and improved social benefits; enhancement of literacy through the establishment of an efficient education program; and recognition and appreciation of ethnic diversity through formulation and implementation of laws that would protect culture, identity and ancestral domain of ethnic groups.

This research was mainly dependent on the availability of data from the NSO and NSCB. Census is not being conducted annually and is mostly limited to the regional or provincial level. More significant analysis would have been made with the availability of an annual census data down to the municipal level. Also, further research is recommended to determine the effects on conflict with all variables integrated in a given time period.

## References

- [1] International Crisis Group, *The Communist Insurgency in the Philippines Tactics and Talks*, 2011. <http://www.crisisgroup.org/~media/Files/asia/south-east-asia/philippines/202%20The%20Communist%20Insurgency%20in%20the%20Philippines%20Tactics%20and%20Talks.ashx>.
- [2] Z. Abuza, *Balik-Terrorism: The Return of the Abu Sayyaf*, Strategic Studies Institute, U.S. Army War College, 2005, p. 2.
- [3] D. Smith, *Trends and causes of armed conflict*, Bergh of Research Center for Constructive Conflict Management, 2004, pp. 2-7.
- [4] National Unification Commission, *NUC Report to PRES. FIDEL V. RAMOS on the Pursuit of a Comprehensive Peace Process*, Quezon City, 1 July 1993, p. 27.

- [5] C. Cusi, The Vulnerability Index of the Country's 75 Provinces to CPP-NPS-NDF Insurgency: An Application of Multivariate Statistical Techniques, Master of Statistics Thesis, University of the Philippines, June 1996.
- [6] S.P. Huntington, The clash of civilizations, *Foreign Affairs* 3 (72) (1993) 25.
- [7] G. McCormick, S. Horton, Things Fall Apart: The "Endgame" Dynamics of Internal Wars (October, 2006), <http://www.math.usma.edu/people/horton/EndGame.pdf> (accessed August 3, 2011).
- [8] G. McCormick, The Political Control and Societal Equilibrium Model, in: Dr. McCormick's Seminar on Guerrilla Warfare, Monterey, CA, January 2011.
- [9] J. Mueller, The Banality of "Ethnic War": Yugoslavia and Rwanda, in: The 2000 Annual Meeting of the American Political Science Association, <http://www.polisci.osu.edu/faculty/jmueller/apsa2000.pdf> (accessed January 23, 2012).
- [10] S. Siddique, Social cohesion and conflict in Southeast Asia, in: N.J. Colletta, T.G. Lim, A. Kelles-Viitanen (Eds.), *Social Cohesion and Conflict Prevention in Asia: Managing Diversity through Development*, Washington DC: World Bank, 2001, p. 29, <http://books.google.com/books?id=64Fvi7j42wMC&pg=PA29&dq=heterogeneous+society+and+conflict> (accessed December 20, 2011).
- [11] C. Anderson, A. Paskeviciute, How Ethnic and linguistic heterogeneity influence the prospects for civil society: a comparative study of citizenship behavior, *The Journal of Politics* 4 (68) (2006) 799.
- [12] P. Kreuzer, Democracy, diversity, and conflict: managing ethnic divisions in the Philippines and Malaysia, Cornell University Peace Studies Program Occasional Paper, 2006, Vol. 30, No. 4, p. 6.
- [13] W. Bossert, C. D'Ambrosio, E. La Ferrara, A Generalized Index of Ethno-Linguistic Fractionalization, June 2005, <http://www-3.unipv.it/webdept/prin/workpv02.pdf> (accessed April 2, 2012).
- [14] W. Fox, Formula driven Poisson regression in EXCEL, *Computer in Education Journal* 5 (3) (2014) 40-51.
- [15] Internal Peace and Security Plan, Armed Force of the Philippines, 2001.
- [16] C. Sriram et al., *Governance in Conflict Prevention and Recovery: A Guidance Note*, Bureau for Crisis Prevention and Recovery, One United Nations Plaza, New York, NY 10017, USA, 2009.