THE NATURE AND CONSEQUENCES OF CIVIL STRIFE

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Submitted to the Graduate Faculty of

the Department of Economics in partial fulfillment

of the requirements for the degree of

Doctor of Philosophy

University of Pittsburgh

2011

UNIVERSITY OF PITTSBURGH

DEPARTMENT OF ECONOMICS

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It was defended on

June 6th, 2011

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Various forms of violence plague our society. While violence is ubiquitous, there is a lack of studies that analyze war upsurges in a more dynamic and disaggregated setting, study its relationship with the country attributes, and its impact on the broader population. In Chapter 1 I build a conceptual framework to analyze violence upsurges in a more dynamic and disaggregated setting. Using the data on the Maoist insurgency in Nepal (1996-2006), I propose a model that conceptualizes violence as a spatial-temporal process. I find that the key determinant of whether or not an area is drawn into a civil war is its proximity of the areas that are already engaged in the civil war. In Chapter 2, I exploit a unique set of education data from Nepal to assess the impact of violence on an important determinant of future economic growth: children's educational attainment. I find that 3 additional deaths per 10,000 population (one standard deviation) from the mean reduces the primary and secondary school examination passing rates by 0.55 and 0.53 standard deviations, respectively. Lastly, in Chapter 3 I present a scenario where differences in a government's innate ability leads to differences in resulting violence. More specifically, I present a scenario where the inability of the government to fully comprehend the ramifications of their actions leads to underinvestment in counterinsurgency. A fully informed government is aware of the breath of consequences of its actions and takes stringent action accordingly, whereas a myopic government engages in *ad hoc* responses only. The overall conclusion is that an armed conflict within a country has specific characteristics that need to be further examined with disaggregated data and tested against the economic theories on institution formation. Additionally, an armed conflict also has far-reaching consequences for a warring state's next generation, thereby making policies to address the loss in human capital a necessity to prevent future conflict relapses.

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PREFACE

This dissertation is dedicated to my family members. I thank Dr. Randall P. Walsh for his guidance and support, Dr. Daniel Berkowitz and Dr. Mark Hoekstra for their patience, advice, and support, and Dr. Spellerberg (Simpson College) for encouraging me to pursue a PhD degree in the first place.

1.0 THE WAR DISEASE: A SPATIAL-TEMPORAL ANALYSIS OF POLITICAL VIOLENCE

1.1 INTRODUCTION

Civil wars [1] can be frequent, persistent, and costly. Since World War II there have been on average 2.3 new civil wars around the world per year (Fearon and Laitin, 2003), lasting an average of seven years- almost six times longer than the average international war (Collier, Hoeffler, and Soderbom, 2004). These wars have taken 20 million lives and caused 67 million people to become refugees (Doyle and Sambanis, 2003). It is estimated that by the end of a conflict, a country's GDP will be 15 percent lower than when it began. It will take an average of 21 years for the country to reach the level of GDP that would have been attained had it not experienced the conflict (Collier and Hoeffler, 2004).

There are two primary views of civil wars. The first, and the traditional view, is that wars have deep roots in socioeconomic conditions. As such, this view seeks to identify the characteristics of a country that make it more likely to breed insurgents. These characteristics are broadly classified as greed, grievance, and opportunity. The provision of natural resources, such as diamonds, causes greed among the population and provides financial means for their armed struggle. While high levels of destitution faced by the denizens leads to grievance, which make them more likely to wage war against the government, armed uprisings can also emerge simply because there are opportunities that allow such activities to take place (Collier and Hoeffler, 2000; Fearon and Laitin, 2003; Collier, Hoeffler, and Soderbom, 2004). Some examples of the socioeconomic conditions that result in grievance are poverty, unstable governments, and religious and ethnic cleavages. Similarly, the presence of a rugged terrain, a large population, and dense forests, are thought to provide suitable

[1] I use civil war, conflict, rebellion, and insurgency interchangeably. Authors like Elbadawi and Sambanis (2002) argue that since civil war and rebellion include collective action and violence against an established authority, the overall meaning remains the same.

environments and opportunities for an armed uprising to emerge and to persist.

Taking a behavioral approach, some studies model these determinants in a game-theoretical context (Hirshleifer, 1991, 1994, 2001). Most of the studies, however, focus on empirically identifying the relationship between the key characteristics of countries and conflict outbreak. Nevertheless, there is little agreement as to what socioeconomic conditions are favorable to insurgents and how they relate to the prevalence of armed struggle. For example, Collier and Hoeffler (2004), Stewart (2001), and Elbadawi and Sambanis (2002) establish the importance of ethnic inequality in causing a conflict, whereas Fearon and Laitin (2003) and Sambanis (2001) refute this argument. Similarly, the importance of other local drivers of conflict, such as a rugged terrain or measures of deprivation, are also contested in the empirical analysis. Generally, these studies highlight some measure of greed, grievance, and opportunity as fuel for a conflict. It is not clear, however, why poverty, ethnic divisions, and the like are pervasive in many areas that are not engaged in a civil war.

The second view of civil war is that the increase in war is a spatial process. That is, war clusters in a certain space and exerts negative externalities on the nearby areas around it. This view of civil war abstracts away from associating the local conditions with conflict outbreak, and analyzes war as a more dynamic spatial phenomenon that has a significant contagion effect once it has emerged. In this regard, the emergence of war is thought to be a direct result of either a gain in knowledge in war-related tactics (which is a diffusion process), or a physical movement of rebellious activities from other war affected areas (which is a contagion process)[2]. This is the more relevant approach, because there are considerable variations in rebel motivation and historical background across countries and regions that render identifying the root causes of war an extremely difficult task. For instance, Fearon (2004) finds that once the heterogeneity in the motivation to rebel is accounted for, none of the "usual suspects" explain why some wars last longer than others.

War spills over national borders as rebels seek refuge, they use the resources of nearby areas, and they aim to spread their presence and influence into these neighboring areas. This knowledge-sharing and expansionary view of war has been formalized since the 1970s. The idea that once an area is at war, the malaise will spread to contingent areas was proposed by Alcock (1972) and further extended by Most and Starr (1980), Hill and Rothchild (1986), and Rosh (1988) to name a few.

More recently, the contagion effect of war is confirmed in empirical analysis as well. Sambanis

[2]Diffusion and contagion are different mechanisms by which a war spreads. Since it is a matter of argument as to which of these mechanisms are at play, I do not distinguish between the two mechanisms.

(2001) finds that having a neighboring country at war significantly increases the probability of ethnic conflict in an adjoining country. Similarly, Ward and Gleditsch (2002) model the likelihood of a country engaging in war conditional on war in proximate states. Although their data covers only a cross-section (1988) of countries at war, it is able to predict roughly half of the international and civil wars from 1989 to 1998. Murdoch and Sandler (2002) analyze the spillover effect of war in a neighboring country on domestic human capital accumulation. To estimate this neighborhood effect, the authors use a weighted average of civil war measures in the neighboring countries, where the weights are proportional to the length of common borders. Buhaug and Gleditsch (2008) study whether the contagion effect of war remains once the spatial clustering of a country's characteristics are accounted for, and find that the contagion effect does remain.

Although most studies focus on the contagion of war across countries, distance from capital city to conflict area is commonly used to study the consolidation of insurgent activities within a country. That is, depending on the rebel motivation, war clusters more nearer or more farther away from the capital city of a country (Buhaug and Gates, 2002). Moreover, the spatial nature of war, or the extent of geographical spread, is also viewed as an outcome of war itself. Regardless of the way proximity is viewed (capital-conflict distance, length of common border, or outcome of a war), the conclusion of these spatial studies is that a region's proximity to an emerging civil war is a major predictor of whether that region will itself become engulfed in the civil war.

The importance of geographical proximity in transmitting externalities goes beyond the study of war. The concept of war being spatially clustered and having spillover effects to nearby areas resonates with the idea that many social phenomena have ripple effects across borders to neighboring countries. Intangible assets, like the knowledge of the workforce, or the political institutions within a country, are traditionally thought to have spillover effects on neighboring countries. That is why there is international support to facilitate the transmission of positive spillover effects and to form coalitions to abate the spread of the negative ones. For instance, democracy (Leeson and Dean, 2009), economic freedom (Sobel and Leeson, 2007), and media freedom (Sobel, Dutta, and Roy, 2001) are also contagious. A general consensus is that approximately 25 percent of a country's economic and political institutions are a direct result of the economic and political institutions of the neighboring countries. The spillover effects of civil war are not understood as clearly as the aforementioned contagion effect of political and/or social institutions. This paper aims to enhance our understanding of this key area.

In summary, while the traditional view of war focuses on identifying the correlates of war, studies

have not been able to fully explain the differences between the attributes of countries and how they relate to the characteristics of war. More importantly, based on their analysis, one cannot predict where conflict outbreak will happen, since the studies cannot explain why many local driving forces which are thought to fuel an insurgency (like poverty, or an unstable government) are pervasive in many areaa, while civil wars are not. There exists an abundance of would-be counter examples in this regard. The second or the dynamic view of war, although new in empirical analysis, is more able to predict the locations of war emergence (Ward and Gleditsch, 2002). This is primarily because war is thought to be a dynamic phenomenon instead of an on-off process. Even though this view takes a dynamic approach to understanding a conflict, one drawback is that war is thought to be only a one-dimensional process. The other dimension, the temporal aspect of war, is not studied in conjunction with the spatial dimension.

Starr (2003) argues that *"time and space are two primary ways in which we contextualize social behavior and interaction ... the notion of movement through space is voluntary and through time is involuntary. Just because it [the movement through space] is voluntary, the spatial context should be even more important to many aspects of our research."* Although the importance of space in the study of war is clear, there is no study that views war as a spatial process and accounts for the temporal dimension as well. That is, the study of war as a spatial-temporal process has not been undertaken, which means the relationship between the spread of violence (the contagion effect) and the escalation of violence (the temporal aspect) remains unexplained.

This leads to a few important questions. Firstly, how can we conceptualize the spread of a war? Since the study of war as a spatial-temporal process has not been undertaken, how can we integrate the space and time dimensions of war to study the characteristics of war? Can we explain war as a dynamic phenomenon rather than being "static" with only local drivers behind its upsurge? If violence is a spatial-temporal process, is the spread completely spatial like the spread of a disease? Or does violence spread systematically according to the characteristics of an area? Additionally, does violence escalate suddenly, like an earthquake, or does it escalate slowly over time like a volcano eruption (Sambanis, 2009)? And perhaps most importantly, once an area is engulfed by war, how does the violence evolve?

These questions remain unanswered, since studies have focused on the spillover of war across international boundaries only. By focusing on the cross-border spillover of war, one cannot explain the heterogeneity in violence within a country. To conceptualize war as a spatial-temporal process, data at a sub-national level is required. There needs to be considerable variation in the geographical

spread of war and the socio-economic conditions within a country, in addition to information on the temporal intensity of violence. As such, the data on the Maoist insurgency in Nepal is quite suitable. This insurgency, which started as low-scale political violence, has grown to a level of war,[3] and has spread through the entire country within seven years of initiation. Most importantly, data gathering remained functional over the duration of the war, and is systematically available for all the administrative units of the country.

There are three main studies that use the Nepali Maoist uprising as their area of interest. Murshed and Gates (2005) and Do and Iyer (forthcoming) analyze the determinants of the insurgency, while Bohara et al (2006) study the pattern of violence exchanged between the government and the Maoist insurgents, and analyze how the pattern varies according to the characteristics of districts (administrative units). A major drawback of these studies is that the spatial nature of war is not accounted for and the analysis of the temporal aspect is not fully exploited.

By recognizing this shortcoming, this study proposes a way to conceptualize violence as a spatial-temporal process. Like the spread of a disease, the spread of war can be broken down into two stages; an infection stage and an escalation stage. First, there is an infection stage when an area becomes engaged in a civil war. In the second stage, there may be an escalation as the surrounding areas engage in violence. The two stages are allowed to be correlated, which allows for unobserved heterogeneity in an area's war receptivity to jointly influence the likelihood of war and the intensity of violence upon war starting in an area. The results of this study suggest that geographical proximity determines how quickly an area gets drawn into violence, and that escalation of violence is due to early exposure to violence. If the spread was systematically related to the attributes of an area, we would expect such factors as poverty rate, literacy rate, forest density, etc, to explain conflict emergence. I show that if the spatial nature of war is ignored, the results are similar to the view of war as having local root causes. Once the spatial nature of conflict is accounted for, however, the aforementioned local conditions do not influence the manner in which violence unfolds.

This Chapter is organized as follows. Section 1.2 presents the data, followed by a brief discussion on the history of the Maoist insurgency in Section 1.3. War-as-a-Process based view is conceptualized in Section 1.4. The results are presented in Section 1.5 and I conclude in Section 1.6.

[3]By the standard definition of war categories, if the fighting results in greater than 1000 deaths in a given year, it is categorized as a war (Gleditsch et al, 2002).

1.2 DATA

Since the traditional studies of war argue that local conditions- broadly categorized as greed, grievance, and opportunity- influence violence upsurge, I use various indicators of these conditions in the analysis. Poverty and literacy rates are used as measures of local grievance. The poverty rate is the percentage of population below the national poverty line. It is calculated from household level data from the Nepal Living Standard Survey (1995-1996) jointly by the Central Bureau of Statistics (Nepal) and the World Bank. It is plausible that poverty rate is measured inaccurately or is endogenous. Miguel et al (2004) show that if the economy is dependent on agriculture, variation in annual rainfall provides an exogenous source of variation in income. They argue that volatility in weather (rainfall) significantly affects agricultural yield in an area, thereby affecting the income of the people of the area. Rainfall data is preferred to poverty, because unlike poverty, rainfall (precipitation level) is measured more accurately and varies over time. Since agriculture is the largest sector of the economy of Nepal, it is reasonable to use rainfall as an alternative indicator of income. Hence, I alternatively use annual levels of rainfall to check the sensitivity of the results.

The lack of natural resources to finance rebel activities in Nepal (like diamonds, oil, timber, or coca) refutes greed as a motivation for the insurgency. Opportunities provided by the geography should still exist, since the country is very mountainous (8 out of 10 highest peaks of the world are located in Nepal), and there is an abundance of densely forested areas. Several authors use percentage of district area covered by forest (forest density), length of road per district area (road density), elevation, population density, etc, as measures of opportunities for rebellious activities (Fearon and Laitin, 2003; Bohara et al, 2006; Do and Iyer, 2010). Elevation and road density are highly correlated, so I use only road density in the main analysis. Road density data is preferred to elevation because it measures accessibility and it is an indicator of demand for public services that is affected by elevation and population. I alternatively use elevation instead of road density and find that the results are not sensitive to using either of these measures. All of these local drivers of conflict are measured at the district level in the pre-conflict period (before 1996).

The dynamic view of war, on the other hand, finds that the relative location of an area determines the likelihood of a war in that area. The measures of relative location that make countries vulnerable to war are length of common border with a country at war and distance from a war affected country. Many authors use distance from capital city to analyze the consolidation of rebellion activities within a country. I argue that distance from capital city is not very relevant for the

study of spread of war. Firstly, the capital city is the decision making center of the government. If the interest lies in understanding the spread of war, the decision making center of the insurgents (the conflict location) should be the area of reference. After all, the conflict location is the source of war emergence. Secondly, the distance from a capital city is only meaningful if the interest lies in investigating whether rebellion activities consolidate nearer or farther away from a capital city. This is simply a function of rebel motivation. For example, if the motivation for the uprising is to overthrow the government, the uprising is likely to be in or around the capital city. Although I use distance from capital city to test the sensitivity my results, the primary measure of proximity is the minimum distance from the initial conflict affected areas.

Besides the local conditions and the geographic proximity to war affected areas, local politics should also matter for the emergence and prevalence of an armed uprising. McColl (1967) and Raleigh *et al.* (2009) argue that the strategic location of a place is more important than the topology of the location. One of strategic advantages of a location is its population base. Hence, it is reasonable that without the support of the local people of an area, insurgents cannot grow in sheer size and capacity.

The mid-western part of Nepal, the Maoist's stronghold, was strategically favorable for the Maoists because of the presence of communist activities in those areas since as far back as in the 1950s. As such, the communist stronghold in a district is measured by the share of votes received by the communist party in the 1994 House of Representative election (obtained from the Election Commission). Furthermore, in the aforementioned area live Magars, an ethnic group known to be of militant in nature, as a dominant population. The Magars were the soldiers of the Gorkha expansionary army, who fought to unite the country (1765-1768). They formed a part of the ruling elite in the initial years of the new empire; nevertheless, over the years they have been marginalized and have thought of themselves as neglected by the government. It has been argued that the presence of the Magars and Rais (another ethnic group with similar history as Magars) and the history of neglect faced by this population also gave the Maoists the much needed support (Thapa and Sijapati, 2004). In order to measure the concentration of the local population base thought to support the Maoist's cause, the Census data is used to calculate the share of population that belong to ethnic groups believed to be of militant in nature [4]. For the ease of reference, the share of these ethnic groups is referred to as "ethnicity" and the share of votes received by the communist

[4]These ethnic groups are Magar, Rai, Tamang, Limbu, and Gurung. They form the majority of Nepali to serve in the British Army, and to some degree in the Nepali Army.

party as "communist stronghold". The ethnicity and communist stronghold capture the strategic importance of a location or are indicators of local politics[5].

Lastly, the data on the temporal levels of violence, such as the number of killings by the Maoist rebels and the government were collected from the Informal Sector Service Center (INSEC). The INSEC maintains the data on yearly human rights violations, such as killings, beatings, threats, arrests, separately by the actors (government or insurgents). Since only the killings data is available consistently throughout the years, I use the number of killings (both by the government and the Maoists) weighted by the district population (of 1990) as a measure of conflict intensity. The years following 2001 were marked by the escalation of violence due to the government engaging in arbitrary counter-insurgency tactics. Upon the change in the Commander-in-Chief of the army, the King, army was mobilized for the first time to abate the insurgency. This further increased the ferocity of violence. Moreover, there were several rounds of futile peace talks and ceasefires after 2001. Given these reasons and that after 2001 the entire country was affected by the conflict, which reduces variation in conflict onset, I use data from 1996-2001 only.

Table (1.1) provides a summary statistics of the data. As the Table shows, there are significant variations in grievance, opportunity, local politics, and violence in the country. For example, the percentage of population below the national poverty line ranges from 4.4 percent to 60 percent. Similarly, literacy rate ranges between almost 20 percent to 70 percent. Furthermore, there is a considerable variation in violence overtime. The sharpest increase in violence happened in 1998, after which the intensity of violence remained high.

1.3 BACKGROUND: THE "PEOPLE'S WAR" (1996-2006)

Nepal is a landlocked country located in Southern Asia surrounded by India on the East, West, and South and China on the North. The country has a population of approximately 28.1 million and total land area of 147.2 thousand square kilometers. Agriculture is the largest sector of the economy with a GDP per capita of USD 470 (Fiscal Year 2009, World Bank: Nepal Country

[5]Several authors use ethnic factionalization or ethnic polarization to measure the heterogeneity of the population base. Such measures are relevant to understand if the violence is ethnic based. Since the conflict under investigation is a politically motivated one and the focus of this paper is to explain violence upsurges, it is more meaningful to analyze how local population base relate to the insurgency.

Table 1.1: Descriptive Statistics

Category	Obs.	Mean	Standard Deviation	Min	Max
Grievance					
% Poverty	75	0.382	0.125	0.044	0.603
Literacy rate	75	0.380	0.110	0.196	0.701
Opportunity					
Population Density	75	204.6	267.2	2.388	1709.7
Forest Density	75	0.398	0.189	0.017	0.983
Road Density	75	0.113	0.210	0.000	1.329
Politics					
Communist Stronghold[a]	75	0.317	0.150	0.000	0.794
Ethnicity[b]	75	0.243	0.217	0.002	0.979
Cumulative Conflict Intensity					
Cumulative deaths per 10,000 population	75	1.761	3.949	0.000	20.38
Yearly Conflict Intensity					
Deaths/10,000 population in 1996	75	0.069	0.339	0.000	2.393
Deaths/10,000 population in 1997	75	0.037	0.160	0.000	1.169
Deaths/10,000 population in 1998	75	0.352	0.985	0.000	5.616
Deaths/10,000 population in 1999	75	0.392	1.179	0.000	6.680
Deaths/10,000 population in 2000	75	0.434	1.268	0.000	6.868
Deaths/10,000 population in 2001	75	0.478	0.931	0.000	6.172

a Communist stronghold is the percentage of votes received by the Communist Party in the 1994 House of Representative Election.*b* Ethnicity is the share of ethnic groups that are militant in nature. They are Magar, Rai, Tamang, Limbu, and Gurung.

Overview 2010). There are 75 administrative units, called districts, which are grouped into 5 development regions. As statistics are consistently reported at the district level, these districts are the units of observation. A district is comparable to a county in the United States. (Do and Iyer, *forthcoming*).

The official birth of the Maoists in Nepal is considered to be in 1995. In 1994 the Election Commission had denied the request for recognition of a communist party, which was a breakaway faction of the Communist Party of Nepal (Unity Center). After the rejection by the Election Commission the party was renamed as the Communist Party of Nepal (Maoist) and the leaders of the party went completely underground in preparation of an armed revolt. February, 13, 1996, marked the initiation of the insurgency in the country, when a series of attacks on government offices were launched in several parts of the country. Baburam Bhattarai, the vice-chairman of the CPN (M), had approached the prime minister with a 40 point memorandum on February, 4, and warned of armed struggle should the government fail to meet those demands by February, 17. However, the attacks were launched on February 13, the date the party had decided, instead of honoring the deadline of February 17, as given in the proposal to the government (Thapa and Sijapati, 2004).

As the monarchy ended in 2006, the political parties signed the Comprehensive Peace Agreement in which the Maoist leaders agreed to keep their arms and soldiers in UN monitored cantonments. An agreement was reached to hold a constituent assembly election, as a step towards writing a new constitution. The signing of the Comprehensive Peace Agreement marked the end of the decade long insurgency.

1.4 WAR-AS-A-PROCESS BASED VIEW

Since the focus of this paper is to conceptualize war as a spatial-temporal process, the characteristics of war are divided into two stages: the contagion stage and the stage when the extent of violence increases. A relevant approach to understanding the contagion effect of violence is to observe the start of violence in an area and time elapsed until the incidence of violence is observed in other areas. This approach relates the attributes of an area to the role those attributes play in determining how quickly the area gets drawn into violence. The time until the first change- onset of conflict- occurs can be implemented using the Poisson distribution. The dependent variable is the time elapsed

between the initiation of conflict in the country and the first incidence of conflict related violence in a district. This variable is equal to zero in the districts where the conflict initiated (in 1996), one for the districts that were affected in the first year after the conflict started (1997), and so on. On the other hand, the stage when the extent of violence in affected areas increases is analyzed using ordinary least squares (OLS) technique.

I begin the analysis with the "static" view of war. That is, I test whether local conditions (grievance, opportunity, and local politics) explain the spread and intensity of violence. As can be seen in Table (1.2), poverty, literacy rate, forest density, and ethnicity are significantly associated with conflict onset. The negative sign on forest density and ethnicity implies that densely forested areas and areas with higher concentration of the ethnic group had violence earlier. Similarly, the positive sign on literacy indicates that higher levels of literacy rate delayed the onset of violence. The sign on poverty rate is opposite, meaning that higher level of poverty is associated with conflict happening at a later stage. As mentioned earlier, rainfall is an alternative measure of poverty and elevation and road density are highly correlated. Column II in Table (1.2) reports a separate analysis using rainfall instead of poverty and elevation instead of road density. Neither of these alternative measures are significant, although the coefficient on forest density becomes insignificant. Similarly, Column IV-VI of Table (1.2) reports the results for the escalation of violence. An OLS estimation of cumulative violence shows that violence was more intense in densely forested areas (Column IV). In Column V rainfall and elevation are used instead of poverty rate and road density, respectively. Upon adding these alternative measures, literacy rate and elevation become significant and the explanatory power of forest density increases.

Nevertheless, these results are in alignment with the other studies that analyze the determinants of conflict. For example, the results suggests that grievance (poverty and literacy rate), geography (forest density), and local politics (concentration of the ethnic group) determine how quickly an area gets drawn into violence and how intense the violence gets. Do and Iyer (forthcoming) find that the association between conflict and poverty is driven by poorer districts being involved in conflict at an early stage of the conflict, and the geographical conditions affect the intensity of the conflict once it started. Similarly, Bohara *et al* (2006) find that the government and the Maoists engaged in higher levels of violence in districts with rugged terrain. The results in Columns I-II and Columns IV-V of Table (1.2) conform the results from these studies. Furthermore, since the local

Table 1.2: Preliminary Analysis

	Onset[a]			Intensity[b]		
	I	II	III	IV	V	VI
Distance	-	-	3.034***	-	-	−13.310***
			(0.621)			(2.306)
Distance Sq	-	-	−1.014***	-	-	5.170***
			(0.260)			(1.123)
Poverty	1.249*	-	-0.859	2.827	-	4.896
	(0.647)		(0.786)	(5.744)		(4.846)
Literacy Rate	3.109***	2.879**	-0.936	-10.660	−12.365***	-0.089
	(0.732)	(0.906)	(1.099)	(6.553)	(5.752)	(6.214)
Population Density	-0.057	-0.046	0.008	-0.308	0.188	-0.455
	(0.082)	(0.036)	(0.093)	(0.516)	(0.217)	(0.437)
Forest Density	−1.043**	-0.444	-0.126	5.170*	6.440***	2.143
	(0.495)	(0.373)	(0.559)	(2.727)	(2.344)	(2.413)
Road Density	0.349	-	0.700	6.174	-	3.452
	(1.056)		(1.145)	(6.689)		(5.498)
Communist Stronghold	0.359	0.568	-0.344	-4.690	-3.791	-1.117
	(0.598)	(0.603)	(0.564)	(3.250)	(3.266)	(2.709)
Ethnicity	−0.952**	−0.743*	0.768	1.980	2.096	-2.947
	(0.437)	(0.420)	(0.539)	(2.716)	(2.432)	(2.601)
Rainfall	-	0.056	-	-	0.326	-
		(0.125)			(0.832)	
Elevation	-	0.088	-	-	1.034*	-
		(0.095)			(0.601)	
Observation	69	69	69	75	75	75
Loglikelihood (R-sq)	-128.02	-127.09	-108.27	0.227	0.248	0.504

*a*The dependent variable is time elapsed since the conflict started in the country and the first incidence of violence in a country. It is implemented using a Poisson distribution. The districts that did not have conflict by 2001 were dropped.*b*The dependent variable is the cumulative violence intensity in 2001.

drivers seem to be important in explaining the characteristics of violence in Nepal, the insurgency in Nepal is comparable to that of the other countries studied in the literature.

As mentioned in the Data section, the view of war as a spatial phenomenon highlights the importance of geographic proximity to war affected areas in determining the likelihood of a war in an area. Hence, minimum distance to initial war affected areas (districts) is used as a measure of geographic proximity. Column III of Table (1.2) shows the results for the same analysis as above with distance as an additional control. Once distance from the nearest conflict affected district is controlled for, the local conditions are no longer significant. A null hypothesis that all the local drivers of conflict are jointly significant cannot be rejected. Similarly, adding distance as a control in the analysis of violence intensity removes the significance of other drivers of violence as well. Distance is both statistically significant, provides a better fit of the data, and explains about a quarter of variation in the violence intensity. I checked the sensitivity of this analysis using distance from capital city (Kathmandu) instead and find that distance from capital is not significantly associated with either the spread or the intensity of violence [6].

Overall, Table (1.2) highlights the importance of proximity in the spread of violence and the higher intensity of violence seems to be driven by early exposure to violence. That is, being close to a war affected area increases the likelihood of war in an area and the longer duration of violence results in higher level of casualties. Figures 1.1-1.6 show the maps of districts affected by the insurgency in various years. As can be seen, the conflict spread to nearby areas and grew ferocious over time. Additionally, Table (1.3) provides the summary statistics of local conditions by proximity. I divide the districts into three groups based on how close the districts are to the districts that had conflict in 1996 (which are initial conflict affected areas) . The Table shows that the areas that were close by (0-50 kilometers) have higher levels of violence compared to the areas in the middle range (50-100 kilometers) and furthest away (greater than 100 kilometers). However, aside from the intensity of violence, these districts are comparable. The districts that are close by are not systematically poorer, have low literacy rate, etc. This simple way of categorizing districts suggests that the differences in conflict spread and intensity is not due to poorer or remote areas being drawn into violence at an early stage, but because the districts happen to be closer to the conflict affected districts. As such, these observations provide motivations to conceptualize war as

[6] For brevity results are not reported.

Table 1.3: Descriptive Statistics by Proximity

Category	0-50 km	50-100 km	$\succ$ 100km
	Mean (std)	Mean (std)	Mean (std)
Conflict Related			
Cumulative deaths per 10,000 population	3.853	1.093	0.272
	(5.714)	(2.729)	(0.436)
Year of Conflict Onset	1.840	3.240	4.478
	(1.700)	(1.268)	(1.122)
Distance	31.436	76.271	141.046
	(20.358)	(13.109)	(32.122)
Grievance			
Poverty	0.388	0.392	0.377
	(0.133)	(0.132)	(0.111)
Literacy rate	0.343	0.381	0.413
	(0.111)	(0.116)	(0.096)
Opportunity			
Population Density	2.598	1.851	1.835
	(4.173)	(1.571)	(1.235)
Forest Density	0.423	0.427	0.371
	(0.223)	(0.126)	(0.188)
Road Density	0.150	0.105	0.091
	(0.324)	(0.147)	(0.082)
Politics			
Communist Stronghold	0.257	0.362	0.355
	(0.143)	(0.147)	(0.128)
Ethnicity	0.259	0.237	0.196
	(0.175)	(0.249)	(0.198)
N	25	27	23

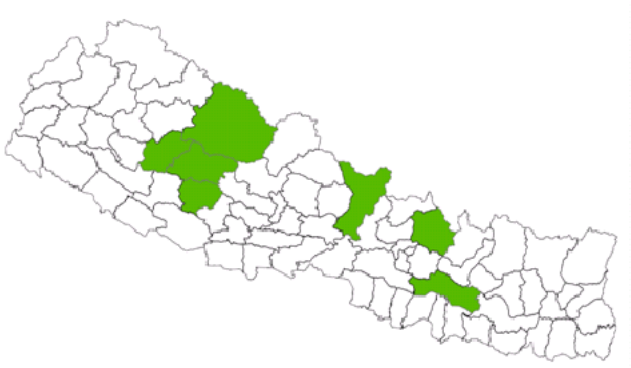

Figure 1.1: Districts with Violence in 1996

a spatial-temporal phenomena.

These things considered, let T be the year the conflict initiates in the country and $\overline{T}$ [7] be the end of observation. Proximity, as measured by distance (d_i) from a district (i) to another district with conflict in 1996, is among many characteristics of a district that make it prone to conflict. If there is more than one district with conflict, then the minimum distance measures the proximity. That is, the year in which the conflict starts in a district (τ_i) is a function of distance (d_i) to an initial conflict affected district and other socio-economic characteristics of the district (X_i). Furthermore, the longer the time elapsed since the conflict started in the country ($t - T$), the more likely it is that the conflict spreads to a district. Here, t is any year under consideration and $t - T$ is the time elapsed since the conflict started, which is the same for all the districts.

Let, $y_i = \tau_i - T$. That is, y_i is the waiting time until the first change occurs in a district (i). The probability that the conflict spreads to a district i after a given interval Y is:

$$Pr[y_i = Y] = f(d_i, X_i, t - T, \epsilon_i) \tag{1.1}$$

$$\frac{\partial f}{\partial d_i} \succ 0, \ \frac{\partial f}{\partial t} \prec 0$$

[7] Since the time period under consideration is 1996-2001, $\overline{T} = 2001$

Figure 1.2: Districts with Violence in 1997

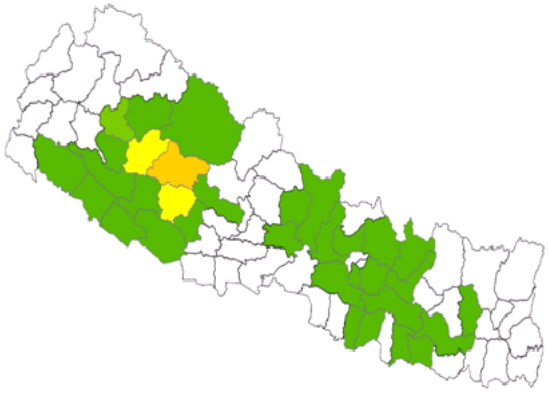

Figure 1.3: Districts with Violence in 1998

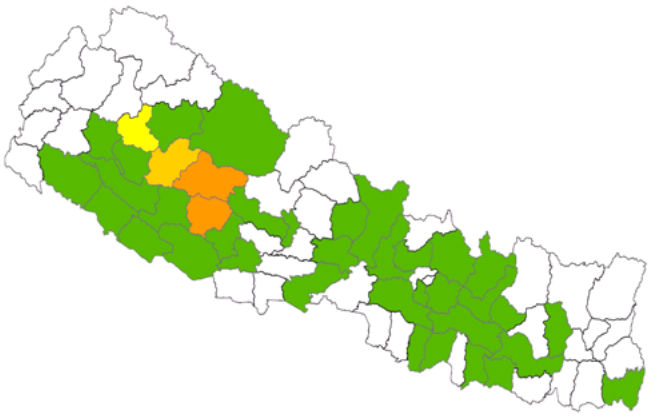

Figure 1.4: Districts with Violence in 1999

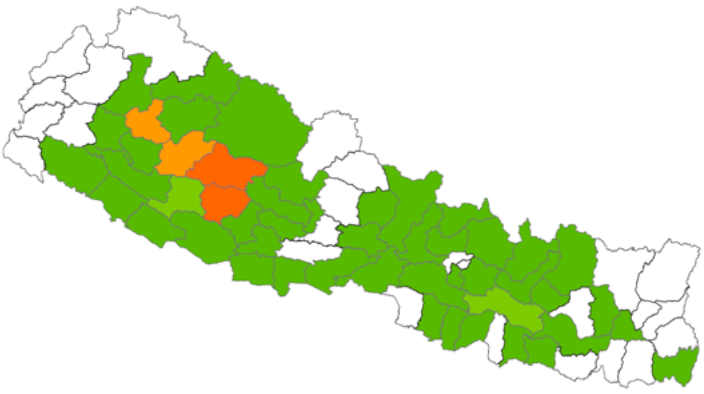

Figure 1.5: Districts with Violence in 2000

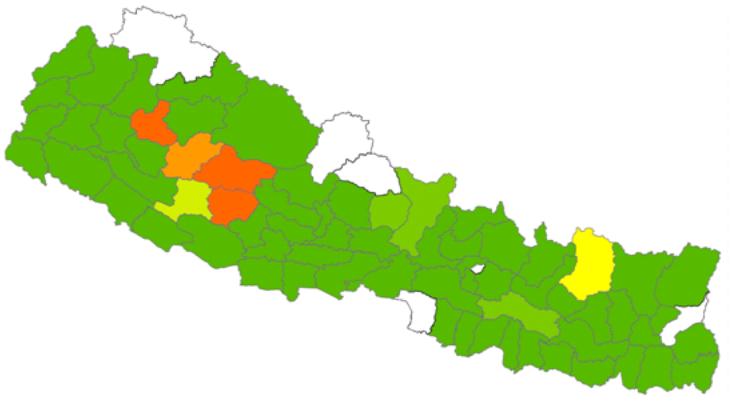

Figure 1.6: Districts with Violence in 2001

In Equation (1.1) X_i is a set of explanatory variables and ϵ_i is the time-invariant unobservable characteristics of a district. Using Poisson distribution to implement the probability,

$$Pr[y_i = Y] = \frac{(exp^{-\lambda_i}) * (\lambda_i^Y)}{Y!} \text{if } \tau_i \leq \overline{T} \tag{1.2}$$

Where, $\lambda_i = exp(\theta X_i + \epsilon_i)$, $Y = 0, 1, 2, ...$ If there was no conflict in a district by the end of the period of observation ($\overline{T}$), then there is still a chance that the district will have violence in the years to follow. Failure to take into account the probability that there might be conflict in year greater $\overline{T}$ means that Y will be truncated at $\overline{T}$.

The probability that there will be a conflict in any given year greater than $\overline{T}$ is

$$Pr[y_i \succ (\overline{T} - T)] = 1 - \sum_{y_i=0}^{\overline{T}-T} \frac{(exp^{-\lambda_i}) * (\lambda^{y_i})}{y_i!}$$

Once the conflict infiltrated a particular location, the intensity escalates with the duration $(t - (\tau_i - 1))$ of the conflict in that location. It is natural to assume that longer lasting conflicts will result in more casualties. The term $(t - (\tau_i - 1))$ will be different in each t, which captures the temporal aspect of the violence. Since, τ_i is the time of start of conflict, $t - (\tau_i - 1)$ $\forall t \geq \tau_i$ is the duration of conflict in district i. Let, ω_i be the time invariant unobservable characteristics of district associated with the intensity of violence and $D_{it} = t - (\tau_i - 1)$ be the duration of conflict

in a district i in year t. The expected level of violence in a given year t and location i is

$$E[V_{it}] = \begin{cases} g(D_{it}, X_i, \omega_i, \eta_{it}) & \text{if } t \geq \tau_i \\ 0 & otherwise \end{cases}$$

Where,

$$\tfrac{\partial g}{\partial (D_{it})} \succ 0, \ \binom{\epsilon}{\omega} \sim N(0, \Sigma)$$

and

$$\Sigma = \begin{bmatrix} \sigma_\epsilon^2 & \sigma_{\epsilon\omega} \\ \sigma_{\epsilon\omega} & \sigma_\omega^2 \end{bmatrix}$$

More specifically,

$$E[V_{it}] = \begin{cases} \beta(D_i) + \pi * X_i + \omega_i + \eta_{it} & \text{if } t \geq \tau_i \\ 0 & otherwise \end{cases} \tag{1.3}$$

To operationalize Σ, ω can be expressed as

$$\omega = \tilde{\sigma}_{\epsilon\omega} * \tilde{\epsilon} + \tilde{\sigma}_\omega * \tilde{\omega}.$$

where, $(\tilde{\epsilon}, \tilde{\omega})\ N(0, 1)$.

The unobservable term $\tilde{\sigma_\omega}$ accounts for the unobserved variation V_{it}, the conflict intensity, once the variation in conflict intensity due to the unobserved variation in conflict start is accounted for. Intuitively, ϵ and ω are time invariant state specific unobserved disturbance term. If $\tilde{\sigma}_{\epsilon\omega}^2 + \tilde{\sigma}_\omega^2$ is the total time-invariant unobserved variation in V_{it}, then $\tilde{\sigma}_{\epsilon\omega}$ is a portion of ω that is due to the the district being drawn into conflict at an earlier stage and $\tilde{\sigma}_\omega$ is the remaining variation of ω that is associated with violence intensity. If the covariance between the two processes is zero, the unobservable characteristics that makes districts more likely to have higher (lower) level of violence is unrelated to the unobservable characteristics of the same districts that make them have conflict early (later) on. If the covariance is positive, then the unobservable characteristics of a district that make them more likely to have conflict early on also make the district *less* likely to have higher levels of violence.

The probability of a given sequence of observation in a district (i) is

$$Pr[V_i = v] = \begin{cases} \prod_{t=\tau_i}^{\overline{T}} \phi(z_t|\epsilon_i) * Pr[y_i = Y|X_i] * f(\epsilon_i) & \text{if } \tau_i \leq \overline{T} \\ \\ Pr[y_i \succ (\overline{T} - T)|X_i] & otherwise \end{cases}$$

Where, $\phi(.)$ is the density of a standard normal distribution and $z_t = \frac{\overline{V_t} - \beta(D_{it}) - \pi * X - \tilde{\sigma}_{\epsilon\omega} * \tilde{\epsilon}}{\tilde{\sigma}_\omega}$. The conditional density of z needs to be adjusted, since $Pr[\omega_i|\epsilon_i]$ is distributed normally with mean $\tilde{\sigma}_{\epsilon\omega} * \tilde{\epsilon}$ and variance $\tilde{\sigma}_\omega^2$

Let, $\delta_i = 1$ if $\tau_i \leq \overline{T}$. The likelihood function is

$$l_i(\theta, \beta, \sigma) = \prod_{i=1}^{N} \left[\int \left(\left\{ \prod_{t=\tau_i}^{\overline{T}} \phi(z_t|\epsilon_i) * Pr[y_i = Y] \right\}^{\delta_i} \left\{ Pr[y_i \succ (\overline{T} - T)] \right\}^{1-\delta_i} \right) * d\epsilon_i \right].$$

The log-likelihood function is

$$L(\theta, \beta, \sigma) = \sum_{i=1}^{N} \int \left[\delta_i * \left\{ \prod_{t=\tau_i}^{\overline{T}} (\phi(z_t|\epsilon_i) * Pr[y_i]) \right\} + (1 - \delta_i) * \left\{ Pr[y_i \succ (\overline{T} - T)] \right\} \right] * d\epsilon_i. \quad (1.4)$$

The parameters of interest are θ, β, σ, where $\sigma \in \{\sigma_\epsilon, \tilde{\sigma_{\epsilon\omega}}, \tilde{\sigma_\omega}\}$. The likelihood function is weighted by the density of ϵ. By simulating the likelihood function, the particular values of ϵ will be integrated out and only the parameters that describe the density of ϵ will contribute to the likelihood function. If there is no correlation between the two random components, then the Poisson distribution and the probability of the violence reaching a certain level are two separate processes. Two separate likelihood functions can be written and maximized individually. Although, the likelihood is a function of parameters of ϵ, an unobservable, simulation methods are used to derive the unbiased estimator of the probabilities.

1.5 RESULTS

Table (1.4) summarizes the main results. A positive coefficient for the conflict spread means the variable causes conflict to happen in later years. Column I allows distance and duration to have non-linear effects in the Poisson analysis and conflict intensity, respectively, while controlling for all local conditions in both cases. Column II differs from Column I only in that distance is removed from analysis. This is to test whether the local conditions are jointly significant in explaining conflict spread. Similarly, in order to test the explanatory power of distance, only distance is included in Poisson analysis (Column III) and all socioeconomic conditions pertain to the conflict intensity only (Column IV).

The effect of distance is substantial in all the specifications. A coefficient of distance (3.098) in Column I of Table (1.4) implies that increasing the proximity from the zero (areas from where violence began) to the tenth percentile (35 kilometers) makes the districts have conflict about 3 years later. Similarly, increasing the distance from tenth percentile to twenty five percentile (from 35 kilometers to 45 kilometers) delays the conflict onset by about a year and half. Put differently, half a standard deviation increase in distance (about 25 km) from zero delays the start of conflict by 1.3 standard deviations (2 years later). This is a very large effect, which is reasonable considering that, on average, a district witnessed violence within 3.15 years of initiation (with 1.75 standard deviation). Figure 1.7 and Figure 1.8 plot the total effect and the marginal effect of distance, respectively.

None of the other social and economic condition are significant in these analysis. This result is consistent across different specifications too. A null hypothesis that the local drivers of the conflict are jointly insignificant (zero) cannot be rejected at the 95 percent confidence level. The covariance between unobserved heterogeneity across the two models is positive. A positive coefficient implies that the unobservable characteristics of districts that are positively associated with conflict onset are negatively correlated with violence intensity. This positive correlation can be interpreted as highlighting a mechanism. If districts having majority of communist supporters are the ones to revolt (conflict happens sooner), the same districts may have less violence in the following years, as their political targets might be located in other districts. It is this type of association between conflict emergence and escalation that the results suggest. The key result is that space and time is what matters the most for conflict start and escalation, respectively.

Similarly, none of the socioeconomic conditions are significant in explaining the conflict escalation either. The most influential variable in explaining conflict intensity is the conflict duration. The coefficient on duration in Column I of Table (2.2) suggests that increasing the mean duration by half a standard deviation increases the violence intensity by 1.2 standard deviation. This translates to 30 additional deaths using the mean population of the country (25,8497) and standard deviation of yearly conflict in 2001. Furthermore, each increment in duration by 1 year from 1996, on average, increases the number of casualties by 125 per year (using the mean population).

It is possible that the lack of significance of poverty could be because poverty is measured incorrectly or because poverty is endogenous. As mentioned in the Data section, variation in annual rainfall provides an exogenous source of variation in income for an economy that is heavily

Table 1.4: Conflict Spread and Intensity

	Onset[a]			Intensity[b]		
	I	II	III	IV	V	VI
Distance	3.098***	-	2.733***	-	-	-
	(0.672)		(0.598)			
Distance sq	−1.052**	-	−0.934***	-	-	-
	(0.284)		(0.268)			
Poverty	-0.588	0.997	-	4.501	8.149	8.931
	(1.167)	(1.022)		(16.148)	(16.304)	(15.911)
Literacy Rate	-0.604	2.818*	-	-2.886	-5.240	-4.367
	(1.531)	(1.120)		(17.546)	(19.138)	(17.192)
Population Density	0.010	-0.063	-	-1.212	-1.179	-1.176
	(0.097)	(0.084)		(1.284)	(1.295)	(1.260)
Forest Density	-0.097	−1.025**	-	2.872	5.211	5.101
	(0.604)	(0.522)		(7.539)	(8.011)	(7.244)
Road Density	0.627	0.365	-	4.338	8.111	7.906
	(1.189)	(1.087)		(16.709)	(16.705)	(16.336)
Communist Stronghold	-0.315	0.460	-	-6.588	-13.006	-12.029
	(0.595)	(0.612)		(8.695)	(8.821)	(8.512)
Ethnicity	0.646	−0.928*	-	-0.781	2.001	1.370
	(0.621)	(0.486)		(7.480)	(8.011)	(7.510)
Duration				6.434***	5.629**	6.097***
				(2.131)	(2.335)	(2.128)
Duration sq				−0.734**	−0.704**	−0.713**
				(0.341)	(0.343)	(0.342)
Covariance	0.420	−0.389	0.606**			
	(0.573)	(1.095)	(0.367)			
Loglikelihood	-891.570	-908.404	-893.463			

*a*The dependent variable is time elapsed since the conflict started in the country and the first incidence of violence in a country. It is implemented using a Poisson distribution. *b* The dependent variable is yearly violence intensity. Time fixed-effects are included in all the analysis.

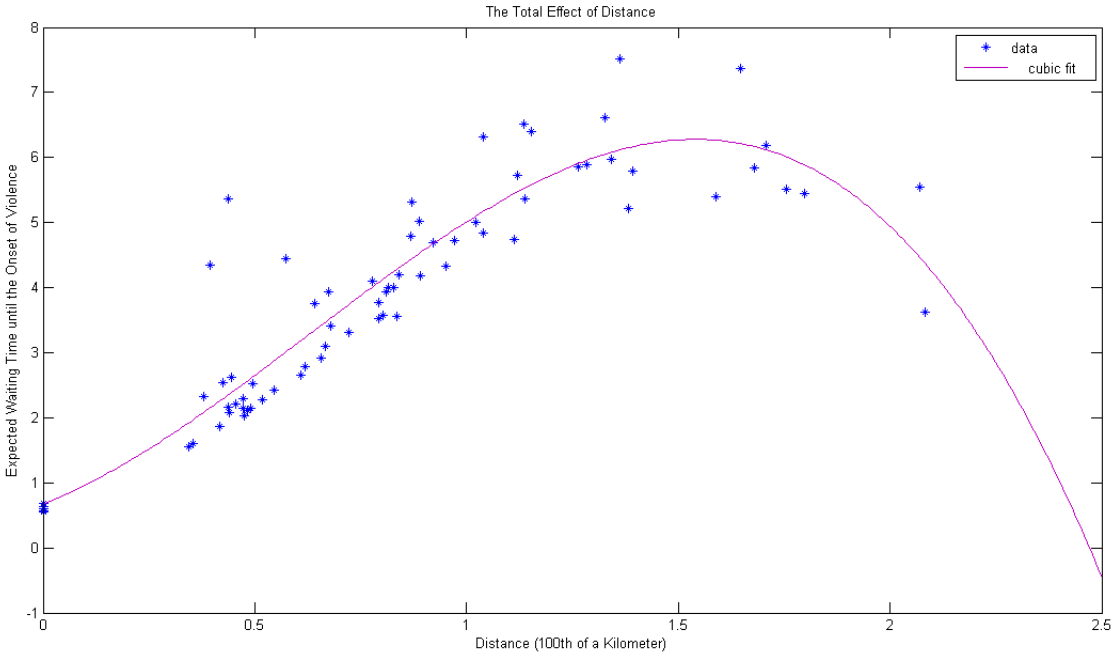

Figure 1.7: The Total Effect of Distance

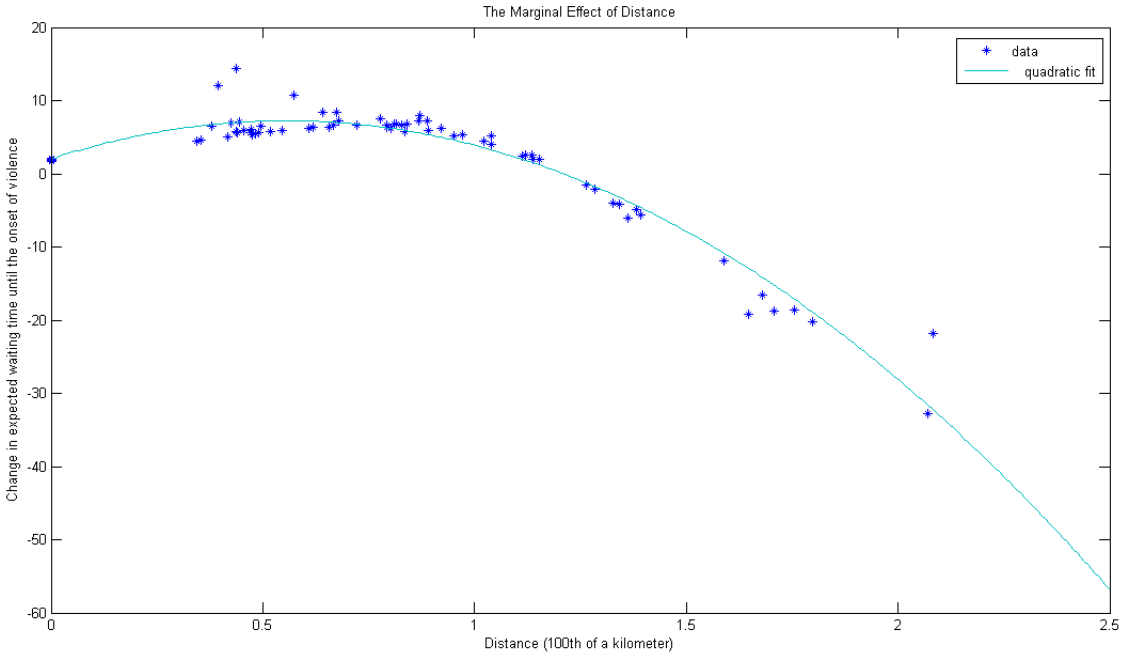

Figure 1.8: The Marginal Effect of Distance

dependent on agriculture. As an alternative to poverty rate, I use annual rainfall and find that the main results are not sensitive to using either of these measures of deprivation. Furthermore, including elevation instead of road density does not alter the main results either.

It is quite surprising that none of the local socioeconomic and political conditions matter for conflict spread and escalation. Although this result seems counter-intuitive at first, I draw upon recent studies of armed uprising that analyze war at disaggregated level (within-country analysis) to argue that the results of this study is not so counter-intuitive after all. In the paragraphs to follow, I revisit each of the local drivers of conflict in turn to document regional differences in the role these local conditions play in inflicting violence.

Firstly, consider the role of poverty and literacy rate in giving rise to violence in a country. The idea that poverty and low education attainment lead to armed revolt is based on the assumption that destitution leads to higher levels of grievance and lower opportunity cost of participating in the revolt. These arguments assume that the poor voluntarily join the rebel army, however, many rebel groups grow in size by forced recruitment. A well known example is the mass abduction of children in Uganda in the 1990s by the LRA insurgents [8]. Djankov and Reynal-Querol (2010) also find the relationship between poverty and conflict to be spurious and that once country fixed-effects (or historical factors) are accounted for, the relationship between poverty and conflict disappears.

Similarly, there are many regional differences in literacy rate that refute the simplistic view that links lower levels of literacy rate with conflict outbreak. For example, Lebanon had one of the highest levels of schooling in the Arab world in the 1950-60 period, while Saudi Arabia had the schooling rate of only 4% and no war (Makdisi and Sadaka, 2002). Similarly, although African countries have low levels of schooling and higher levels of violence, countries like Cyprus, Yugoslavia, Georgia, Russia had high schooling rates at the time of war (Sambanis, 2009). Moreover, Krueger and Maleckova (2003) find that Hizbollah recruits in Lebanon were among the highly educated ones. Hence, it is not very surprising that conflict does not spread through the areas of low literacy rate or high poverty, specially when analyzing the spread of war within a country.

The geography of Nepal would be thought to provide the rebels a safe haven from the government, since the country is very mountainous and has abundance of dense forests. However, during the initial phases of the insurgency, and during the other times the leaders were operating in secrecy, they sought refuge in India (South Asia Terrorism Portal). That is, the Maoists fleeing the

[8] Sambanis (2009) argues the same point. That is, he argues that there is considerable regional heterogeneity in the relationship between poverty and literacy rate and armed conflict.

government were not hiding in the jungles of Nepal, but went underground in neighboring India. The training and meetings that the Maoists held were also carried out in India. The Maoists have links with the Kamtapur Liberation Organization (KLO), which provided a support for the Maoists from Nepal to flee to certain parts of India (South Asia Terrorism Portal).

In this regard, the porous border with India might have rendered more opportunities for the Maoists to sustain and to carry out their campaign than the rugged terrain of Nepal. While rugged terrain and inaccessibility certainly contribute to the ability of the rebels to hide, it is hard to imagine that if the government considered the would-be rebels a credible threat, a campaign to wipe them out would be so infeasible. This is certainly true given that the Maoists barely had more than two rifles when they initiated their war in 1996 and the Communist Party had merely 2000 members enlisted in 1990 (Thapa and Sijapati, 2004). From the start of insurgency to within 7-8 years the Maoists were able to gather 5,500 combatants, 8,000 militia, 4,500 cadres, 33,000 serious followers, and 200,000 sympathizers (South Asia Terrorism Portal). By 2003 their capacity surpassed that of the Nepali Police. The growth of their capability stands out as an example that such highly politically motivated campaign could not be fully sustained simply by the poor peasants joining the revolt and seeking refuge in the hinterlands.

The presence of rugged terrain and forests are thought to create a barrier for the government to access the rebel bases or headquarters. However, there are old and emerging studies that challenge this viewpoint. McColl (1967), as quoted in Raleigh, Witmer, and O'Loughlin (*working paper*), argues that, "ï¿½ *locations must have access to political targets... these are the treaty ports for their wealth and large administrative centers for their political and economic significance. This means that bases cannot be simply located where they would be safe due to topography or distance for the enemy.*" Raleigh and Hegre (2009) hold an analogous view. Arguing that the strategic location of a place is more important than the topology of the location, they find that conflict in the Central African countries were not primarily located in remote hinterlands. They argue that for a battle to take place, both parties (the government and the rebel group) must be able to reach to the particular location. Additionally, the rebel groups target places that are high value to them (natural resources in case of the African countries), which are connected by roads. In this regard, the usual way in which rugged terrain is thought to influence conflict may not always hold true for two reasons. Firstly, for the rugged terrain to actually matter the rebels must be using it to their advantage. Secondly, the potential battlefields need to be accessible to both parties. This means that extreme rugged terrain is unfavorable to both parties, as it is not only difficult for the

government to access those areas, but presumably, rebels will find those areas hard to access as well. Furthermore, without any strategic importance of those areas, it is unlikely that rebels would base their activities in those regions for the sole reason to take refuge in those areas.

Lastly, the importance of proximity is very evident in the analysis and can be interpreted in many ways. Distance poses cost in transmitting economic (or war related) activities, as it represents access to market for final goods (violence, for example) and it is also indicative of the access to resources for the production of the final goods. That is, in terms of acquiring resources to produce or sell violence (manpower to help the revolution and the targets of revolution), proximity plays a crucial role. As the distance from potential targets or resources increases, the value of the final good decreases due to the increasing cost. As such, the results and the motivations are similar to the Gravity Model of trade.

1.6 CONCLUSION

This paper is a first step towards understanding war as a spatial-temporal process. Although the importance of proximity to a conflict affected area in increasing the likelihood of war has long been observed, spatial-temporal view of war has not been fully incorporated into empirical analysis. As such, there exists no conceptual framework to understand how contagion of war takes place. By recognizing these shortcomings, I propose a way to systematically conceptualize war as a spatial-temporal process. This approach helps us understand the mechanism that drives the spread of violence separately from the mechanism that makes violence escalate over time. As a result, heterogeneity in violence within a country can be explained. That is, using the model proposed in this study, we are able to understand why certain areas are drawn into violence or have higher levels of violence.

I show that if war is viewed as a result of a dire economic situation or local political grievance, a within-country analysis of war conforms this view. Once the spatial nature of war is accounted for, however, the local drivers commonly thought to breed insurgents are no longer significant. I test the sensitivity of the results using alternative measures of poverty, road density, and an area's relative location. Annual rainfall is used as an exogenous source of variation in income. Similarly, elevation and distance from a capital city are alternative measures for road connectivity and relative location, respectively. The results are not sensitive to the inclusion of either measures of poverty or

road density, and distance from a capital city is not significant in explaining a spread of a conflict.

The conceptual framework proposed in this study is implemented using the case study of a country. Future work will be to implement this framework using other countries to examine if the patterns observed in this study are generalizable. The results of this study aid in answering questions that abound in the study of conflict. For example, Sambanis (2009) questions whether violence escalates suddenly, like an earthquake, or whether it builds slowly over time like a volcanic eruption. The results strongly suggest that the escalation of violence is like a volcano eruption. The implications for policy intervention is that "hot spot" areas ought to be targeted at an early stage. On the spatial analysis of conflict, Raleigh, Witmer, O'Loughlin (*working paper*) question, " *once we have modeled the variation in local causes and accounted for spatial autocorrelation, is there evidence remaining that indicates that location matters?*." I show that it does matter, and interpret the results with respect to local politics as well; an approach that is missing in the literature but is increasingly recognized as being necessary for understanding in-country variation in war attributes.

2.0 EXPOSURE TO VIOLENCE AND STUDENT PERFORMANCE

2.1 INTRODUCTION

Various forms of violent incidents plague our society. While these activities, like wars and crime, are ubiquitous, most of them are of low intensity levels (as a percentage of the total population). For example, the average homicide rate in the world is about 8.62 per 100,000 population (United Nations Office on Drugs and Crime, 2008). A key feature of such low level violence is that the people of the affected areas carry on (or resume) with their day-to-day activities. To what extent do these violent incidents affect population at large, however, remains unknown.

For instance, consider the prevalence of one of the most common forms of civil disruption, the civil wars. During the mid-1990s there were 44 civil wars in the world, affecting about a quarter of the states in the international system (Fearon, 2004). A most obvious way to categorize the destruction from these wars is the count of war casualties. The casualty figure is a small percentage of the potential population affected by a war, and does not account for the impact of the violence on the survivors. Arguably, it is more important to assess the impact on the survivors, since they constitute the remaining population that needs to make the transition into the post-conflict period.

Among the survivors of a war, the most vulnerable group of citizens are the children. Besides, the children also constitute the majority of the population in developing countries (where wars are most frequent) [1] and the children are also the group of people who will carry on the impact of violence for a longer period of time. A detail analysis of the impact on this age group will help design appropriate policies to help the loss in human capital to rebound, to assist the country into making post-conflict transition, and to prevent further conflict relapses. Given that the countries that have experienced a civil war are 44 percent likely to experience another conflict within five years after peace (Collier and Hoeffler, 2004), it is imperative to assess the breadth of externalities

[1] Approximately 40 percent of population of developing countries is under the age of 14.

and identify the impact of the conflict not only in terms of direct and immediate loss, but also on the population at large and on the next generation of citizens.

There are few studies that analyze the impact of violence on health and psychological outcomes of children abducted to serve in the insurgent army. Namely, McNullin and Loughry (2002) and Derluyn et al (2004) study the levels of post-traumatic stress of the abducted youth and find that the child soldiers were more hostile, depressed, and showed various other signs of post-traumatic stress. Panhuis (2002) studies mortality rates in war affected areas and finds higher mortality rates in the post-conflict period due to the spread of communicable diseases such as HIV and malaria.

One of the pioneering study that focuses on the impact of child soldiering is by Blattman and Annan (2010). Their study of the impact of child soldiering uses survey data from Uganda to investigate the education and the labor market outcomes of the child soldiers. Their analysis, however, is limited to only the child soldiers of the war. The remaining non-combat children of the war zone are used as the control group (counterfactuals) in all these aforementioned studies. This means, the impact of violence on non-combat youth, which comprises of the majority of the population of the affected areas, remains unknown.

Part of the lack of a systematic study of the consequences of violence on a broad group of population is due to the lack of a sufficient data and the identification problems, such as the endogeneity of violence and the self-selection of students in schools. The violence itself results in such a dire situation that appropriate data become harder to obtain. Given that for a detailed study of consequences of violence a systematic data at the sub-national level is required, the case of the Maoist insurgency in Nepal is quite suitable. There is a considerable variation in the intensity of the insurgency within the country and the data is available at the level of administrative units for the entire duration of the insurgency. Thus, using the data on the insurgency and the archived data on schooling, I estimate the impact of the conflict on schooling completion at primary level (grade 5), on the passing rate at the national standardized examination (grade 10), and on the percentage of students taking the same exam (the appearance rate). Additionally, I test for various mechanisms by which the violence affected the schooling outcomes.

The identification problem that arises when estimating the impact of exposure to violence is that the unobservable characteristics of an area that is related to higher (lower) intensity of violence could also be related to lower (higher) educational attainment. I use differences-in-differences estimation to address this concern. Based on the different levels of violence, I classify districts into high or low violence groups. The identifying assumption is that in the absence of violence the trajectory

of education attainment of those districts would have been the same. I show that these groups of districts follow similar trend in education attainment in the pre-conflict period. Hence, differences in the education outcomes overtime in the conflict period can be attributed to the differences in violence in those districts.

The results suggest that the passing rate at the national standardized examination decreased significantly during the war period. I define the passing rate such that the negative impact on the passing rate is not because of the displacement of students passing the exam from one year to another. That is, the conflict did not just delay the passing rate, but the students were more likely to fail overtime during the conflict period. At the primary level, the conflict resulted in significant decrease in primary completion rate. This results help us understand the stagnancy of primary completion rate, despite the increase in the enrollment rate at the primary level. Lastly, the mechanism by which the war affected the schooling attainment is not primarily through a reduction in the availability of private schools (a measure of quality of education) or through a reduction in the total number of schools (a measure of accessibility of education). Instead, the adverse effects may be due to a reduction in the length of school year, the disruption in the learning environment, or due to an increase in the opportunity cost of education, though the data do not allow me to test for these possibilities.

This Chapter is organized as follows: Section 2.2 presents the identification strategy used to quantify the impact of exposure to violence. Various outcomes of interests and the sources of the data are discussed in Section 2.3, followed by a brief introduction of the insurgency in Section 2.4. The results are presented in Section 2.5, followed by the robustness checks of the results in 2.6. Finally, I conclude in Section 2.7.

2.2 IDENTIFICATION

A differences-in-differences estimation with OLS is

$$y_{it} = \alpha + \beta * Violence_{it} + \pi * t + \epsilon_{it}. \tag{2.1}$$

y is various educational outcomes of district i in year t. Some of the outcomes of interest are primary school completion rate and passing rate at a national standardized examination (to be discussed in detail in the Data Section). *Violence* is the cumulative number of conflict related

deaths per 10,000 population, t is a year dummy for each year, and ϵ is the idiosyncratic error term. Since all the measures of quality of education, like the teacher-to-student ratio and the percentage of private schools, that affect student performance can themselves be affected by the conflict, I do not include them in the analysis. I only include the measures of quality of education to test whether the mechanism by which the conflict affected the student performance was through a reduction in the quality of education. The pre-conflict district characteristics, such as poverty and literacy rates, are another set of district-specific characteristics that could jointly affect the likelihood of violence in a district and the education attainment of the students of the district. There is no overtime variation in those characteristics. Since district fixed effects is used to account for all the time invariant unobservable characters of a district, time-invariant socioeconomic characteristics of a district are not included in the analysis. The coefficient of interest is β, which captures the difference in educational outcome that can be attributed to the difference in conflict intensity[2].

Similar to Equation 2.1, I alternatively classify districts into different categories according to the intensity of violence, and compare the outcomes as a result of being in one of the categories. As such, the districts are classified as "high violence"or "low violence" based on the cumulative violence in 2001, the end of the observation. The districts that have violence in the upper 25 percentile are classified as the "high" violence districts, whereas the districts with violence in the lower 25 percentile are classified as the "low" violence districts. The remaining districts are not used in the analysis. The estimation strategy is

$$y_{it} = \alpha + \beta_1 * High + \beta_2 * High * Post + \beta_3 * Post + \epsilon_{it}. \tag{2.2}$$

$High$ is a dummy if a district is classified as a district with high intensity of violence. $Post$ is a dummy if the observations belong to the conflict period. In Equation (2.2) β_1 captures the average effect of being in the "high" violence category, whereas β_2 captures the additional impact of being in the "high"violence category during the conflict period. For the identification of β_2, the districts classified in this way must be following the same trajectory in education attainment such that any differences in the educational outcomes overtime can be attributed to the difference in violence in those areas (being in the "high" violence versus being in the "low" violence group). The estimation includes district fixed effects, year fixed effects, and the standard errors are clustered at the district level [3].

[2]It is not evident whether yearly levels violence should be used instead of cumulative violence. Since education is a cumulative process, it is more reasonable to use cumulative violence.

[3]I also use Instrumental variable method to address the possibility of the endogeneity of violence. Interaction

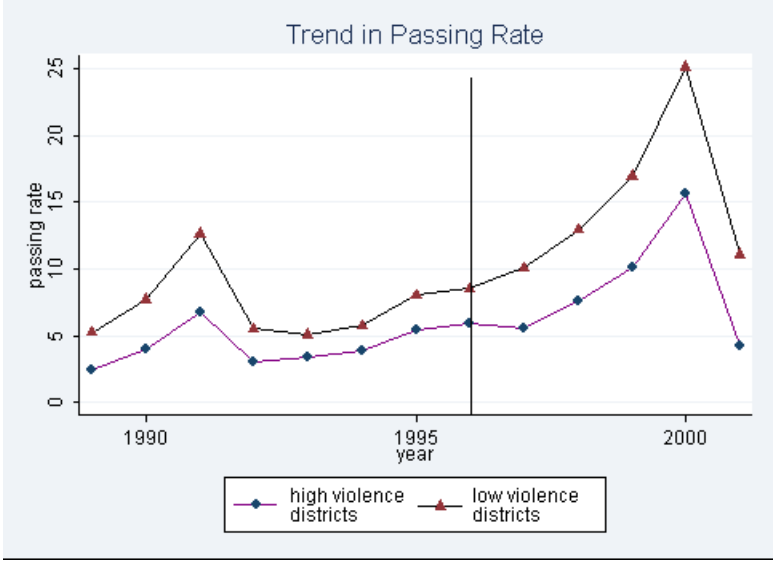

Figure 2.1: Trend in Passing Rate

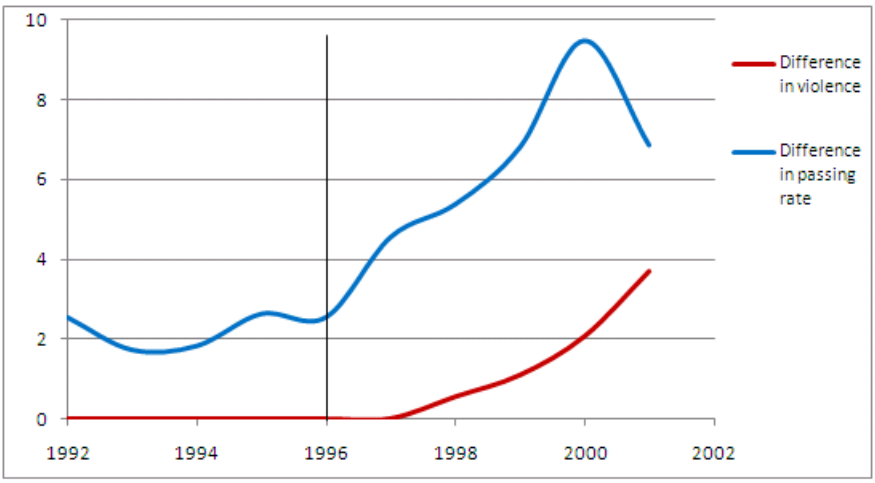

Figure 2.2: Differences in Passing Rate and Violence between High Violence and Low Violence Districts

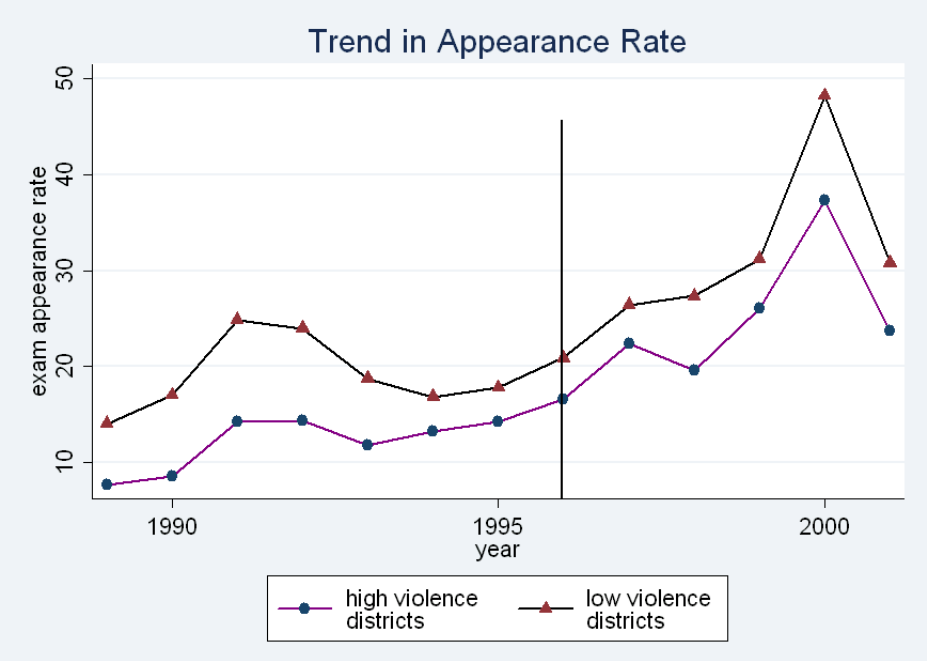

Figure 2.3: Trend in Exam Appearance Rate

Figure 2.1 plots the trend in passing rate of the districts classified as having high and low levels of violence. The identification does not come from the difference in the levels of the passing rate. The districts, however, must follow a similar trend in passing rate in the pre-conflict period, so that any differences in the trend in passing rate in the conflict period can be attributed to the differences in violence between the groups. As can be seen in Figure 2.1, the trend in passing rate is quite similar in the two groups of districts. Upon conflict infiltration in 1996, there is a significant divergence in the passing rate over time. Figure 2.2 plots the differences in passing rate and violence of these two groups of districts. The difference in passing rate and violence is relatively constant until 1996. As the difference in violence increased overtime, so did the difference in the passing rate.

Similarly, Figure 2.3 and Figure 2.4 plot the trend in exam appearance rate and primary com-

of distance from initial conflict areas and year is used to instrument for overtime variation in violence. Similarly, I classify districts into two categories based on their proximity to initial conflict affected areas (being near versus being far). While there is a significant correlation between violence and proximity, the first-stage F-stat is less than the desired level of 9. Most importantly, the second stage results are insignificant due to higher standard errors. Since the coefficients from using instrumental variable method and differences-in-differences estimates are comparable, the results from Instrumental Variable are not reported.

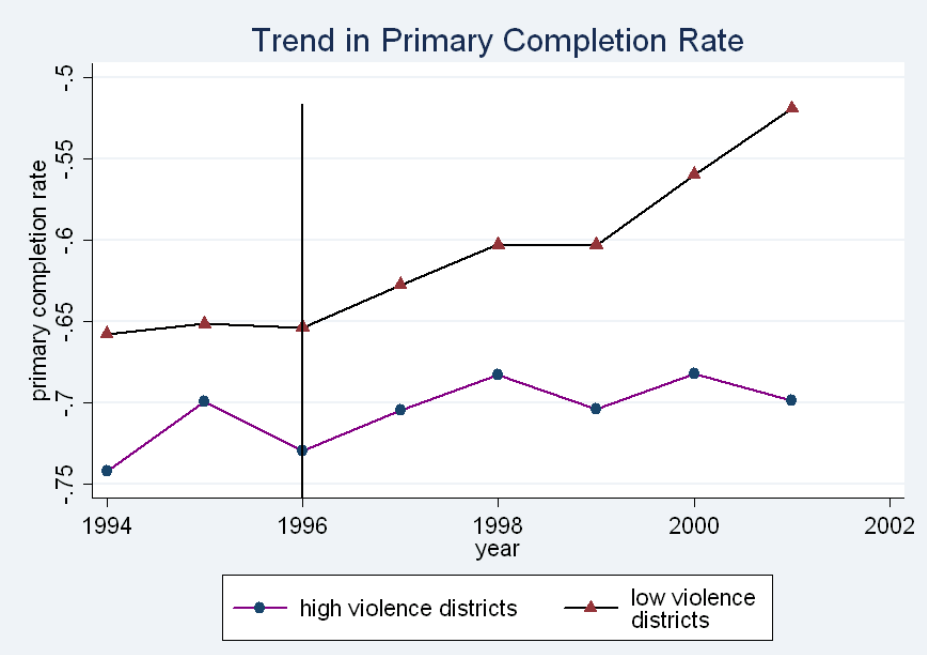

Figure 2.4: Trend in Primary School Completion Rate

pletion rate, respectively. In Figure 2.3 there is no significant divergence in exam appearance rate between the two groups of districts, however, the primary school completion rate shows significant divergence in the conflict period (Figure 3). Table 2.1 provides a summary statistics of the pre-conflict levels of education attainment of all the districts, and of the districts that are classified as the "high" and the "low" violence districts. Although the districts with the low level of violence have a higher education attainment, Figures 2.1, 2.3, and 2.4 show that the trend in those measures of education attainment was comparable in the pre-conflict period.

It is plausible that many students drop out of school as a result of the conflict. This selection of students might lead to underestimation of the impact on the exam passing rate. To account for this bias, passing rate is defined as the number of students passing the exam divided by the total secondary schooling aged population of the district. As the conflict might affect the population size itself, I use the population aged 15-19 years in 1995 as the best guess of the secondary schooling aged population. The official age to enroll in grade 10 is 15 years (Education Statistics of Nepal). However, there are overwhelmingly over-aged students enrolled in the secondary level (grade 9 and

Table 2.1: Summary Statistics

Variable	All	High Violence	Low Violence
Passing Rate	5.381	4.211	6.27
	(4.416)	(2.795)	(5.293)
Appearance Rate	16.087	13.076	17.789
	(8.009)	(6.483)	(9.575)
Primary Completion $Rate^a$	0.675	-0.721	-0.655
	(0.097)	(0.093)	(0.108)
Cumulative Violence	0.491	1.253	0.010
	(1.609)	(2.405)	(.021)

a a negative sign implies dropout

10). For example, the 2004 secondary level Net Enrollment Ratio[4] (NER) was only 35.2 (Education Statistics of Nepal, 2004). By defining the passing rate in such a manner the dropout of students before taking the exam will not bias the estimation, and it also rules out the possibility that the conflict affects the passing rate by simply delaying the passing rate. Similarly, the primary schooling completion rate is defined as the percentage of students enrolled in grade 1 that transition to grade 5.

If the students most likely to pass the exam from a conflict affected district move to a different district to take the exam, the compositional change in students appearing for the exam will cause the estimates to be biased upward. To appear for the exam the students must register through a school at least a year in advance and it is uncommon for students to change schools after grade 8. Therefore, the compositional change in this case will not cause as severe problem as it would if the students could simply take the exam from any district in a given year. Any compositional change is likely to occur in the long run. Moreover, long term compositional change can itself be an outcome of the conflict.

[4]Net Enrollment Ratio is a measure of correct-age enrollment at a particular grade level. For example, the Net Enrollment Ratio at the secondary level is defined as the share of students 15-16 year olds enrolled in secondary schools.

2.3 DATA

The schooling level data is collected from the Ministry of Education and Sports in Nepal. The Education Statistics of Nepal consists data on student enrollment (grades 1 to 10), various types of schools available (public or private), and teacher's qualification. The examination results data is maintained by the Office of the Controller of Examination in Kathmandu, Nepal. The data reports the yearly total number of students taking the exam and the total number of students passing the exam. The data on the temporal levels of violence, such as number of killings by the Maoist rebels and the government were collected from the Informal Sector Service Center (INSEC).

I use grade enrollment data to calculate the percentage of students enrolled in grade 1 who transition to grade 5 after four years (primary completion rate) as an outcome of interest at the primary level. A caveat in calculating primary completion rate in this way is that if the students are enrolled in grade 5, it does not necessary mean that those are the students who completed grade 5. Hence, I alternatively calculate primary completion rate as the percentage of students enrolled in grade 1 who transition to grade 6. The impact of violence in primary completion rate is particularly important to assess, because over the years the enrollment in primary schooling has increased. The completion rate at the primary level, however, has not increased. Hence, it becomes important to assess if the stagnancy in primary completion rate can be attributed to the upsurge in violence.

All the students finishing their secondary schooling appear for a standardized national examination called the School Leaving Examination (SLC). All students are required to pass this examination to continue their higher education. Depending on the type of employment, passing this exam is also a minimum requirement for many government jobs. The exam, therefore, is a binding constraint for the students. Any impact at this level suggests a substantial loss in human capital as both the higher education and the employment prospects of the students are hindered.

Lastly, since only the killings data is available consistently throughout the years, I use the number of killings (both by the State and the Maoists) weighted by the district population (of 1990) as a measure of conflict intensity. The years following 2001 were marked by the escalation of violence due to the government engaging in arbitrary counter-insurgency tactics. Upon the change in the Commander-in-Chief of the army, the King, army was mobilized for the first time to abate the insurgency. This further increased the ferocity of violence. Moreover, there were several rounds of futile peace talks and ceasefires after 2001. Given these reasons and that after 2001 the entire

country was affected by the conflict, which reduces variation in conflict onset, I use data from 1996-2001 only.

2.4 BACKGROUND: THE INSURGENCY (1996-2006)

Nepal is a landlocked country located in Southern Asia surrounded by India on the East, West, and South and China on the North. The country has a population of approximately 28.1 million and total land area of 147.2 thousand square kilometers. Agriculture is the largest sector of the economy with a GDP per capita of USD 470 (Fiscal Year 2009, World Bank). There are 75 administrative units, called districts, which are grouped into 5 development regions. As statistics are consistently reported at the district level, these districts are the units of observation. A district is comparable to a U.S. county. (Do and Iyer, 2010).

The official birth of the Maoists in Nepal is considered to be in 1995. In 1994 the Election Commission had denied the request for the recognition of a communist party, which was a breakaway faction of the Communist Party of Nepal (Unity Center). After the rejection by the Election Commission the party was renamed as the Communist Party of Nepal (Maoist) and the leaders of the party went completely underground in preparation of an armed revolt. February, 13, 1996, marked the initiation of the insurgency in the country, when a series of attacks on government offices were launched in several parts of the country. Baburam Bhattarai, the vice-chairman of the CPN (M), had approached the prime minister with a 40 point memorandum on February, 4, and warned of armed struggle should the government fail to meet those demands by February, 17. Nevertheless, the attacks were launched on February 13, the date the party had decided, instead of honoring the deadline of February 17, as given in the proposal to the government (Thapa and Sijapati, 2004).

As the monarchy ended in 2006, the political parties signed the Comprehensive Peace Agreement in which the Maoist leaders agreed to keep their arms and soldiers in UN monitored cantonments. An agreement was reached to hold a constituent assembly election, as a step towards writing a new constitution. The signing of the Comprehensive Peace Agreement marked the end of the decade long insurgency.

2.5 RESULTS

Table 2.2 shows the results of the OLS and the differences-in-differences estimation. Panel A pertains to OLS estimation and Panel B pertains to the results of the differences-in-differences estimation. The OLS results suggest a significant decrease in the exam passing rate, the exam appearance rate, and the primary schooling completion rate. The coefficient of -0.667 in Column I implies that increasing the intensity of violence by one standard deviation from the mean decreases the passing rate by approximately 0.53 standard deviation. A one standard increase in violence intensity from the mean is equivalent to about 3 additional deaths per 10,000 population. Using the mean population of a district, this translates to 76 additional deaths.

Table 2.2: OLS and Differences-in-Differences Estimation

	Passing Rate	Appearance Rate	Primary Comp
PANEL A: Cumulative Violence			
$violence^a$	-0.667^{**}	-0.987^{***}	-0.016^{***}
	(0.267)	(0.303)	(0.003)
Obs	544	544	544
PANEL B: High versus Low Violence			
$high * post^b$	-3.714^{**}	-2.959	-0.040^{**}
	(1.419)	(1.770)	(0.020)
Obs	248	248	248
District FE	Y	Y	Y
Year FE	Y	Y	Y
Controls	N	N	N

a violence is the cumulative deaths per 10,000 population. *b* high*post is the interaction of whether a district is classified as having high violence and whether the time period of observation is the conflict period. Standard errors are clustered at the district level.

Similarly, a coefficient of -0.987 on the exam appearance rate (Column II) implies that increasing the intensity of violence by one standard deviation from the mean decreases the number of students taking the exam by 0.4 standard deviation. The impact on the primary school completion is also

similar. That is, the same increase in violence intensity decreases the primary school completion rate by 0.55 standard deviation [5].

Another way to understand the magnitude of the effect is to estimate the number of students affected by the war. For example, the drop in the passing rate by 0.667 percentage point means, on average, approximately 4,329 students fail the exam because of the war. Moreover, the decrease in the exam appearance rate by 0.987 percentage points means about 6,118 students did not take the exam at the time of the war[6]. Similarly, the decrease in primary school completion rate by 0.016 percentage points implies that out of those students enrolled in grade 1 approximately 287 students do not transition to grade 5.

This result raises a concern whether the decline in passing rate can be explained by fewer students taking the exam. I use the pre-conflict levels of passing and exam appearance rate to analyze whether the drop in the passing rate can be explained by fewer students taking the exam. In the pre-conflict period 5.381 percent of the total eligible students passed the exam[7] and 16.087 percent of the total eligible students took the exam. If there were a total of 10,000 eligible students (hypothetically), approximately 1608 students would take the exam and 538 students would pass the exam. Hence, out of those students who appear for the exam, about 33 percent of the students pass the exam. Assuming the passing rate would have remained 33 percentage (out of those who appear for the exam) and that the total drop in passing rate in the conflict period is 0.66 percentage points, about half of the drop in passing rate is due to fewer students taking the exam [8].

Panel B of Table 2.2 shows the results of the differences-in-differences estimation for the districts that are classified as the "high" violence districts. Although the results are quite similar to the OLS estimation, the exam appearance rate is no longer significant. Since classifying districts in this way reduces a lot of variation in the data, there is a possibility that the standard errors are a lot higher. Figure 2.2 also suggests no clear evidence on the adverse impact on the appearance rate. The coefficient of -3.714 on the exam passing rate in Column I of Panel B implies that compared to the

[5] I perform the analysis separately for boys and girls. Since there is no differential impact by gender, the results are not reported separately for each gender.

[6] These numbers are calculated based on the secondary school aged population. Since not all secondary school aged youth enroll in school in the presence or absence of a war, the calculated number may be higher.

[7] The total eligible population is aged 15-19. Since the government defined correct-age of students at this level is 16 year old, which is one fifth of 15-19 age groups, I use one fifth of 15-19 year old population as the estimate of the eligible students.

[8] Out of 10,000 students approximate 1510 students appear for the exam and 471 students pass the exam in the conflict period. If we were to assume that 33 percent of students taking the exam would have passed, then 498 students would have passed the exam. The difference in passing rate calculated in this way is 0.33 percentage points (compared to 0.66 percentage points drop). That is, about half of the drop in passing rate is due to fewer students taking the exam.

districts with low violence, the passing rate in the districts with high violence was lower by 3.714 percentage points during the conflict period. This difference translates into a difference in passing rate (between the two groups of districts in the conflict period) of 0.9 standard deviations. In other words, compared to the districts with low level of violence, the passing rate in the districts with high level of violence was reduced by about 0.9 standard deviation during the conflict period. Similarly, the coefficient of the primary school completion rate is -0.040, which means that compared to the districts with low level of violence the primary completion rate in the districts with high levels of violence was lower by 0.04 percentage points (0.4 standard deviation) during the conflict period. All these analysis include district and year fixed-effects and the standard errors are clustered at the district level. Although the results of the differences-in-differences estimation indicate slightly greater negative impact than the OLS results, the magnitude suggested by the coefficients from both estimates are quite comparable.

In addition to the impact of violence on educational attainment, I test whether the negative impact of the violence was due to the reduction in the quality or the accessibility of schools. It is likely that the students fail the exam or drop out of schools because fewer schools remain open or because fewer teachers are available to teach during the conflict period. As such, various measures of quality and accessibility of schools are included in the analysis [9]. In addition to including these measures in the above analysis, I separately analyze these measures as outcomes of interest to test whether the conflict affected the education attainment through a reduction in these measures.

Table 2.3 shows the results of including the measures of quality and accessibility of education as additional controls. The coefficients do not change once these measures are included in the analysis. For comparison purpose, the results of Table 2.2 are also reproduced. Also, for brevity the results of estimating these controls as outcomes of interest are not reported. Out of 8 measures of quality and accessibility of education analyzed, only the coefficient on the percentage of primary school students enrolled in private schools was significantly affected in the conflict period. Hence, the results suggest that the mechanism by which the conflict increased the dropout rate at the primary level and decreased the passing rate at the secondary level is not primarily through the

[9]The measures of quality and accessibility of education are the share of private schools, teacher-to-student ratio, percentage of students enrolled in private schools, and schools per 100 population. All these measures are calculated at the secondary and primary schooling levels.

Table 2.3: Are Performance Declines Due to Reduction in School Quality and Accessibility?

	Passing Rate		Appearance Rate		Primary Comp. Rate	
	I	II	III	IV	V	VI
PANEL A: Cumulative Violence						
violence[a]	−0.929***	−0.856***	−1.227***	−1.143***	−0.015***	−0.015***
	(0.271)	(0.236)	(0.368)	(0.338)	(0.005)	(0.005)
Obs	513	513	513	513	513	513
PANEL B: High versus Low Violence						
high*post	−3.711**	−3.739***	-2.852	-2.945	−0.038*	−0.038**
	(1.421)	(1.131)	(2.221)	(1.770)	(0.020)	(0.018)
Obs	233	233	233	233	233	233
District FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Controls[b]	N	Y	N	Y	N	Y

There are a total of 15 missing observations for controls. Analysis were carried out to see if the missing observations were random. The results are not sensitive to restricting sample to missing observations. *a* Violence is the cumulative deaths per 10,000 population. *b* Controls are share of private schools, teacher-to-student ratio, percentage of students enrolled in private schools, and schools per 100 population. Standard errors are clustered at the district level.

reduction in the availability of teachers or in the availability of schools [10] .

It is plausible that the lack of significance of the measures of quality and accessibility of schools is because the data on the number of schools and teachers are misreported. For example, a school could have remained closed during the time of the war, but the school may not be permanently closed. In that case, the school will be counted as being operational. Hence, it would have been ideal to have data on the length of school year, as the length of school year allows us to understand how much of the reduction in the education attainment was due to disruption in the learning environment. Unfortunately, such data is not consistently available over the period of analysis.

2.6 ROBUSTNESS CHECKS

In this section I perform various tests to check the sensitivity of the results. Firstly, I test whether the results are sensitive to including prior years. The main analysis is carried out including the years 1994-2001. The data on examination passing and appearance rates, however, are available from 1989. Columns II and VI of Table 2.4 reports the results of including years 1989-2001 in the main analysis. For comparison purpose, the main results of Table 2 are also reported in Columns I, V, and IX of Table 2.4. Panel A shows the results of the OLS estimates and Panel B shows the results of the differences-in-differences estimation. As can be seen, the results are fairly robust across the columns, when comparing Column I to Column II and Column V to Column VI. Since the primary school completion data is available from 1994 only, the same robustness check cannot be carried out for the results on the primary school completion rate. A similar analysis was carried out limiting the data to years 1992-2001 and the results remain robust to including these years as well. For brevity, the results are not reported.

All the analysis exclude the initial violence districts (7 out of 75 districts) due to the concerns that the districts from where the violence started may not be comparable to the rest of the country. In Columns III, VII, and X of Table 2.4 I test whether the results are sensitive to excluding those districts. I replicate the main results with the initial violence districts included in the analysis.

[10]There are few missing observation in the measures of quality and accessibility of education. A sensitivity test was performed to test the sensitivity of the results to these missing observations. The results are not sensitive to either restricting the sample to non-missing observations, or accounting for the missing observations.

Table 2.4: Robustness Checks

	Passing Rate				Appearance Rate				Primary Completion		
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
PANEL A: Cumulative Violence											
violence	−0.667**	−0.712**	−0.440***	-0.065	−0.987***	−0.829***	−0.708***	−0.920***	−0.016***	−0.009***	−0.013***
	(0.267)	(0.271)	(0.102)	(0.335)	(0.303)	(0.288)	(0.182)	(0.283)	(0.003)	(0.003)	(0.005)
Obs	544	884	600	544	544	884	600	544	544	600	544
PANEL B: High versus Low Violence											
high*post	−3.714**	−2.920*	−3.948**	0.576	-2.959	0.469	−4.329**	0.548	−0.040**	−0.018	0.031
	(1.419)	(1.500)	(1.351)	(1.338)	(1.770)	(2.331)	(1.913)	(1.675)	(0.020)	(0.029)	(0.041)
Obs	248	403	304	248	248	403	304	248	248	304	248
District FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Controls	N	N	N	N	N	N	N	N	N	N	N
Specification	Main Result	More *Years*[a]	Initial *Districts*[b]	Trend *c*	Main Result	More *Years*[a]	Initial *Districts*[b]	Trend *c*	Main Result	Initial *Districts*[b]	Trend *c*

a Years 1989-2001 included. *b* Initial violence districts included. *c* District-specific linear trends included. Standard errors are clustered at the district level.

Although the OLS results are comparable with the inclusion of these districts (Panel A), the significance of exam appearance rate and primary completion rate changes in Panel B (comparing Column VII to Column V, and comparing Column X to Column IX). This suggests that the decrease in the exam appearance rate is greater, and the decrease in the primary completion rate is lower for those initial districts with violence.

A possible concern is that the districts were in different trajectories in terms of education attainment throughout the periods of observation. In this case, the differences in trend could be falsely attributed to the differences in violence intensity in those districts, or the "treatment" (violence upsurge) could be correlated with the trend in the education attainment. In Columns IV, VIII, and XI of Table 2.4 I include district-specific linear time trends in addition to district and year fixed effects. As expected, including district-specific linear time trend reduces the magnitude of the coefficients and the standard errors increases. The results, however, are comparable to the main results (Column I, V, and IX). In Columns IV, VIII, and XI of Panel B the coefficients are not different from zero. This could also be expected, because of the small sample size, the district and year fixed effects, and the inclusion of the district-specific trends in addition to categorizing districts into the two groups[11].

Lastly, I perform a falsification test where I assign the violence measure to the pre-conflict level of education attainment and test the relationship between violence and examination outcomes. In Column I and Column III of Table 2.5 I assign all the six years of violence measure to the examination outcomes in the six years prior to the conflict in the reverse order. For example, I assign the 2001 violence to the 1989 examination outcome, the 2000 violence to the 1990 examination outcome, and so on. As an additional falsification test, in Column II and Column IV of Table 2.5 I assign the violence measure of the last three years of conflict to the education outcomes to the first three years prior to the conflict. That is, I assign the 1999 violence to the 1993 education outcome, the violence in 2000 to the 1994 education outcome, and the violence in 2001 to the 1995 education outcome. As the results of Table 2.5 show, there is no relationship between the violence measure and the examination outcomes.

[11]I performed the same test using 1989-2001 data to allow for more observations. I find that the signs and significance of the coefficients of Panel B are comparable to the main results, although the magnitude of the coefficients are reduced.

Table 2.5: Falsification Tests

	Passing Rate		Appearance Rate	
	I	II	III	IV
Violence	-0.059	0.147	0.239	0.234
	(0.075)	(0.124)	(0.144)	(0.204)
Obs	408	408	408	408
District FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Controls	N	N	N	N
Specification	2001-1997 violence assigned to 1989-1994 outcome	1999-2001 violence assigned to 1993-1995 outcome	2001-1997 violence assigned to 1989-1994 outcome	1999-2001 violence assigned to 1993-1995 outcome

Standard errors are clustered at the district level.

2.7 CONCLUSION

I find a significant negative impact of exposure to violence on student performance. In the wake of conflict, the primary school students are likely to drop out of school. Similarly, the secondary school aged youth are likely to fail the national examination at the transition between the secondary school and the high school. The mechanism of this adverse effect is not primarily through a reduction in the availability of schools and teachers. The increase in opportunity cost of education and disruption in learning environment, therefore, could be possible reasons behind the adverse effects.

The students who drop out of school are least likely to continue schooling later in life. Hence, creating job opportunities for youth through vocational training is arguably the fastest and surest way of achieving peace via increasing the opportunity cost of joining a rebel group. In this sense, programs like "Jobs for Youth" launched by the UN in Nepal are invaluable at engaging youth in productive activities. Even though the population directly and indirectly impacted by war may be the "lost generation," failure to take appropriate measures in the short-term could severely hinder peace prospects and long-term growth possibilities. This paper is a step towards arguing for increase attention towards identifying the border impact of conflict with hopes to aid policies to effectively target the affected youth. Studies analyzing the impact of violence focus on the children directly involved in war as child soldiers and use the remaining children as counterfactuals. The severe reduction in education attainment found in this study points out the need to incorporate the remaining children in the analysis, too.

3.0 MYOPIC GOVERNMENT AND STRATEGIC REBELS: EXCHANGE AND ESCALATION OF VIOLENCE

For evil to flourish, all that is needed is for good people to do nothing. - Edmund Burke

3.1 INTRODUCTION

What contributes to the escalation of violence? Why are some wars relatively more peaceful than the others? These are the central questions of conflict studies. These questions are even more important when the type of war in question is a civil war. In such a case, why doesn't the government simply wipe out the insurgents right from the start? This is especially perplexing given that the rebels are usually relatively weak at the beginning of an insurgency. How is it possible that an armed group smaller in size, weaker in arms-strength, and newfound in ideology successfully revolts against a government that is much bigger, much stronger, and more deeply established?

Researchers argue that the answer lies in the structural roots of the country (like poverty and low literacy rates), in the differences in set of skills, motivations, and resources that insurgents have, and in the manner in which the government tackles an insurgency. The researchers who view the structural roots as important determinants of a war attributes argue that socioeconomic characteristics of a country make the country vulnerable to outbreak of war. Although this conceptualization has been the focus of most empirical studies of the attributes of war upsurges, it is not the most convincing argument as the empirical evidence remains mixed and fails to explain why the "root conditions" are pervasive in areas where civil wars are not (Collier et al, 2000; Fearon and Laitin, 2003). In regards to this critique, Mesquita (2010) builds a theoretical model to argue that there exist multiple equilibria in a game where the structural roots of a country facilitate or

hinder rebellious activities. Depending on the strategy that the population plays, the same "root conditions" can lead to an outcome with a revolution as well as one without.

Many authors argue that the violence perpetrated by insurgents is both a means to achieve their goal and an outcome of the environment in which they find themselves. More precisely, rebels use violence to signal the weakness of the government (Ginkel and Smith, 1999), or to signal their own strength to the government (Lepan and Sandler, 1993; Overgaard, 1994). Bloberg, Hess, and Weerpana (2004) present a scenario in which a terrorist uses different degrees of violence as a strategic response to information about the government's willingness to expand economic or political freedom. In a series of papers Mesquita models situations in which the insurgents use violence to increase participation by increasing anti-government sentiments (Mesquita, 2010; Mesquita and Dickson, 2007; and DeNardo, 1985). Kalyvas (1999) presents a host of motivations behind the use of violence against the citizens using the case of Algeria. While these studies focus on a rebel group's motivation to instigate violence in a theoretical setting, empirical research also finds the level of violence to be dependent on insurgent's motivation to revolt (Fearon and Laitin, 2003).

Besides understanding the motivations behind a rebel group's use of violence, a principal question in conflict studies is the reason behind a government's lack of full response to an armed threat. It is clear that even when the government is actively participating in abating a conflict situation at hand, a rebellion still grows in size and capacity. As such, it must be the case that the government's actions somehow facilitate the growth of rebellious activities. This brings us to question the reason behind the government's failure to abate the insurgency, despite having the objective and the capacity of doing so. Many researchers argue that governments engage in less than optimal counterinsurgency practices because of a threat of backlash, the government use of violence can lead to more violence, or simply because the government neglects the insurgency and is more concerned with other issues.

The possible threat of backlash is a much-studied factor in the lack of a full response by the governments. If any action the government takes will result in retaliation by the rebels, then the rational strategy is to take non-stringent actions. In certain situations where the voters elect politicians, the voters may be more concerned about their safety and choose to elect a government that is not as proactive in responding to rebellious activities. As such, the voter's preference to minimize the threat of backlash induces the government to be less active than the government would have otherwise been. Whether it is the voter's desire for minimal backlash or government's willingness to let the rebellious activities grow for the safety of the larger population, this explanation is very well

suited to study international terrorism (Siquira and Sandler, 2007; Acre M. and Sandler, 2005). When two nations are faced with a common terrorist, one of the countries (who is the primary target) engages in proactive responses, while the other needs to support that country. Should the country support the harder hit country, there is a possibility of attack by the terrorist group or by its sympathizers. Some commonly cited examples are the Madrid bombing in March, 2004 and the London subway and bus bombings in July, 2005, which were likely the result of Spain's and Britain's support for the United States-led war on terrorism. As such, if a threat of backlash is credible for a country that is thought to be a hardliner in antiwar measures, it is a rational strategy for the government to remain relatively passive (Berman, Shapiro, and Felter, 2008).

A major problem with assuming that a threat of backlash prevents a government from taking effective counterinsurgency measures is that such a threat is not credible when the insurgency is at its infancy. A key characteristic of an insurgency is the relative weakness of insurgents during its initial phase. While backlash is a plausible concern for a country, such a setting is more applicable to the case of international terrorists than to the case of domestic uprisings.

A second concern facing the government is that any proactive measure the government takes may help the rebels gain more sympathizers. Rosendorff and Sandler (2004) present a scenario in which proactive government policy leads to grievances, which helps terrorists recruit more sympathizers. Similarly, Mesquita and Dickson (2007) model a situation where the rebels use violence to trigger government crackdown, which will further help the rebels mobilize the population. In their model the government response causes either economic damage, or simply changes the population's assessment of the government in favor of the rebels. In identifying the relationship between economic opportunities and participation in rebellious activities, Bueno de Mesqutia (2005) show how governmental crackdown can have competing effects. In his model, a counterinsurgency measure can decrease the ability of a terrorist to carry out successful attacks, while the same action can also make it easier for the terrorists to recruit sympathizers. Lichach (1987) proposes classifications of government's action and its various impacts on an opposition group's actions. More specifically, the author models how a government's repression of nonviolent activities and inconsistent policies can increase violent activities of the opposition group.

Lastly, the government may take less stringent countermeasures simply because of neglect or lack of concern. The government may be more concerned about reelection than the insurgency problem at hand, or it may simply represent the population's preferences (Siquira and Sandler, 2007) for free riding on another country's defense spending. The possibility of acquiring external

military aid can also lead to the government neglect of insurgency (Felter, 2005).

Considering that a government's lack of full response is the most perplexing and the most significant determinant of war upsurges and that the studies thus far focus only on the threat of backlash as a bottleneck in effective counterinsurgency practices, I propose a model in which the innate inability of the government to fully comprehend the ramifications of their action leads to underinvestment in counterinsurgency measures. Such a model is better suited to study internal conflicts. The government is myopic in their ability to foresee the long-term consequences of their action (or inaction). The government may be myopic for various reasons, such as the inability to foresee future rebel growth if left unrestrained, the incapability to fully understand the initial rebel capacity, or simply because of indifference towards the rebellious activity. The rebellion group, on the other hand, need to grow in sheer size and capacity. As it is typical for the group to start with lower levels of resources, the group needs to be strategic for them to be able to thrive and revolt against a much-established authority.

The myopia of the government and the rebel's strategic nature allows the rebels to further thrive. It is the inability to foresee the full extent of impact an issue may generate that leads to *ad hoc*, inconsistent, and arbitrary government responses or policies. This short-sightedness causes the government to delay what would be an appropriately severe response until it is too late. The rebels are aware of this and thus are able to manipulate it to their advantage.

To model this phenomenon, I assume that the government's objective is to minimize the probability of a revolt, while the rebels seek to maximize the same probability subject to a constraint. Any action that the government takes in the current period will have ripple effects into the next period. For example, any crackdown on insurgency related activities in the current period hinders the ability of the insurgents to carry out successful revolt in the next period. The mechanism may be due to destruction of rebel resources, or simply a breakdown of rebel morale. A perfectly foresighted government is able to realize that their action today continues to affect the rebel's actions tomorrow. A myopic government, however, engages in *ad hoc* responses only. As the government is unable to realize the full extent of consequences of their actions, their response is based on their limited perception of reality. The rebels are strategic in that they are not only able to understand the full extent of government's action, but they are able to use the government's myopia to their advantage. Such interaction determines the exchange of violence between the two parties and the escalation of violence.

A key difference between most of the current literature and this study is that it is customary to

assume a government crackdowns to either help a rebel group gather more sympathizers or have the dual effect of creating grievance and limiting the rebellious activities. Knowing that any violence instigated by the government will further lead to higher violence or higher grievance, the government engages in less stringent countermeasures. The setting of this study is such that any countermeasure a government takes can only lower a rebel group's capacity to carry out a successful revolt. It is almost natural to find that when the government's action has dual effects or only negative effects, a government that is concerned about minimizing violence will resort to less stringent actions. In situation where any action a government takes can only reduce the likelihood of a revolt, however, the same cannot be said. It is even more important to understand the circumstances that give rise to higher levels of violence even in situations where the government crackdowns can lower the rebel's use of violence. As such, our search is for an understanding of exchange of violence between a government and an opposition group and of violence escalation that captures the dynamics of war during the initial phase, yet is conceptually tractable, and thus able to provide a basis of further analysis.

I find that a fully informed government takes an action that is equal to or less than that of the rebels. Knowing that their efforts in this period will help minimize the chances of revolt in the next period, the government will take a higher action in the current period and lower action in the next period. In this setting, the rebels being strategic is advantageous for them in that they choose lower action in the current period for higher action in the later period when the government is unlikely to respond as harshly. Similar to (Berman, Shapiro, and Felter (2008) I find that a myopic government is proactive when rebels are weakly entrenched. When the government is myopic, the rebels choose a high level of violence, thereby making it too costly for the government to respond. The government, therefore, takes no action and a revolt is certain to happen in each period. This result is independent of the effectiveness of the government's action and the degree of myopia. Although the rebels exploit the first-mover's advantage to drive the government's response to zero, the result that a myopic government underinvests in countermeasures is not completely driven by the rebel's first-mover's advantage.

An interesting result is that in case of a fully informed government, the exchange of violence between the government and the rebels are strategic complements. That is, higher levels of rebel violence will be met by higher levels of government crackdowns. The resulting violence, therefore, is relatively low. When the government is myopic, however, the violence by the rebels and the government crackdown are strategic substitutes. In such a case the rebels will choose high levels

of violence, thereby rendering any government action too costly for the government to undertake. A simple inability to foresee long-term consequences of their actions leads to such stark difference in the nature of exchange of violence by the two parties. Most of the theoretical studies (the aforementioned studies) and empirical research (Bohara et al, 2006) find the exchange of violence to be strategic complements. As such, the competing nature of violence between the two parties give rise to higher level of violence. In this study I find that when the two parties are strategies complements in their use of violence the resulting violence is lower than when the their use of violence are strategic substitutes.

An implication of this study is that if we are concerned about an outbreak of a revolt, then it is clear that a myopic government allows a revolt to happen more so than a fully informed government. If violence is violence regardless of the source that generates it, then the violence by the government is higher in the full information case. It is, therefore, more desirable to be in the myopic situation. This result suggests that if we are concerned about rebels gaining momentum, then the myopic government provides an opportunity that facilitates further rebel movement and we would prefer to be in a world with a fully informed government. On the other hand, if the government's use of violence is viewed as negatively as the rebel use of violence, then having a fully informed government leads to higher violence and lower chances of revolt. The trade-off, according to the model, lies in exchanging higher levels of government violence for higher chances of revolt. Recent cases of uprisings in Egypt and other Middle Eastern countries stand out as examples that having a revolt may not necessary be an undesired outcome.

The organized of this Chapter is as follows. The Model is presented in Section 3.2, followed by Comparative Stats in Section 3.3. In Section 3.4 I propose two extensions of the Model. In it, I check whether the results of a myopic government are driven by the first-mover's advantage that the rebels have in the basic setting or whether the results are due to the complete ignorance of the government ("extreme myopia"). The limitations of the study and further extensions are proposed in Section 3.5, and I conclude in Section 3.6.

3.2 THE MODEL

The Government (G) and the Rebels (R) play a sequential game in which the Rebels move first (choose a level of violence) and the Government responds to that level of violence. Both parties (G

and R) are similar in their objectives and constraints. The difference between the two lies in the timing of their move and in the foresightedness of the Government. There are two time periods $\{0, 1\}$ and the Rebels move first in each period followed by the Government. Since the Rebels move first, they use backward induction to solve for the Government's optimal actions in each period to determine their own best response to those actions. That is, the Rebels start out with the Government's response in the last period and use the information to make decisions on their actions in an achronologically backward order.

The objective of the Government is to minimize the probability of a successful revolt subject to a constraint, whereas the Rebels seek to maximize the same probability subject to a similar capacity constraint. The probability of a successful revolt in each period is

$$\pi^0 = \frac{A_R^0}{A_G^0 + A_R^0}, \pi^1 = \frac{A_R^1}{A_G^1 + \delta A_G^0 + A_R^1}. \tag{3.1}$$

Where, $\delta \succ 0$ is a portion of the Government's action in $t = 0$ that affects the probability of revolt in $t = 1$. This means that the action the Government takes in $t = 0$ destroys the rebel resources in a way that the rebels will have to recover those losses. For example, government crackdown may capture the rebel's headquater or kill their fighters, which will have to be recovered in the next period. Alternatively, it could also mean that any resources the Government leaves to rebels in one period can be used to the rebel's advantage in the next period. δ can also be interpreted as the effectiveness of the Government's action today in hindering Rebel's prospects in the later period.

The only difference between a fully informed Government and a myopic Government is in the knowledge of δ. A fully informed government knows that their action today will have an effect on reducing the likelihood of revolt in the following time period, whereas a myopic government assumes no such possibility ($\delta = 0$). Rebels are strategic in that they know whether the government is myopic or not, and take that into account when making their own decision when choosing a level of violence. This case is presented in the next Section.

For the probability to be well defined and to avoid imposing additional assumptions, let $A_i^t \succ 0$, $i = \{G, R\}$. This means that any action the Government (Rebels) takes can only reduce (increase) the likelihood of a successful revolt. If $A_G^t \prec 0$, then the Government's action could potentially help the Rebel's objective of having a revolt. Finally, if both the Government and the Rebels take no action, then there is a fifty percent chance of having a revolt. The Government gets no utility if a revolt is to happen, and a utility of $1 - \gamma A_G^1$ if there is no revolt. A revolt can signify regime change,

or simply a successful mass mobilization against the Government. Regardless of the extremity of the situation, having a revolt is a disutility that the Government seeks to minimize.

The utility of the Government and the Rebel are

$$U_G = \{1 - \pi\} - \gamma A_G;$$

$$U_R = \pi - \gamma A_R.$$

Any action each party (Government and Rebels) takes has a constant marginal cost of $\gamma \succ 0$. The actions can be interpreted in many ways. While the Government's action can be any counterinsurgency practices, ranging from engaging in arms race with insurgents to using diplomatic tactics, Rebels actions are directly related to infiltrating violence. For the purpose of this study, I interpret the Government's action as being directly related to responding to Rebel's actions. Any action the Rebels take contributes to the likelihood of a successful revolt, and any action the Government takes counterbalances the Rebel's efforts.

As there are two time periods and the Rebels move first, we begin with the last period and use backward induction to solve for the Government's response. This Section presents the results when the Government is fully informed. As mentioned earlier, all the structures of the game are the same in both cases with the only difference being that a myopic Government assumes $\delta = 0$.

In the last period ($t = 1$) the objective of a fully informed Government is to maximize

$$\frac{A_G^1 + \delta A_G^0}{A_G^1 + \delta A_G^0 + A_R^1} - \gamma A_G^1. \tag{3.2}$$

Solving the first order condition, the optimal response of a fully informed Government in the last period is

$$A_G^{1*} = \sqrt{\frac{A_R^1}{\gamma}} - A_R^1 - \delta A_G^0 \tag{3.3}$$

Note that for $A_G^{1*} \succ 0$ we need $(\sqrt{\frac{A_R^1}{\gamma}} - A_R^1) \succ \delta A_G^{0*}$. Given the Government's response is A_G^{1*} (Equation 3.3), the probability of a successful revolt in $t = 1$ is

$$\pi^1 = \frac{A_R^1}{A_R^1 + A_G^{1*} + \delta A_G^0}, \tag{3.4}$$

Or,

$$\pi^1 = \sqrt{\gamma A_R^1}. \tag{3.5}$$

As the Rebels move knowing the Government's response (use backward induction), the Rebels take A_G^0 (given in this period) and A_G^{1*} (derived in Equation 3.3) into account when choosing their optimal action. Unlike the Government, the Rebel's objective is to maximize the probability of a successful revolt. Now that the Government's response and the probability of revolt in $t = 1$ is determined, the Rebel's objective is to maximize

$$\sqrt{\gamma A_R^1} - \gamma A_R^1. \tag{3.6}$$

Similar to the Government, the Rebels get no utility if there is no revolt. The Rebel's optimal action, A_R^{1*}, is

$$A_R^{1*} = \frac{1}{4\gamma}. \tag{3.7}$$

As such, the Government's response and the resulting probability of a successful revolt in $t = 1$ are

$$A_G^{1*} = \frac{1}{4\gamma} - \delta A_G^0, \tag{3.8}$$

$$\pi^1 = \frac{1}{2}. \tag{3.9}$$

Likewise, in $t = 0$, the Rebels base their decision on knowing the Government's response. In $t = 0$ the Government's objective is to maximize

$$\frac{A_G^0}{A_R^0 + A_G^0} - \gamma A_G^0 + \beta\left[\frac{A_G^{1*} + \delta A_G^0}{A_R^{1*} + A_G^{1*} + \delta A_G^0} - \gamma A_G^{1*}\right]. \tag{3.10}$$

Where, $\beta \succ 0$ is a discount factor. Substituting the optimal Government's response from Equation 3.8 and the Rebel's optimal response from Equation 3.7 in Equation 3.10, the Government's objective in $t = 0$ is to maximize

$$\frac{A_G^0}{A_R^0 + A_G^0} - \gamma A_G^0 + \beta\left[\frac{1}{4} + \gamma\delta A_G^0\right]. \tag{3.11}$$

Solving the first order condition, the optimal response of a fully informed Government in $t = 0$ is

$$A_G^{0*} = \sqrt{\frac{A_R^0}{\gamma(1-\beta\delta)}} - A_R^0. \tag{3.12}$$

For $A_G^{0*} \succ 0$ $A_R^0 \prec \frac{1}{\gamma(1-\beta\delta)}$. Also, $\beta\delta \prec 1$ for A_G^{0*} to be well defined. For the remainder of this study $\beta\delta \prec 1$ is assumed to hold.

Given the Government's response in Equation 3.12, the probability of a successful revolt in $t = 0$ is

$$\pi^0 = \frac{A_R^0}{A_R^0 + A_G^{0*}},$$

or,

$$\pi^0 = \sqrt{\gamma(1-\beta\delta)A_R^0}. \tag{3.13}$$

Knowing the Government's reaction and the resulting probability of a successful revolt, the Rebel's objective is to maximize

$$\sqrt{\gamma A_R^0} - \gamma A_R^0 + \beta\left[\frac{A_R^{1*}}{A_R^{1*} + A_G^{1*} + \delta A_G^0} - \gamma A_R^{1*}\right]. \tag{3.14}$$

The Rebel's optimal action in $t = 0$ is

$$A_R^{0*} = \frac{(1-\beta\delta)}{4\gamma}. \tag{3.15}$$

Finally, the Government's response in $t = 0$ is solved by substituting the Rebel's optimal action (Equation 3.15) in Equation 3.12. That is

$$A_G^{0*} = \frac{(1+\beta\delta)}{4\gamma}. \tag{3.16}$$

In summary, the actions of each parties in case of a fully informed Government are

$$A_G^{0*} = \frac{(1+\beta\delta)}{4\gamma}; A_R^{0*} = \frac{(1-\beta\delta)}{4\gamma}; A_G^{1*} = \frac{1-\delta(1+\beta\delta)}{4\gamma}; A_R^{1*} = \frac{1}{4\gamma}, \tag{3.17}$$

and the resulting probabilities of a successful revolt in each period are

$$\pi^0 = \frac{1-\beta\delta}{2}; \pi^1 = \frac{1}{2}. \tag{3.18}$$

Proposition 3.2.1. *A fully informed Government engages in crackdown in $t = 0$ that is higher than the Rebel's use of violence in $t = 0$ and their own action in $t = 1$. In $t = 1$ the Rebels engage in higher violence than the Government and their own level of violence in $t = 0$.*

Since $\beta\delta \succ 0$, it is straightforward that $A_G^{0*} \succ A_R^{0*}, A_G^{1*} \prec A_R^{1*}$ and $A_R^{0*} \prec A_R^{1*}$. Now, $A_G^{0*} \succ A_G^{1*}$ if $\frac{1+\beta\delta}{4\gamma} \succ \frac{1}{4\gamma} - \delta\left[\frac{1+\beta\delta}{4\gamma}\right]$. Upon further simplification, the condition becomes if $1+\beta+\beta\delta \succ 0$. This condition is satisfied, since $\beta, \delta \succ 0$.

Furthermore, when the Government is fully informed, the probability of revolt in t=0 is less than half. Given the actions of the both parties, the probability of revolt in t=0 is $\pi^{0*} = \frac{1-\beta\delta}{2}$. Since $\beta\delta \succ 0$, $\pi^{0*} \prec \frac{1}{2}$. Figure 3.1 and Figure 3.2 show the reaction of the Government with respect to the Rebel's use of violence. In t=0, the Government's countermeasure surpasses the Rebel's action.

In the next period ($t = 1$), the Rebel's take higher action that the Government. As the fully informed Government overinvests in the earlier period, the action in the later period need not be that high. Since the Rebels base their decisions of violence taking into account the Government's response, this leads to their actions to be independent of the parameters in $t = 1$ other that the cost of taking an action. The Rebels trade lower violence in the current period for higher violence in the next period when the violence is unlikely to be met quite as harshly, whereas the Government tradeoff higher crackdown in the current period for lower effort in the next period.

Note that since $A_R^{0*} \prec \frac{1}{4\gamma(1-\beta\delta)}$, a fully informed Government's action is increasing in the Rebel's action. As Figure 3.1 shows, when the action of the Rebels range from 0 to $\frac{1}{4\gamma(1-\beta\delta)}$, the Government's response and the Rebel's actions are complementary. Hence, the two actions are strategic complements, such as Bertrand type competition, albeit the game is not simultaneously played. The two parties are neither strategic complements nor substitutes in t=1. If the Rebel's are to resort to higher violence ($\succ \frac{1}{2}$), the actions by the two parties are strategic substitutes. However, if the Rebel's were to engage in lower levels of violence, the two parties are strategic complements.

3.2.1 Myopic Government

All the structures of the game are the same as in the previous Section. Similar to the main Model (full information case), the Government and the Rebels play a sequential game in which the Rebels move first. The Rebels, therefore, start out with the Government's response in the last period and use the information to make decision on their actions in achronologically backward order. While

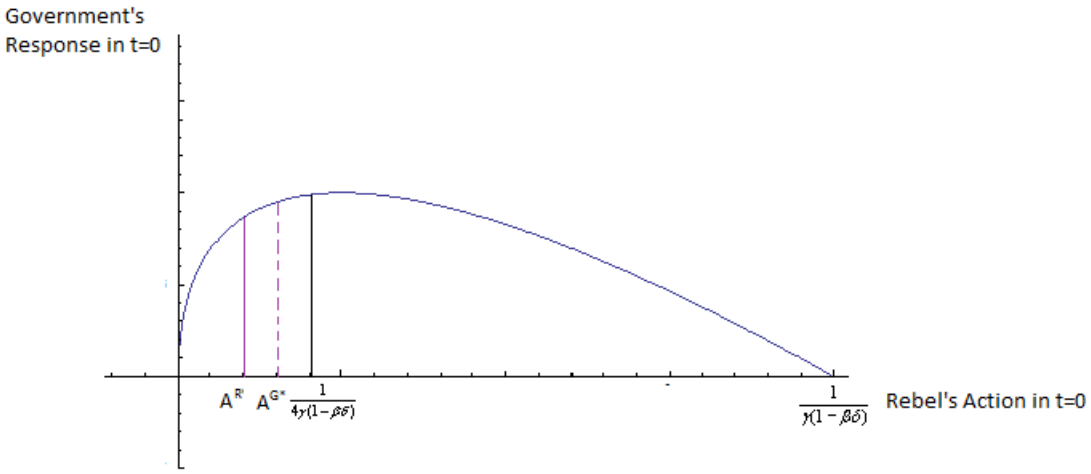

Figure 3.1: The Government and Rebels Actions in t=0

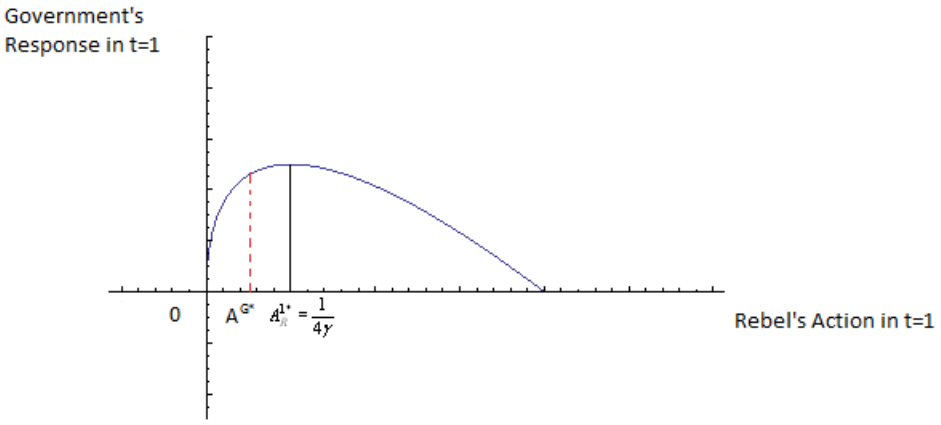

Figure 3.2: The Government and Rebels Actions in t=1

the objective function of a myopic Government is the same as that of a fully informed Government, the myopic Government assumes $\delta = 0$. The Rebels not only take δ into account, but also know that the government assumes $\delta = 0$.

Since the myopic Government assumes $\delta = 0$,

$$\pi^0 = \frac{A_R^0}{A_R^0 + A_G^0};$$

$$\pi^1 = \frac{A_R^1}{A_R^1 + A_G^1}.$$

Moreover, the Government's objective function in each period is

$$\frac{A_G^t}{A_R^t + A_G^t} - \gamma A_G^t.$$

The Best Responses of the Government are

$$A_G^{0*} = \sqrt{\frac{A_R^0}{\gamma}} - A_R^0, \tag{3.19}$$

$$A_G^{1*} = \sqrt{\frac{A_R^1}{\gamma}} - A_R^1. \tag{3.20}$$

For $A_G^{t*} \succ 0, A_R^{t*} \prec \frac{1}{\gamma}$. Also, $A_G^{t*} = 0$ if $A_R^{t*} = 0$, or if $A_R^{t*} = \frac{1}{\gamma}$. The Government's optimal response is the same as the optimal response in the full information case, except that $\delta = 0$ when the Government is myopic. When the Government is myopic, the actions reflect *ad hoc* responses to the Rebel's actions. This is so, because there is no account for future when making decision in the current period. As such, each period presents a separate problem for the government, which is solved as though the problem is relevant for that period only.

With the given myopic Government's Best Response, the probability of revolt is:

$$\pi^0 = \sqrt{\gamma A_R^{0*}} \tag{3.21}$$

$$\pi^1 = \frac{A_R^1}{\sqrt{\frac{A_R^1}{\gamma}} + \delta(\sqrt{\frac{A_R^0}{\gamma}} - A_R^0)} \tag{3.22}$$

The Rebels factor in the Government's myopia and know that regardless of the Government's awareness the Government's actions have far-reaching consequences for them. The Rebels are not

only forward looking in that they are aware of the effects of the Government countermeasures in the likelihood of revolt in the future, but they are also aware of the extent of effectiveness of the countermeasures. In the last period the Rebels choose A_R^1 to maximize

$$\frac{A_R^1}{\sqrt{\frac{A_R^1}{\gamma}} + \delta(\sqrt{\frac{A_R^0}{\gamma}} - A_R^0)} - \gamma A_R^1. \tag{3.23}$$

The First Order Condition is

$$\frac{1}{\sqrt{\frac{A_R^1}{\gamma}} + \delta A_G^{0*}} - \frac{\sqrt{A_R^1}}{2\sqrt{\gamma}\left[\sqrt{\frac{A_R^1}{\gamma}} + \delta A_G^{0*}\right]^2} - \gamma = 0. \tag{3.24}$$

Proposition 3.2.2. *When the Government is myopic, the Rebels choose maximum possible violence. As it is too costly for the Government to respond to that level of Rebel violence, the Government will take no action. The revolt, therefore, is certain to happen in each period.*

Proof of Proposition 3.2.2 is provided in Appendix 1. The maximum level of violence that the Rebels can engage in without incurring negative utility is $\frac{1}{\gamma}$. At this level of violence, the Government will take no action and the Rebel get utility of 0. Although the Rebels can take lower action to gain positive utility, the Government will respond to such lower action. Similarly, the Rebels could engage in higher level of violence and gain negative utility. Therefore, in order to force the Government to take no action, the Rebels will take minimum possible action to drive the government response to zero and gain 0 utility in return. Put differently, below $\frac{1}{\gamma}$ Rebel's utility is increasing in their action because of the decreasing Government response to their action. But, once the Government action (or response) is 0, the gains from the Government's response disappear and increasing Rebel action decreases their utility. Since the Government's response is the same in each period, the Rebels will engage in the same level of violence in each period. This means, a successful revolt is certain in each period.

Figure 3.3 plots the Government's response function and the Rebel's use of violence in each period. Note that as $A_R^{t*} = \frac{1}{\gamma}$, the two sided violence are strategic substitutes. When the Government's use of violence is a strategic substitute of Rebel's use of violence, the Rebels being strategic and the first-mover engage in maximum level of violence, thereby making it too costly for the Government to respond.

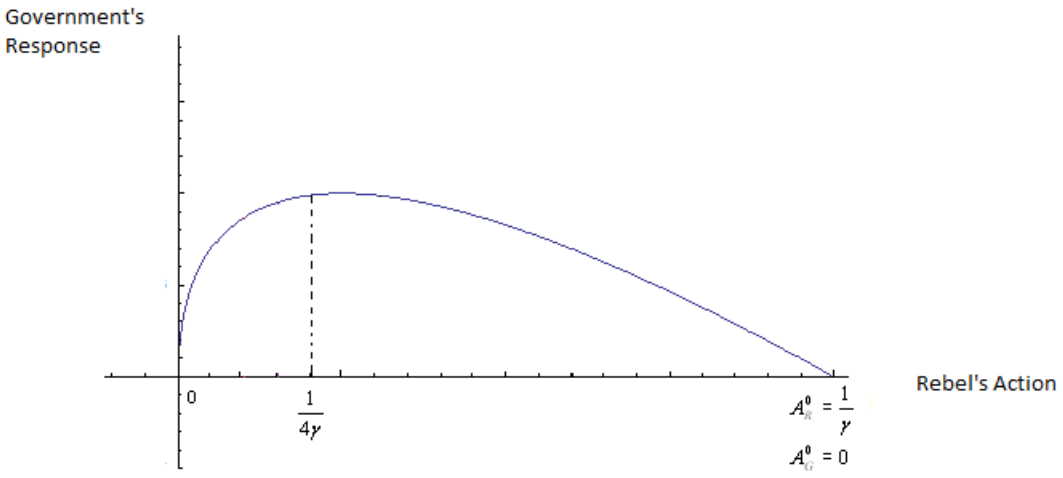

Figure 3.3: The Myopic Government's and Rebel's Actions in Each Period

3.3 COMPARATIVE STATS

In this Section I compare the two cases (fully informed and myopic Government), and provide comparative stats with respect to δ.

Proposition 3.3.1. *A myopic Government's investment in counter-insurgency is lower than a fully informed Government's investment, while the Rebels engage in higher violence when a Government is myopic.*

A fully informed Government's action in is always greater than zero (Equation (3.17)), whereas a completely myopic Government's response is zero. Likewise, the total Rebel violence when a Government is fully informed is $\frac{2-\beta\delta}{4\gamma}$ (Equation (3.7) and (3.15)), whereas the total Rebel violence when a Government is myopic is $\frac{2}{\gamma}$. The total Rebel violence in the myopic case is greater than the total violence in the full information case if $\frac{2}{\gamma} \succ \frac{2-\beta\delta}{4\gamma}$. Upon further simplification, if $8 \succ 2-\beta\delta$, the Rebel's use of violence in case of a myopic Government is greater than the Rebel's use of violence in case of a fully informed Government. Since $\beta\delta \leq 1$, $8 \succ 2-\beta\delta$. Hence, even though the Rebels exchange higher levels of violence, a myopic Government's response is lower than a fully informed Government.

For simplicity of further comparative statistics let $\beta = 0.5$ and allow δ to vary. As such, the

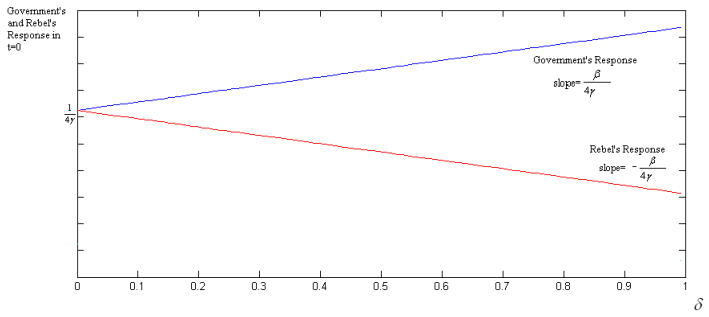

Figure 3.4: Government and Rebel Actions in t=0 when the Government is Fully Informed

comparative stats with δ will be of primary focus. Figure 3.4 plots Government's and Rebel's action in t=0 in the case of a fully informed Government. For a given β, the Government's action is always greater than the Rebel's in case of a fully informed Government, whereas the action is independent of δ when the Government is myopic. The Government's action in the full information case is an increasing function of δ, while the Rebel's action is decreasing in δ. Smaller values of δ implies ineffectiveness of Government's action in the present to abate the chances of revolution in the next period. When $\delta = 0$ the probability of revolt in each period is half. As δ increases, the Government trades-off higher action in the present for lower action in the future. Knowing this, the strategic Rebels take lower action in the present. A myopic Government's response is independent of δ, since the Government is unaware of δ. In this case, the Rebels have the first-mover advantage and take an action that is too costly for the government to respond to.

Even when the effectiveness of the Government crackdowns (δ) is low, the Rebel violence in the full information case never reaches the maximum possible level like in the myopic case. This is so, because when δ is low a fully informed Government takes this knowledge into account to take some action, which binds the Rebel's action. On the other hand, when the effectiveness is low and the Government is unaware of this ineffectiveness, then the Government's action is unable to restrict the Rebel's use of violence. With increasing effectiveness, the Rebels are cautious enough to engage in lower levels of violence.

In case of a fully informed Government, the Rebels take a fixed action ($A_R^{1*} = \frac{1}{4\gamma}$) and the Government respond by taking a less stringent action in t=1. As mentioned earlier, when $\delta = 0$, both parties take the same action and the probability of a revolt is half. As δ increases, the

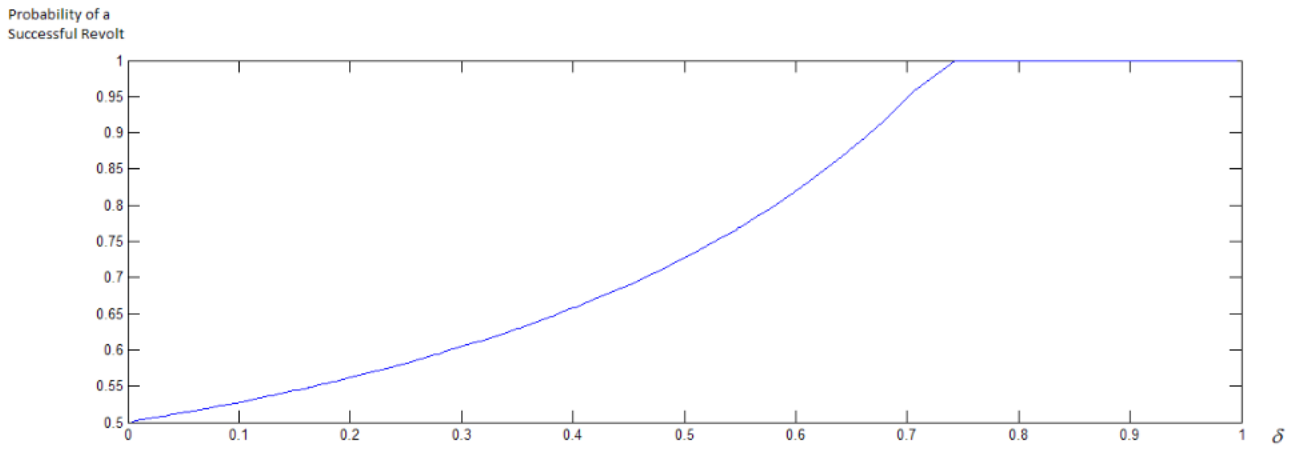

Figure 3.5: Probability of a Successful Revolt in t=1 when the Government is Fully Informed

Government takes less stringent action, which becomes zero for larger values of δ. Hence, even though the Rebels take lower action in t=1 than in t=0, the chances of revolt in t=1 increases with δ due to shirking Government's response in t=1.

Figure 3.5 plots the probability of revolt in the second period of a fully informed Government. The likelihood of a revolt is increasing in δ and a revolt becomes certain once the Government's response reaches zero. In this situation, the Rebels seek to maximize the probability of revolt in t=1 and choose lower level of violence in t=0 when the action is likely to be met harshly. Figures 3.6 and 3.7 plot the Government's and Rebel's actions of a fully informed Government in each period with varying marginal cost. If the marginal cost of taking an action is, the resulting violence is higher. The overall dynamics, however, remains the same. A summary of each party's actions in each period and the probability of a successful revolt is outlined in Figure 3.8.

3.4 EXTENSIONS

The result that a revolt is certain in each period in case of a myopic Government may be driven by the Rebels having the first-mover's advantage or by the "extreme" myopia of the Government. The myopia is extreme in that the Government is completely unaware of the ramifications of their

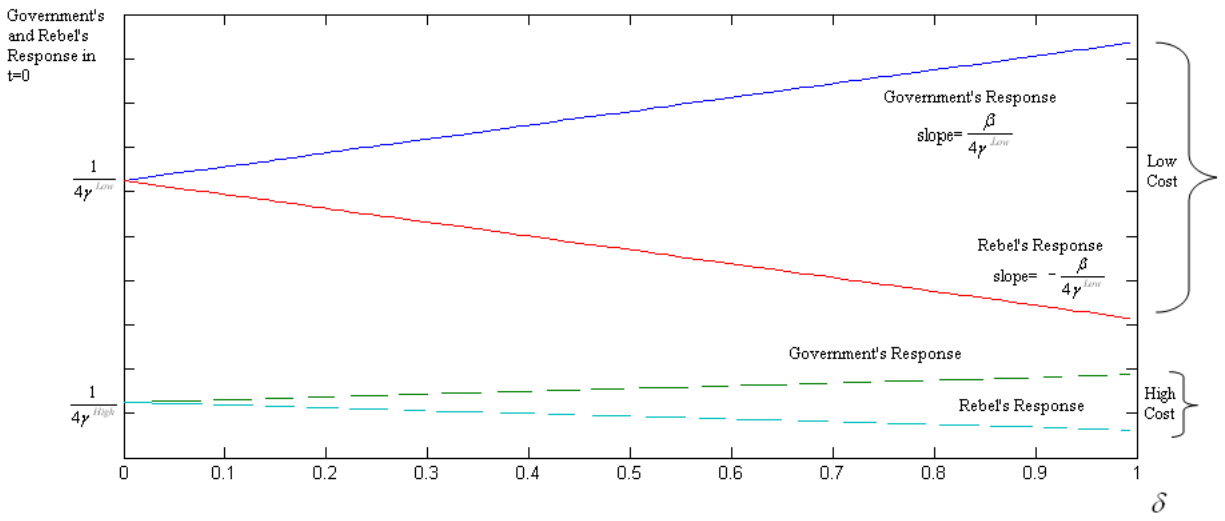

Figure 3.6: Government and Rebel Actions in t=0 with varying cost when the Government is Fully Informed

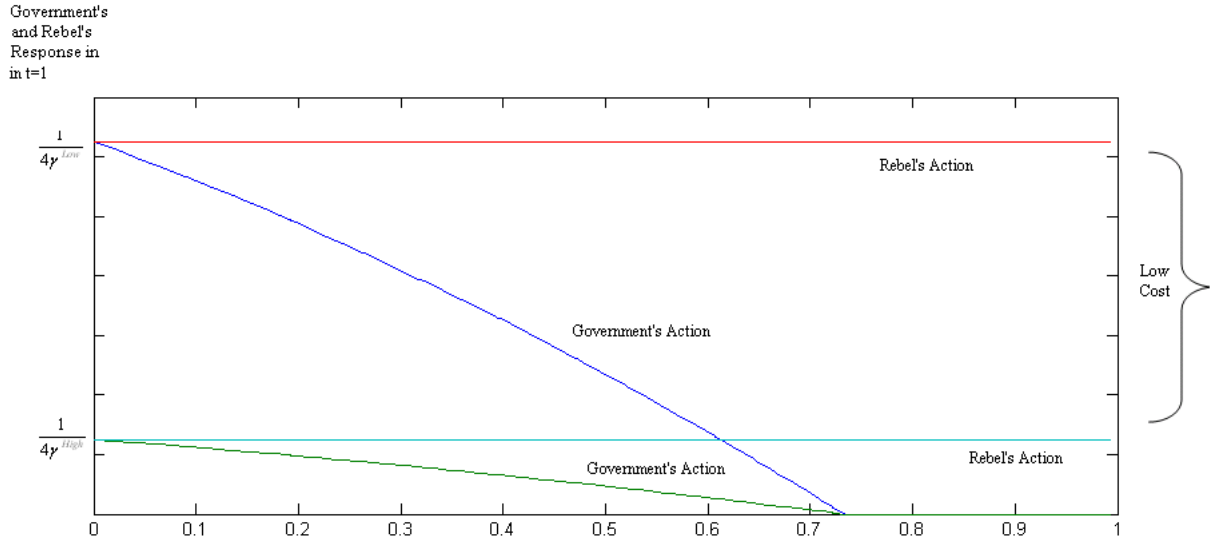

Figure 3.7: Government and Rebel Actions in t=1 with varying cost when the Government is Fully Informed

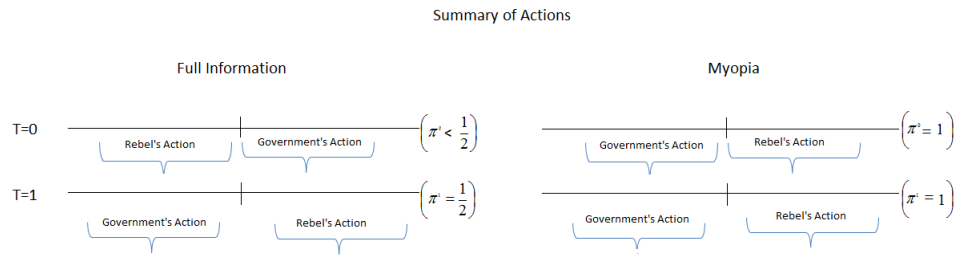

Figure 3.8: Summary of Actions by Each Party in Each Period

actions. An alternative approach to modeling myopia is to allow the Government to have "limited" but not complete ignorance of the ripple-effects of it's actions. This section considers the outcomes if a myopic Government was to move first and if the Government is to be only "partially" myopic.

3.4.1 First-Mover's Advantage

In order to ensure that this alternative scenario is comparable to the main Model presented in Section 3.2, assume that a myopic Government assumes $\delta = 0$, but now the Government moves first. Hence, applying backward induction, the Government solves the Rebel's objective function assuming $\delta = 0$ and take actions accordingly. The Rebels, however, know δ and thus, engage in a different level of violence than the Government assumes.

Starting with the last period, the Government assumes the objective of the Rebels is to maximize the following.

$$\pi^{1G} - \gamma A_R^1.$$

Where, π^{1G} is the Government's assessment of the probability of revolt in each period. That is:

$$\pi^{1G} = \frac{A_R^1}{A_R^1 + A_G^1}.$$

Here, superscript "G" is used to distinguish between the actual probability and the probability that the Government assumes. The actual probability of revolt in $t = 1$ is

$$\pi^1 = \frac{A_R^1}{A_R^1 + A_G^1 + \delta A_G^0}.$$

The Government's assumption of the Rebel's objective can be rewritten as:

$$\frac{A_R^1}{A_R^1 + A_G^1} - \gamma A_R^1$$

The optimal Rebel's action according to the Government is

$$A_R^{1G*} = \sqrt{\frac{A_G^1}{\gamma}} - A_G^1. \tag{3.25}$$

Again, subscript "G" is used to indicate the Government's belief of the Rebel's actions. Note that the optimal actions derived in Equation(3.25) is the same as a myopic Government's response. Since, a myopic Government would engage in *ad hoc* responses, it assumes that the Rebels would also do the same. As such, the Government assumes the Rebels to respond in the same manner in each period. The optimal Rebel response, therefore, is

$$A_R^{tG*} = \sqrt{\frac{A_G^t}{\gamma}} - A_G^t. \tag{3.26}$$

Now, assuming that any action the Government takes will be reciprocated by Rebels according to Equations (3.26), the probability of a revolt not happening in each period is

$$1 - \pi^{tG} = \sqrt{\gamma A_G^t}.$$

Using backward induction the Government's objective in each period is to maximize:

$$[\sqrt{\gamma A_G^t} - \gamma A_G^t]$$

The Government, therefore, chooses:

$$A_G^{t*} = \frac{1}{4\gamma}. \tag{3.27}$$

Although the Government chooses $A_G^{t*} = \frac{1}{4\gamma}$ in $t = 0$ and in $t = 1$, the Rebel's will not react according to the Government's assumption. The actual objective function of the Rebels (in $t = 1$) is to maximize

$$\pi^1 - \gamma A_R^1.$$

Or,

$$\frac{A_R^1}{A_R^1 + A_G^1 + \delta A_G^0} - \gamma A_R^1.$$

The Best Response of the Rebels is:

$$A_R^{1*} = \sqrt{\frac{A_G^1}{\gamma}} - A_G^1 - \delta A_G^0. \tag{3.28}$$

Similarly to the full-information case, the rebels optimal action in $t = 0$ is

$$A_R^{0*} = \sqrt{\frac{A_G^0}{\gamma(1-\beta\delta)}} - A_G^0 \tag{3.29}$$

Note that the best responses of the Rebels in Equations (3.29) and (3.28) are same as a fully informed Government's best responses. Now that the Government takes action given by Equations (3.26) ($A_G^{t*} = \frac{1}{4\gamma}$), the Rebel's actual actions are:

$$A_R^{0*} = \frac{1}{2\gamma\sqrt{(1-\beta\delta)}} - \frac{1}{4\gamma}, \tag{3.30}$$

and

$$A_R^{1*} = \frac{1}{4\gamma} - \frac{\delta}{2\gamma\sqrt{(1-\beta\delta)}}. \tag{3.31}$$

The Rebel's optimal actions are very similar to a fully informed Government's optimal actions. Consider the actions of each party in $t = 0$. A few points worth noting are that: (a) the Government is never able to wipe-out the insurgents, as the insurgents were to wipe-out the Government in case of the Rebels moving first, and (b) the Government's action is always less than the Rebel's use of violence. To see this consider the optimal Rebel's action in t=0. That is:

$$A_R^{0*} = \frac{1}{2\gamma}\frac{1}{\sqrt{(1-\beta\delta)}} - \frac{1}{4\gamma}.$$

$A_R^{0*} = 0$ if $A_G^{0*} = \frac{1}{\gamma(1-\beta\delta)}$. That is, $A_R^{0*} = 0$ if $\frac{1}{4\gamma} = \frac{1}{\gamma(1-\beta\delta)}$. This implies, if $(1-\beta\delta) = 4$, $A_R^{0*} = 0$, which is impossible.

Now,

$$A_R^{0*} \succ A_G^{0*}$$

if

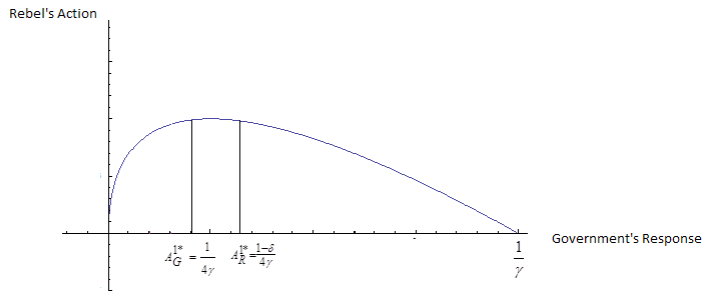

Figure 3.9: Summary of Actions by Each Party in t=0

$$\frac{1}{2\gamma}\frac{1}{\sqrt{(1-\beta\delta)}} - \frac{1}{4\gamma} \succ \frac{1}{4\gamma}.$$

Or, if

$$\sqrt{(1-\beta\delta)} \leq 1.$$

Since $\beta\delta \prec 1$, the above condition is met. Hence, $A_R^{0*} \succ A_G^{0*}$. Figure 3.9 summarizes the actions by each parties. In comparison to a myopic Government, the first-mover's advantage allows the Government to respond. The short-sightedness, however, ensures that the Rebels engage in higher level of violence. Also, the actions of each parties are strategic substitutes as in the case of a myopic Government.

Although the first-mover's advantage ensures that the Government takes some positive action, the short-sightedness costs the Government in that the Rebels are able to reciprocate the Government's action with higher level of violence. Hence, the main idea that the inability to foresee the complete breadth of consequences an action may generate allows a rebellion group to engage in higher level of violence still holds. As such, the model is not very sensitive to allowing the Government to move first. As in most real life situations a Government reacts to some level of violence instigated by a rebellion group, the Rebels moving first is a more realistic setting.

3.4.2 Varying Degrees of Myopia

Thus far the myopia of a government is of binary form. The Government is either aware of the effectiveness of their countermeasures (know the true value of δ) or assumes zero effectiveness ($\delta = 0$). An extension of this model is to allow for the degree of myopia to vary. For example, a myopic Government may perceive λ ($\lambda \in [0,1]$) of δ and take actions accordingly. If $\lambda = 0$, then the Government is completely myopic (as in Section 3.2), whereas $\lambda = 1$ implies full information as in Section 3.1. Any value of $\lambda \in (0,1)$ indicates partial myopia in that the Government undermines the effectiveness of their action. As such, the Government and Rebel's actions can be analyzed with respect to varying degrees of government myopia.

The Government's objective function in $t = 0$ is

$$\frac{A_G^0}{A_G^0 + A_R^0} - \gamma A_G^0 + \beta \left[\frac{A_G^1}{A_G^1 + A_R^1 + \lambda\delta A_G^0} - \gamma A_G^1 \right]. \tag{3.32}$$

Solving the game in a similar manner as in the full information case, the optimal actions are

$$A_G^{0*} = \sqrt{\frac{A_R^0}{\gamma(1 - \beta\lambda\delta)}} - A_R^0; \tag{3.33}$$

$$A_G^{1*} = \sqrt{\frac{A_R^1}{\gamma}} - A_R^1 - \lambda\delta A_G^{0*}. \tag{3.34}$$

The optimal actions are similar to a fully informed Government's optimal responses. If $\lambda = 1$, then the response is the same as a fully informed Government's response, while $\lambda = 0$ gives us a myopic Government's response. The probability of a successful revolt in each period is:

$$\pi^0 = \sqrt{\gamma(1 - \beta\lambda\delta)A_R^0}, \tag{3.35}$$

$$\pi^1 = \frac{A_R^1}{\sqrt{\frac{A_R^1}{\gamma}} + (1 - \lambda)\delta A_G^{0*}} \tag{3.36}$$

Similarly, the Rebel's Objective is summarized in the following equation.

$$\sqrt{\gamma(1 - \beta\lambda\delta)A_R^0} - \gamma A_R^0 + \beta \left[\frac{A_R^1}{\sqrt{\frac{A_R^1}{\gamma}} + (1 - \lambda)\delta A_G^{0*}} - \gamma A_R^1 \right]. \tag{3.37}$$

Note that just as in case of a completely myopic Government, the Rebels will drive the Government's response to zero in case of a partially myopic Government. To see this consider the

probability of revolt in $t = 1$ (Equation (3.36)) and compare it with the probability of revolt in $t = 1$ when the Government is fully informed. In case of a fully informed Government, the Rebels trade lower actions in t=0 for higher chances of revolt in t=1. As such, the probability of revolt in t=1 is $\sqrt{\gamma A_R^1}$. This probability is greater than the probability of revolt when the Government is myopic (unless $\delta = 0$ or $A_G^{0*} = 0$). That is,

$$\frac{A_R^1}{\sqrt{\frac{A_R^1}{\gamma}} + (1-\lambda)\delta A_G^{0*}} \prec \sqrt{\gamma A_R^1} \tag{3.38}$$

The best case for the Rebels is to keep the probability of revolt in t=1 the same as in the full information case. This is only possible if $A_G^{0*} = 0$. $A_G^{0*} = 0$ if $A_R^{0*} = 0$ or if $A_R^{0*} = \frac{1}{\gamma(1-\beta\lambda\delta)}$ (Equation (3.33)). The Rebels get 0 utility if $A_R^{0*} = 0$ or if $A_R^{0*} = \frac{1}{\gamma}$. When $A_R^{0*} = 0$ and $A_G^{0*} = 0$ the probability of revolt is half, however, when $A_R^{0*} = \frac{1}{\gamma(1-\beta\lambda\delta)}$ and $A_G^{0*} = 0$ the probability is 1. Hence, the Rebels will choose $A_R^{0*} = \frac{1}{\gamma(1-\beta\lambda\delta)}$, the maximum possible violence to drive the Government response to zero. Although the Rebels could choose slightly less action and gain positive utility, that would cause the Government to take some action and thus, lower the probability of revolt. Therefore, even if the Government is partially myopic, the Rebels will take action that is too costly for the Government to respond to.

3.5 LIMITATIONS AND FUTURE DIRECTION

This study presents a simple model that is able to capture the dynamics of a government's response to an insurgency depending upon the foresightedness of the government. A government that is able to foresee the larger consequences of their action takes proactive measures that make revolution unlikely and maintain low levels of violence. A myopic government, however, engages in *ad hoc* responses and is unable to prevent revolution when the Rebels are able to foresee the shortsightedness. This result is very intuitive and it presents a crucial difference between a proactive and an indifferent government. Nevertheless, there are a few limitations of this study that provide room for further analysis.

First of all, I assume that $\delta \succ 0$. This means that the government's action can only hurt the rebel's chances of having a successful revolt. An extension of the study will be to allow $\delta \prec 0$, and compare the results. Most studies analyze situations where government's actions could help rebels

mobilize more sympathizers. I abstract away from this assumption, because is more interesting to understand the reason behind lower government investment even when any action the government takes could only hurt the rebel's objective in present and in future.

Similarly, I assume that a government investment is directly related to counterinsurgency only (defense related). Any action a government takes is directly related to abating insurgency and there is no delay in the effectiveness of the response. Alternatively, one could allow for two types of government actions- spending in public goods and direct countermeasures- with the possibility of substitution between those two actions. It will be interesting to analyze how the two public goods are substituted and what the resulting implications will be in case of a myopic and a fully informed government. In this study, I assume that all public goods are the same in their effectiveness for limiting the rebel growth and that the public good is directly related to defense.

Note that learning is implicitly built in the model, although not directly incorporated. As the rebels take action knowing δ, the government's action is also a function of δ. A further extension of the model would be to allow the government to learn in the next period. The rebel's use of violence in t=0 could signal the government their relatively low efforts in t=0, which in turns leads to higher government effort in the next period. As such, the government may be myopic initially, but learns to overcome their shortcoming with time. Similar to this extension is to incorporate regime change in the model. As of now, the probability of revolt is interpreted as anything from the government being overthrown to visible mass mobilization that threatens its authority. Since the government gets no utility if there is a successful revolt, this is equivalent to assuming that the government is no longer in charge. However, if this is the case, then there is no second period for the government to worry about. Even though this is a likely situation, I do not interpret the model in such a way. It could very well imply that even if a new government is to be in power in the next period (if regime is changed), the problem the new government faces in that period remains the same.

3.6 CONCLUSION

I present a simple model that is able to capture the dynamics of a government's response to an insurgency problem at hand. With no assumption on the benevolence of the government and on the motivation of a rebellion group, I am able to show a circumstance that leads to higher violence and

a revolution. An important question in conflict studies is the lack of government's full response to abating an insurgency while it is still at its infancy. I show that the government being unaware of the broader implications of their actions while the rebels are in their own trying stage provides the rebels the opportunity to thrive. This is true even if the broader implications of the government's proactive measures are low (government's actions are not as effective).

Similar to previous studies, I find that a myopic government is proactive when rebels are weakly entrenched. A fully informed government engages in proactive measure early on, so that the efforts can be reduced in the later periods. A myopic government, on the other hand, underinvests in each period, making revolution certain to happen. This result is not sensitive to the varying degree of myopia or the ramifications of the government's actions. Regardless of the manner in which a revolution is interpreted (a regime change, or a mass mobilization of anti-government sentiments), the study presents a scenario where the myopia of a government allows the rebels to get away with what they desire.

The study also highlights the nature of exchange of violence between a government and a rebel group. When a government is fully informed, the government and rebel uses of violence are strategic complements, whereas when a government is myopic, the two-sided violence are strategic substitutes. When the two parties are complementary in their use of violence, the resulting violence is lower than when the two parties act as substitutes for their use of violence. While rebels engage in higher levels of violence when the government is myopic, the government's use of violence is higher when the government is fully informed.

Although a desirable outcome is to have higher effectiveness of government countermeasure, a fully informed government will take less stringent action in the future. This leads to higher chances of revolt in future than in present. Future study will be focused on investigating a government's investment in increasing the effectiveness of their actions (such as public awareness) rather than the government's investment in direct countermeasures (such as defense spending) alone.

APPENDIX

PROOF

In this section I derive the optimal Rebel actions in case of a myopic Government. There are two ways to see that the Rebels engage in maximum possible violence when the Government is myopic.

Consider the Rebel's objective function

$$\pi^{0*} - \gamma A_R^0 + \beta\Big[(\pi^{1*}) - \gamma A_R^1\Big]. \tag{.1}$$

The First Order Conditions are:

$$\frac{1}{2}\sqrt{\frac{\gamma}{A_R^0}} + \frac{\beta\delta A_R^1(2\sqrt{\gamma A_R^0} - 1)}{2\sqrt{\gamma A_R^0}\Big[\sqrt{\frac{A_R^1}{\gamma}} + \delta A_G^{0*}\Big]^2} - \gamma = 0. \tag{.2}$$

And

$$\frac{1}{\sqrt{\frac{A_R^1}{\gamma}} + \delta A_G^{0*}} - \frac{\sqrt{A_R^1}}{2\sqrt{\gamma}\Big[\sqrt{\frac{A_R^1}{\gamma}} + \delta A_G^{0*}\Big]^2} - \gamma = 0. \tag{.3}$$

Consider the First Order Condition in t=0:

$$\frac{1}{2\sqrt{2A_R^0}} - \frac{1}{2} + \frac{\beta A_R^1\delta(\sqrt{2A_R^0} - 1)}{(\sqrt{2A_R^1} + \delta(\sqrt{A_R^0} - A_R^0))^2\sqrt{2A_R^0}} = 0.$$

The above equation can be further simplified as

$$\frac{(\sqrt{2A_R^1} + \delta(\sqrt{2A_R^0} - A_R^0))^2 + 2\beta\delta A_R^1(\sqrt{2A_R^0} - 1)}{2(\sqrt{2A_R^1} + \delta(\sqrt{2A_R^0} - A_R^0))^2} = \frac{\sqrt{2A_R^0}}{2}.$$

Or,

$$\left(\sqrt{2A_R^1}+\delta\left(\sqrt{2A_R^0}-A_R^0\right)\right)^2+2\beta\delta A_R^1\left(\sqrt{2A_R^0}-1\right)=\sqrt{2A_R^0}\left(\sqrt{2A_R^1}+\delta\left(\sqrt{2A_R^0}-A_R^0\right)\right)^2.$$

or,

$$\left(\sqrt{2A_R^1}+\delta\left(\sqrt{2A_R^0}-A_R^0\right)\right)^2=2\beta\delta A_R^1. \tag{.4}$$

Equation (.4) can be further simplified to

$$A_R^1=\frac{\delta^2(\sqrt{2A_R^0}-A_R^0)^2}{2(\sqrt{\beta\delta}-1)^2} \tag{.5}$$

Using A_R^1 derived in Equation (.5) in the second First Order Condition we get:

$$\left(\sqrt{2A_R^0}-A_R^0\right)=\frac{\sqrt{\beta\delta}-1}{\delta\sqrt{\beta\delta}}.$$

Or,

$$A_G^{0*}=\frac{\sqrt{\beta\delta}-1}{\delta\sqrt{\beta\delta}}.$$

Since $\beta\delta\prec 1$, $A_G^{0*}\prec 0$. By assumption, $A_G^0\succ 0$. So, $A_G^{0*}=0$. When $A_G^{0*}=0$, $A_R^{0*}=0$ or $A_R^{0*}=$ maximum possible. Either actions will yield zero utility, but $A_R^{0*}=0$ implies fifty percent chance of revolt, whereas $A_R^{0*}=$ maximum possible implies a revolt with certainty. Hence, the Rebels will choose maximum possible level of violence in t=0. Since the Government response is same in both period, the Rebels will choose maximum possible level of violence in t=1 as well.

Alternatively, consider the probability of revolt in each period (Equation (3.21) and (3.22). That is,

$$\pi^{0M*}=\sqrt{\gamma A_R^{0*}} \tag{.6}$$

$$\pi^{1M*}=\frac{A_R^1}{\sqrt{\frac{A_R^1}{\gamma}}+\delta(\sqrt{\frac{A_R^0}{\gamma}}-A_R^0)}. \tag{.7}$$

The subscript "M" denotes myopic case. Now, compare the probabilities with that of a full information case (Equations (**??**) and (**??**)). The probabilities are:

$$\pi^{0F*}=\sqrt{A_R^0\gamma(1-\beta\delta)}. \tag{.8}$$

and

$$\pi^{1F*} = \sqrt{\gamma A_R^1}. \tag{.9}$$

The subscript "F" denotes the full information case. Since $\pi^{0M*} \succ \pi^{0F*}$, the rebels chances of successful revolt in t=0 in greater in myopic case. More importantly, in t=1 $\pi^{1F*} \succ \pi^{1M*}$. Hence, the Rebels are worse off in t=1 unless $\delta A_G^{0*} = 0$ in myopic case. To keep their chances of revolt as high, the Rebels would prefer $\delta A_G^{0*} = 0$. As δ is exogenously given, the Rebels would prefer $A_G^{0*} = 0$.

Now, $A_G^{0*} = 0$ if $A_R^{0*} = 0$ or $A_R^{0*} = \frac{1}{\gamma}$. The Rebels get the utility of zero in each case. If $A_R^{0*} = 0$, then the probability of revolt is only half. However, if $A_R^{0*} = \frac{1}{\gamma}$, the probability of revolt is 1. Hence, although the Rebels can take slightly lower action and gain positive utility, doing so would trigger Government response. As such, the Rebels will take maximum possible action and zero utility in exchange for the certainty of revolt (and to drive the Government action to zero). Since the Government response is the same in each period, the Rebels will take maximum possible action in t=1 also.

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